

Batteries



Before handling batteries, safety is always to be considered

- Use rubber gloves and goggles when working on and testing batteries.
- Keep sodium bicarbonate handy to neutralize acid should a spill occur.

When charging batteries Hydrogen gas is produced, which can explode. Therefore, charging batteries must be done in a well-ventilated area with no sparks or flames.

Look for obvious problems such as low electrolyte levels, a dirty or wet battery top, corroded or swollen cables/terminals or a leaking or damaged battery case.

- A battery with swollen sides is a telltale sign that the battery will need replacement. Repair or replace such items as required.
- Terminal brushes are a good thing and make cleaning the terminals fast and effective.
- When replenishing the battery with water, **distilled water is a MUST!**
- Use boiled kettle water only in an emergency.

Use the chart below as a guide:

When at all possible use the manufacturer's product specifications and recharge the battery to 100% state-of-charge. If checking a non-sealed battery using the specific gravity and there is a difference of .50 (sometimes expressed as 5.0 "points" or more of a difference between the cells, then you should equalize the battery using the battery manufacturers procedures. On sealed batteries use a digital voltmeter to check the state of charge based on the voltage. Do not load test batteries below a 75% state of charge.

Any battery that does not go over 12.4V when charged must be replaced.

12 Volt SYSTEM	24 Volt SYSTEM	SPECIFIC GRAVITY	STATE OF CHARGE (%)
12.7	25.4	1.265	100
12.64	25.25	1.257	95
12.58	25.16	1.249	90
12.52	25.04	1.241	85
12.46	24.92	1.233	80
12.4	24.8	1.225	*75
12.36	24.72	1.218	70
12.32	24.64	1.211	65
12.28	24.56	1.204	60
12.24	24.48	1.197	55
12.2	24.4	1.19	50
12.12	24.24	1.176	40
12.04	24.08	1.162	30
11.98	23.96	1.48	20
11.94	23.88	1.34	10

Once charged the battery is still not ready for load testing. The surface charge, if not removed, will make a weak battery appear bad. Eliminate the surface charge by allowing the battery to sit for between four to twelve hours in a warm room.

- To load test a battery 50% of the CCA rating must be applied as a load, typically a carbon pile or series of resistors depending on the tester. After 15 seconds the voltage must be checked with the load still applied.
- The voltage must be more than 9.6V (if 21C or warmer), if the voltage is less than that the battery fails to load test.

See the chart below to compensate for load testing in colder conditions

BATTERY TEMP IN C	BATTERY TEMP IN F	MIN VOLTAGE WHEN LOAD TESTING
21	70	9.6
16	60	9.5
10	50	9.4
4	40	9.3
-1	30	9.1
-7	20	8.9
-12	10	8.7
-18	0	8.5

System Checks on Starter motors and Alternators

The battery must be fully-charged (specific gravity or electrolyte 1.28 g/cm³) in order for these tests to be valid.

To carry out the tests you will need the following:

- Electrolyte tester & Volt / Ohmmeter & Test lamp

Test:

- Check ground strap from the engine block to the frame - must have a good connection.
- If alternator is mounted in rubber grommets, check external ground strap from alternator.
- Check battery plus connection to the electrical system.
- Ambient temperature should be 20 - 30°C. Temperatures outside this range will heavily affect results.
- Check tightness of V-belt according to manufacturer's specifications.
- Charging output test: start engine and run at approx. 2000 RPM. Create electrical load by turning on headlights and heater blower (vehicles). On stationary engines, crank engine for approx. 15 seconds with fuel supply off. Reconnect fuel supply and start engine. Measure regulating voltage from alternator battery terminal to ground:

Integrated regulator: 13.7 - 14.5 (12V systems)

27.4 - 28.4 (24V systems)

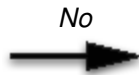
External contact regulator: 13.9 - 14.8V (12V systems)

27.2 - 28.3V (24V systems)

- *If regulator is cold, take readings after one minute of operation. The regulating voltage may be 0.5V lower if the engine is hot.*

Battery Test

The acid level must be along the plates and separators. OK?



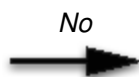
Add distilled water up to the mark or above the plates and charge battery.

Use a Volt meter to test the Battery.

Battery Condition:		
12.6 Volts	=	a fully charged battery 100%
12.4 Volts	=	75%
12.2 Volts	=	50%
12.0 Volts	=	25%
11.8 Volts	=	0%



Test specific gravity of electrolyte.
Minimum value = 1.28 g/cm³
OK ?



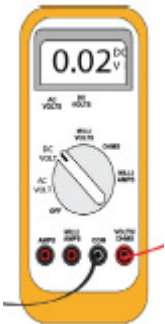
Charge battery, check regulator voltage (see KTR Alternator test procedure). Replace defective battery.

Voltage Drop Testing

Voltage drop testing is a vital test when doing any type of electrical work, when done properly voltage drop testing can be used to identify faulty wiring, relays/solenoid and connections. Voltage drop is simply the loss of energy in a system due to wiring resistance, connections and corrosion. A comparison would be water in a garden hose. If the connections are good and there are no leaks. What does an electrical "leak" look like? Heat!! Some loss is normal and depending on the source of the information anywhere between the unattainable 0.0 volt and 0.5 volt would be considered acceptable.

To do a voltage drop test a digital voltmeter is required (preferably with a hold feature but not a must). The battery must be charged as the engine will require cranking to check the starter wiring and it must be able to run to check the alternator wiring.

- Set the digital voltmeter to the DC voltage setting.
- With the engine off connect one probe to the positive battery post (not to the wire terminal). Connect the other probe to the starter positive battery post.
- Have an assistant crank the engine with both test leads connected.
- If the reading is less than 0.2 volts then the positive side is fine. If the reading is more than 0.2 volts the source of the drop must be determined. Look for loose connections, frayed wires, feel for hot spots and swelling (wires that have pin holes or nicks in the insulation may allow water inside and will swell up while corroding).
- Perform the same test from the starter housing to the negative battery post. If the reading is higher than 0.2 volts check for dirty/corroded contact surfaces from the starter to the engine and for corroded engine grounding cables.
- To do the voltage drop test on the alternator wiring start the vehicle, allow the system to stabilize, turn on all the accessories and measure the voltage from the positive post of the alternator to the positive post of the battery. Anything over 0.2 volts should be analysed and corrected (wires / terminals / connections etc).
- Perform the same test on the alternator grounding by connecting one probe to the alternator frame and the other to the battery negative post. Again anything over 0.2 volts should be checked and rectified.



TIP If you get a high voltage drop reading, do the same test on a portion of the path to determine the problem. Start with the most probable cause, the **BATTERY!!!**

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