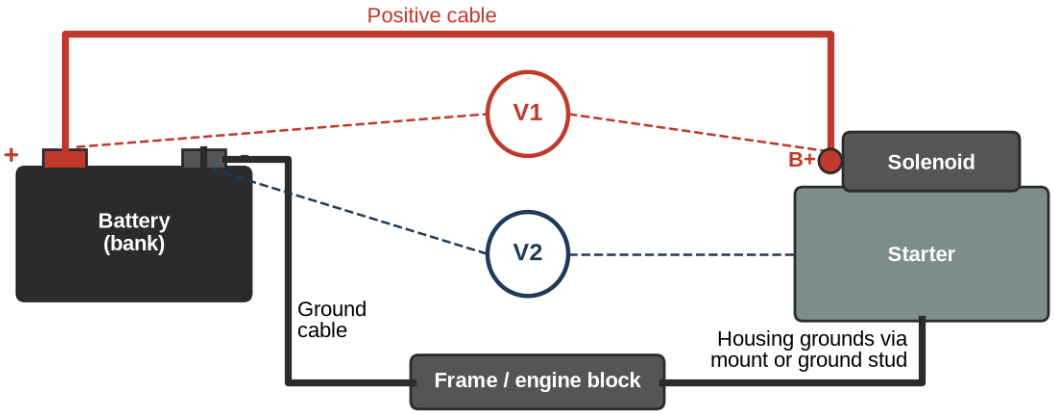
Starting and Charging Cheat Sheet

Batteries, cranking circuit, starter draw, alternator output and parasitic draw on 12 V and 24 V systems. Values are typical only.

Cranking circuit voltage drop test points



V1 Positive side

Battery + post to starter B+ terminal, while cranking

V2 Ground side

Starter housing to battery negative post, while cranking

Each side: under about 0.5 V (rule of thumb)

Meter leads go across each side of the circuit while it carries current. Move the leads junction by junction to find where the drop is.

Tools needed

- DMM with min/max and AC volts; DC amp clamp (plus a low-amp clamp for parasitic draw)
- Battery conductance tester or carbon pile load tester; battery charger
- Fused jumper and test leads long enough to reach from the battery to the starter
- Service information: starter draw and alternator output specs

Safety

Batteries vent hydrogen. No sparks or flames; wear eye protection. Remove rings and watches.

Disconnect the ground cable first and reconnect it last. A heavy-duty bank can weld a wrench across a terminal.

Use the amp clamp, not the meter in series, for cranking or charging current.

Prevent starting during crank tests (disable fuel per OEM). Keep clear of belts and fans.

Step-by-step procedure

1. **Visual.** Cable ends, corrosion, loose or chafed cables, engine-to-frame and frame-to-battery grounds, belt condition, alternator connections.
2. **Battery state.** Isolate each battery in the bank and read rest voltage (about **12.6 to 12.7 V** full). Charge any low battery, then run a conductance or load test on each one. One weak battery drags the bank.
3. **Cranking voltage.** At the starter on a 12 V system, it should stay above about **9.6 to 10 V**.
4. **Voltage drop, cranking (V1 and V2).** Each side under about **0.5 V**; control circuits about **0.2 V**. High: clean or repair that junction.
5. **Starter current draw.** Clamp all starter positive cables and crank. Compare to the OEM spec. High draw with slow crank: starter or engine drag. Low draw with slow crank: resistance in the circuit.
6. **Charging.** Engine running: about **13.8 to 14.4 V** (12 V) or **27.5 to 28.5 V** (24 V). Load test toward rated output per OEM. Check voltage drop on the alternator output cable and ground under load.
7. **Ripple.** AC volts at the alternator output under about **0.5 V AC**. Higher points to a diode or stator fault.
8. **Parasitic draw.** Everything off, doors shut, let modules sleep 10 to 30 min. Clamp all battery negative cables together (or each one and add them). Find the circuit by reading millivolt drop across fuses.
9. **Repair and verify.** Fully charge the bank, recheck drops, cranking voltage and charging.

Readings and what they mean

Test	Typical good	If not
Rest voltage, each 12 V battery	About 12.6 to 12.7 V	Charge, then retest
Cranking voltage, 12 V	Above about 9.6 to 10 V	Battery, cables, starter drag
Drop, each cranking side	Under about 0.5 V	Corrosion, loose or undersized cable
Charging voltage	About 13.8 to 14.4 V (12 V); 27.5 to 28.5 V (24 V)	Regulator, belt, wiring
AC ripple	Under about 0.5 V AC	Diode or stator
Parasitic draw	Rule of thumb under about 0.1 A	Telematics, add-ons, a module awake

12 V and 24 V notes

- A 24 V pair of 12 V batteries rests at about 25.2 V. Test each 12 V battery on its own.
- Series-parallel switch systems charge at 12 V and crank at 24 V. Test both modes.
- OEM parasitic limits vary (one bulletin allows up to 1.0 A total after a 10 min settle).
- Test the batteries before any electrical or network diagnosis. A weak bank causes ghost codes and CAN errors at crank (SPN 168 battery potential).