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2005 JEEP Cherokee/Liberty OEM Service and Repair Workshop Manual

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SYSTEM OPERATION - 12 VOLT BATTERY SYSTEM

The 12 volt battery connects to the Power Distribution Center (PDC) to provide the electrical power for the vehicle modules and accessories. The battery will also absorb electrical spikes in the system. There is an Intelligent Battery Sensor (IBS) connecting in series on the negative battery cable which provides information about the battery to the Body Control Module (BCM) over a Local Interface Network (LIN) bus. The IBS monitors the current flow going out of the battery, and current flowing into the battery during charging to make these calculations. Some of the information stored and provided by the IBS are:

- Battery voltage
- Battery temperature
- Battery State of Charge (SOC) - The battery SOC is the percentage of battery charge based on measured voltage, charge and discharge rates.
- Battery State of Function (SOF) - The SOF is the calculated voltage that the battery will drop to when the starter is engaged to crank the engine.
- Battery State of Health (SOH) - The SOH is the measurement of current battery capacity factoring the depreciation in battery health.

The BCM broadcasts this information over the CAN bus. The Powertrain Control Module will use the battery SOC to determine charge rates when the ignition is on. The BCM will use the battery information received from the IBS to make decisions on load shedding when battery SOC is determined to be low.

When the ignition is off and the vehicle is in sleep mode the Hybrid Control Processor (HCP) monitors the 12 volt battery SOC. The HCP will determine when it is necessary to wake-up and command the Integrated Dual Charging Module (IDCM) to perform periodic charging of the 12 volt battery.

However, the IBS accuracy is determined to be low until the IBS can relearn battery SOC. This occurs after an engine run cycle and a subsequent ignition off sleep cycle of between one to four hours. Some features will be disabled until the IBS SOC is updated.

FUNCTIONAL DESCRIPTION - INTEGRATED DUAL CHARGE MODULE (IDCM)

The Integrated Dual Charge Module (IDCM) is a Power Inverter comprised of the following two integral modules:

- **On Board Charging Module (OBCM):** Converts the Alternating Current (AC) power supplied from the grid through the Electric Vehicle Supply Equipment (EVSE) Charging Port into a Direct Current (DC) power for charging the High Voltage Battery. The OBCM also provides galvanic isolation for the vehicle. Galvanic isolation simply prevents unwanted current from flowing between two units that share the same ground connector. This helps protect the internal electrical circuits as well as people that come into contact with the device.
- **Auxiliary Power Module (APM):** Converts the high voltage DC power in the High Voltage Battery into a low voltage DC power for charging the Low Voltage Battery. The APM contains systems that ensure voltage output, current draw, and current demand "spikes" do not damage any electronic components within the LV circuit while charging the 12V battery.

When the Electric Vehicle Supply Equipment (EVSE) Charging Cable is plugged into the charge port the IDCM sends a wake up signal to the high voltage modules to allow the modules to operate and the batteries to charge.

- **High Voltage Charging:** The OBCM converts the AC current from the grid into a suitable DC current supplied to the Battery Pack Control Module (BPCM) for charging of the high voltage battery. The IDCM regulates voltage and current flow to maintain proper State Of Charge (SOC) and State Of Health (SOH) of the high voltage Battery system.
- **Low Voltage Charging:** The APM is used as a DC to DC converter, responsible for charging of the low voltage system battery. This replaces the need for an alternator on PHEV vehicles. The high voltage can be provided by the EVSE charging cable or the high voltage battery.

The IDCM generates heat as it operates. The IDCM is liquid cooled by the Low Temp Cooling Loop. The IDCM monitors its internal temperature, voltage and current flow. If any of these items are out of range, the IDCM will not operate.

For the IDCM to operate, the IDCM must detect a minimum of 10.0 volts from the 12.0 volt Battery, along with a wake up signal from the HCP Module through the EPT ECU Wake-Up Signal circuit.

The IDCM is a stand alone module that does not contain any internal serviceable parts, but does have full diagnostic and programming capabilities through the vehicle Controller Area Network (CAN) C-EPT Bus.

FUNCTIONAL DESCRIPTION - INSTRUMENT PANEL CLUSTER (IPC)

The IPC receives information from the Powertrain Control Module (PCM), Power Inverter Module (PIM) and Integrated Dual Charging Module (IDCM) on the CAN-C Network to display current system voltages and vehicle

At the end of the check procedure:

- Close the cover (1) on the dummy positive pole (4);
- Remove the ground lead nut (2);
- Pull the ground lead (3) out of the insulating hole (5), reconnect it to the negative dummy pole and lock it in position with the nut (2), tightening it to a torque of 28 N·m.

Use the leads in the kit to connect the instruments as follows:

- Red clip connected to the positive battery terminal (or to the positive dummy pole).
- Black clip connected to the negative battery terminal (or to the negative dummy pole).

The lead clips must be connected correctly; an incorrect connection could cause the following messages:

- On the EXP 813 FCA - CHECK CONNECTIONS
- On the GRX 3228 FCA - CHECK TERMINAL CONNECTIONS

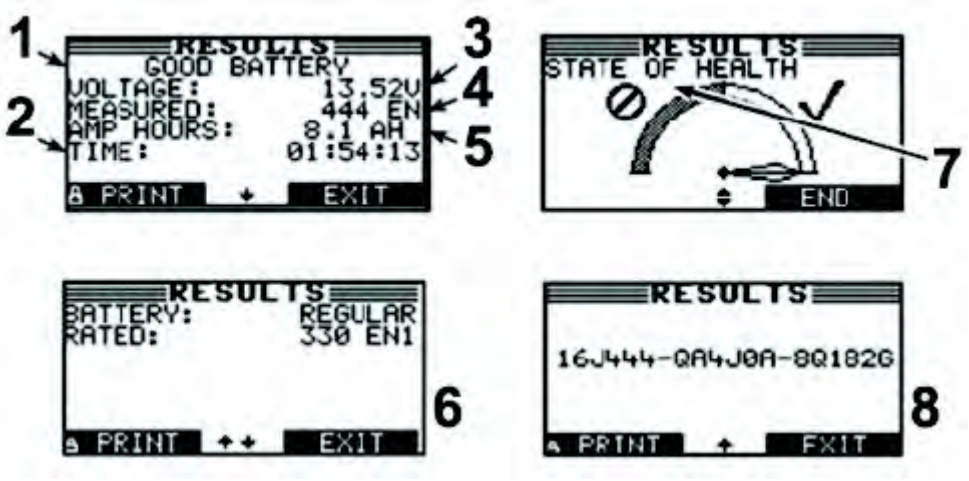
If the leads are connected with the incorrect polarity, the tester will display the following message: TERMINALS REVERSED (the GRX 3228 FCA also emits an alarm signal).

CONFIGURING THE INSTRUMENTS FOR THE CHARGE STATE CHECK

In the main menu, use the LEFT and RIGHT arrows to select "BATTERY TEST" / "DIAGNOSIS" (battery icon on the display) and proceed as follows:

1. Use the UP and DOWN arrows to select the TEST LOCATION:
    - BATTERY TERMINAL (A)
    - STARTER TERMINAL (B)
2. Press the **NEXT** button to continue.
    - **If BATTERY TERMINAL was selected, proceed as follows:**

1. Select the battery location:
    - OUTSIDE THE VEHICLE
    - IN THE VEHICLE
2. Press the **NEXT** button to continue.
3. Select the BATTERY TYPE:
    - NORMAL - Flooded (Pb and Pb Heavy Duty)
    - AGM - AGM with flat plates (Pb AGM)
    - SPIRAL - AGM with spiral plates (PbAGM Spiral)



NOTE

Fig. 4 - Battery check result on the GRX 3228 FCA

1. Battery test result
2. Total charging time
3. Measured voltage
4. Measured current
5. Charging current
6. Rated battery data
7. State of health
8. Test code

NOTE

TEST RESULT AND REPAIR OPERATIONS

Depending on the test results, perform the operations in the table below:

MIDTRONICS READING	OPERATION
Good battery	No Operation

NOTE

Previous service information reported never to blind charge the battery around the Intelligent Battery Sensor (IBS). Software changes to the GR8 battery tester has improved how the battery is tested. However, this requires the GR8 battery tester to be connected directly to the battery posts, bypassing the IBS.

1. Disconnect the main battery positive and negative cables to isolate the battery. Connect the

AGM Battery Tester/Charger Station

1. Inspect the battery for any physical damage to the battery or posts.
    - If physical damage is obvious, replace the battery and retest.
2. Verify the battery is the proper size and rating for the vehicle. (Refer to Electrical/8F - Engine Systems/Battery System - Specifications).
    - If the battery does not meet the required specifications, replace the battery and retest.
3. Verify the battery and cable connections are tight and clean. Check the battery cable connections at the battery posts, alternator terminal and ground locations.
    - Clean and repair any poor connections and retest.
4. Verify the charging system is operating properly.
    - If the charging system output is low, repair the inoperative charging system.
5. If the vehicle has a no crank condition but the electrical system has power check the starting system operation.
    - Repair the inoperative starting system as required.
6. Check the battery electrolyte level if applicable. Always use the necessary safety precautions when working with batteries to prevent possible serious or fatal injury.
    - If the electrolyte level is low, fill to the proper level and retest.
7. If the battery, starting and charging systems test good, but the battery discharges after sitting for a short period, check the electrical system for an ignition off draw. Perform the IGNITION OFF DRAW TEST procedure.

If all preliminary checks are good, test the battery using the GR8 Battery Tester.

CHARGING AND TESTING BATTERIES WITH THE GR8 BATTERY TESTER: Always use the Midtronics GR8 Instruction Manual that was supplied with the tester as a reference. If the Instruction Manual is not available the following procedure can be used:

WARNING

Always wear appropriate eye protection and use extreme caution when working with batteries.

NOTE

Previous service information reported never to blind charge the battery around the Intelligent Battery Sensor (IBS). Software changes to the GR8 battery tester has improved how the battery is tested. However,

Open Circuit Voltage Test

OPEN CIRCUIT VOLTAGE TEST

A battery open circuit voltage (no load) test will show the approximate state of charge of a battery.

Before proceeding with this test, completely charge the battery, (Refer to Electrical/Battery System/Standard Procedure).

1. Before measuring the open circuit voltage, the surface charge must be removed from the battery. Turn on the headlights for 15 seconds, then allow up to five minutes for the battery voltage to stabilize.
2. Disconnect and isolate the negative battery cable. If equipped with an Intelligent Battery Sensor (IBS), disconnect the IBS connector first before disconnecting the negative battery cable.
3. Using a voltmeter connected to the battery posts (see the instructions provided by the manufacturer of the voltmeter), measure the open-circuit voltage.

See the Open Circuit Voltage Table. This voltage reading will indicate the battery state of charge, but will not reveal its cranking capacity. If a battery has an open-circuit voltage reading of 12.4 volts or greater, it may be load tested to reveal its cranking capacity.

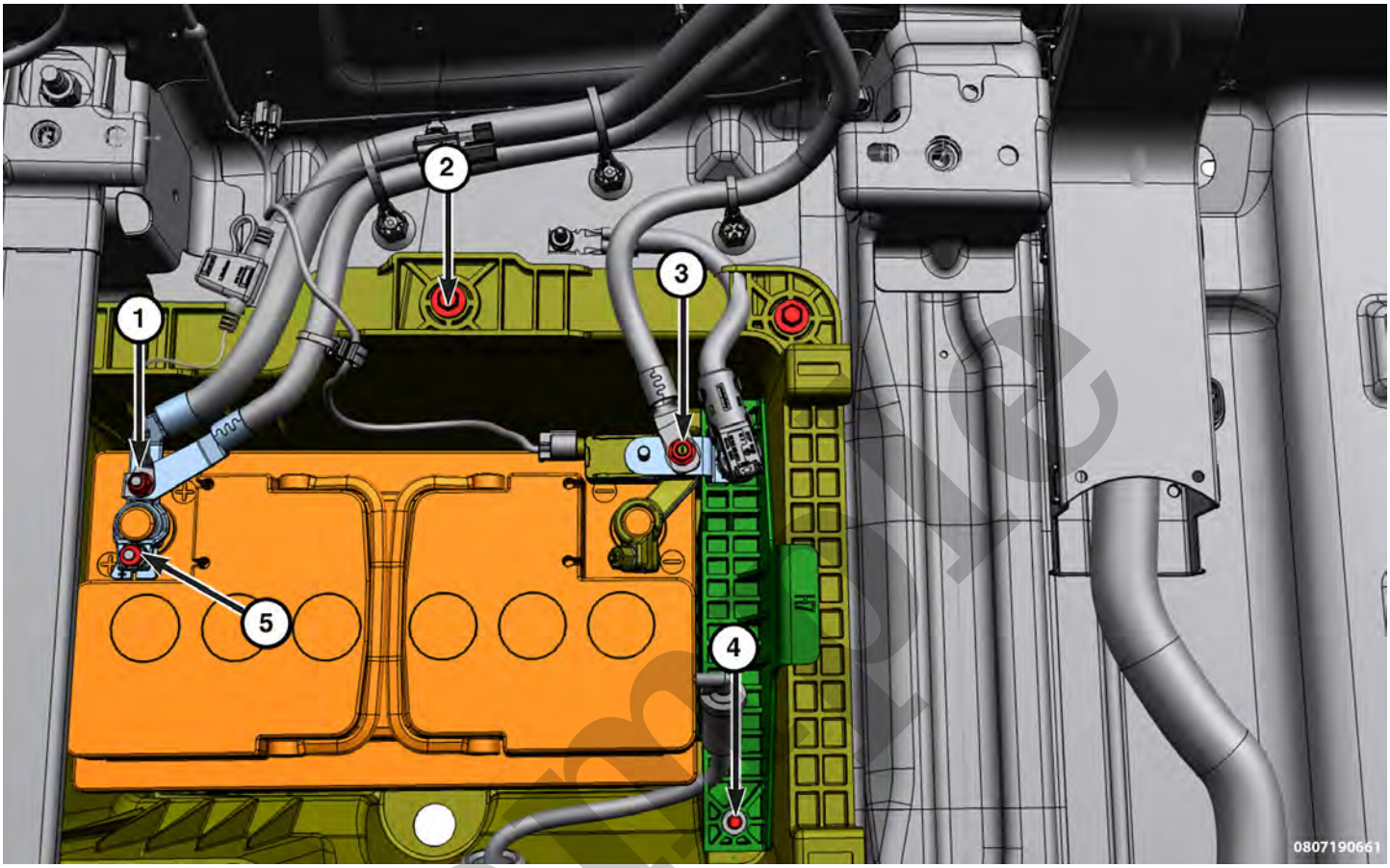
OPEN CIRCUIT VOLTAGE TABLE

Open Circuit Voltage	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.2 volts	50%
12.4 volts	65%
12.8 volts or more	90%

Follow the removal procedure in reverse for general reassembly of the components on the vehicle.

TORQUE SPECIFICATIONS - BATTERY SYSTEM

MAIN BATTERY



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Battery Positive Cable End Nut	**7 N·m (63 In. Lbs.)**	—
2	Battery Tray Bolts	**10 N·m (89 In. Lbs.)**	—
3	Battery Negative Cable to the IBS	**11 N·m (8 Ft. Lbs.)**	—
4	Battery Hold Down Bolt	**5 N·m (44 In. Lbs.)**	—
5	Battery Positive Clamp to Positive Post	**7 N·m (63 In. Lbs.)**	—
–	Intelligent Battery Sensor (IBS) Sensor to Negative Post	**6 N·m (53 In. Lbs.)**	–

AUXILIARY BATTERY

Intelligent Battery Sensor 2 (Ibs2)

INTELLIGENT BATTERY SENSOR 2 (IBS2)

NOTE

ADAS Equipped vehicles only

REMOVAL

1. Remove the fasteners that secure the front passenger seat and tip it forward to gain access to the auxiliary battery.