

# Component Procedures: Battery

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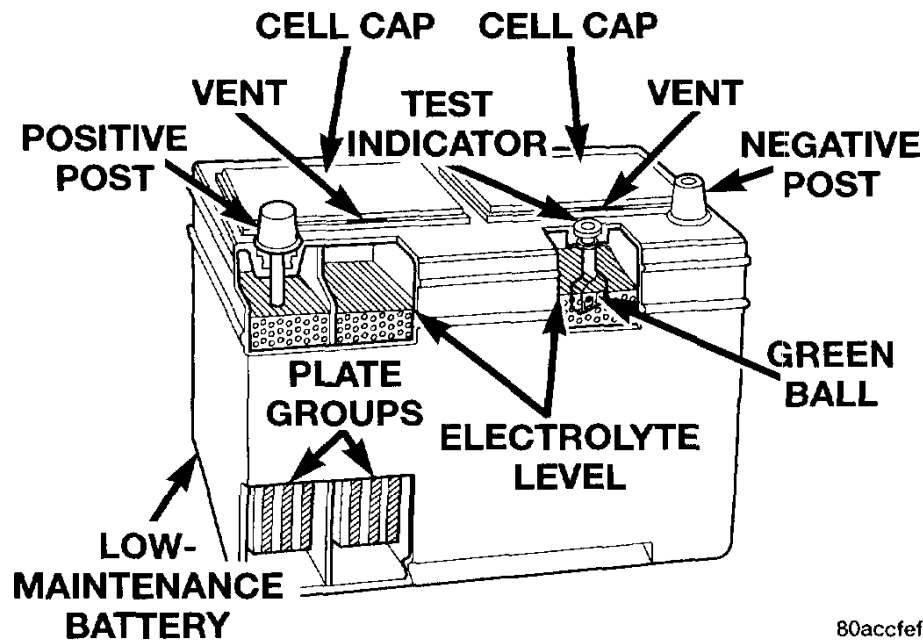
# Component Procedures: Battery

## Parts and Labor (itype\_189)

### Labor

Operation	Qualifier Path	Skill	Std Hrs	Wty Hrs
Service or Charge	Battery, Charge/Test	B	0.4	0.0
Replace	Battery, R&R	C	0.3	0.0
Clean	Battery Terminals, Clean	C	0.3	0.0

## Components (itype\_392)



## Components (itype\_32)

The battery is mounted in a stamped steel located in the passenger side rear corner of the engine compartment.

## Battery Charging (Article 2023930)

A battery is fully-charged when:

- All cells are gassing freely during battery charging.
- A green color is visible in the sight glass of the built-in test indicator.
- Three hydrometer tests, taken at one-hour intervals, indicate no increase in the temperature-corrected specific gravity
- Open-circuit voltage is 12.4 volts or above.

### WARNING:

- IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.
- EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.
- THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

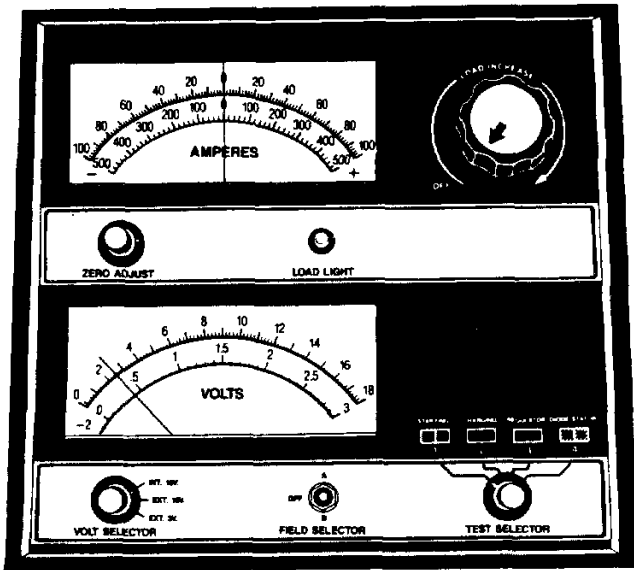
- IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS

CAUTION

- Always disconnect and isolate the battery negative cable before charging a battery. Do not exceed sixteen volts while charging a battery. Damage to the vehicle electrical system components may result.
  - Battery electrolyte will bubble inside the battery case during normal battery charging. Electrolyte boiling or being discharged from the battery vents indicates a battery overcharging condition. Immediately reduce the charging rate or turn off the charger to evaluate the battery condition. Damage to the battery may result from overcharging.
  - The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the charger and/or the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.
- After the battery has been charged to or greater, perform a load test to determine the battery cranking capacity. Refer to Load Test for the procedures. If the battery will endure a load test, return the battery to use. If the battery will not endure a load test, it is faulty and must be replaced.
- Clean and inspect the battery hold downs, trays, terminals, posts, and top before completing service. Refer to Battery/Service and Repair for the proper cleaning and inspection procedures.

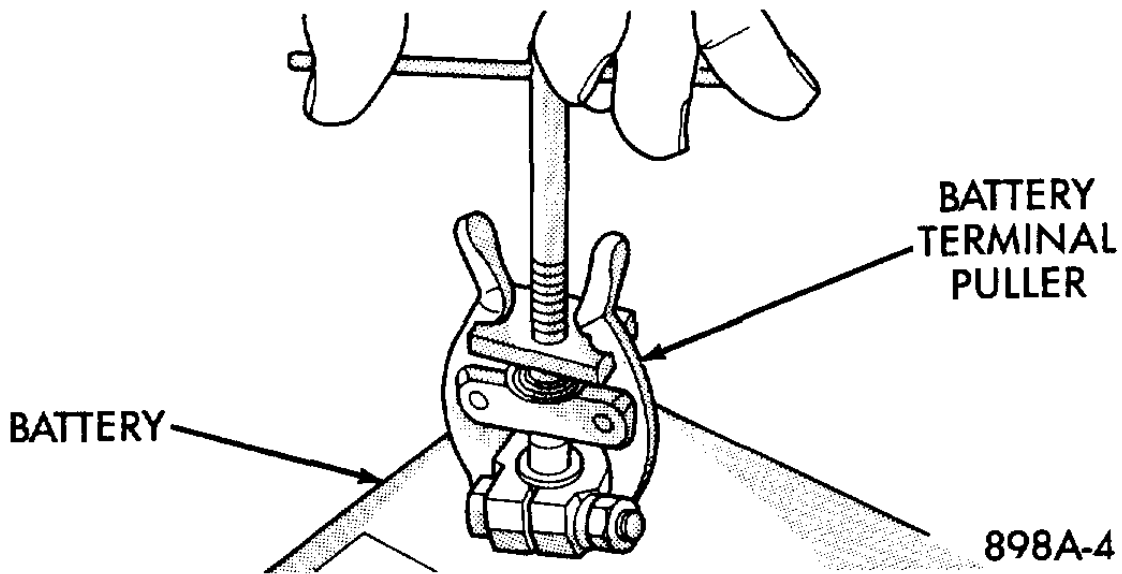
**Charging A Completely Discharged Battery (Article 2023936)**

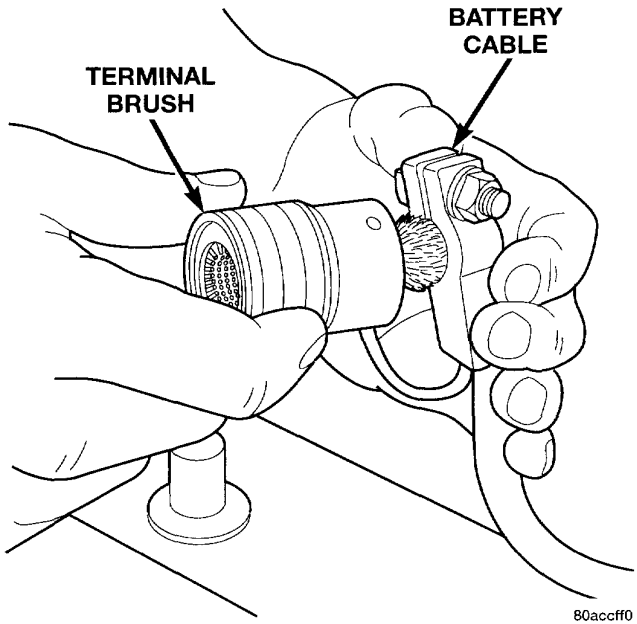
Battery Charging Timetable			
Charging Amperage	5 Amperes	10 Amperes	20 Amperes
Open Circuit Voltage	Hours Charging at 21° C (70° F)		
12.25 to 12.49	6 hours	3 hours	1.5 hours
12.00 to 12.24	10 hours	5 hours	2.5 hours
10.00 to 11.99	14 hours	7 hours	3.5 hours
*Below 10.00	18 hours	9 hours	4.5 hours
*Refer to Charging A Completely Discharged Battery			



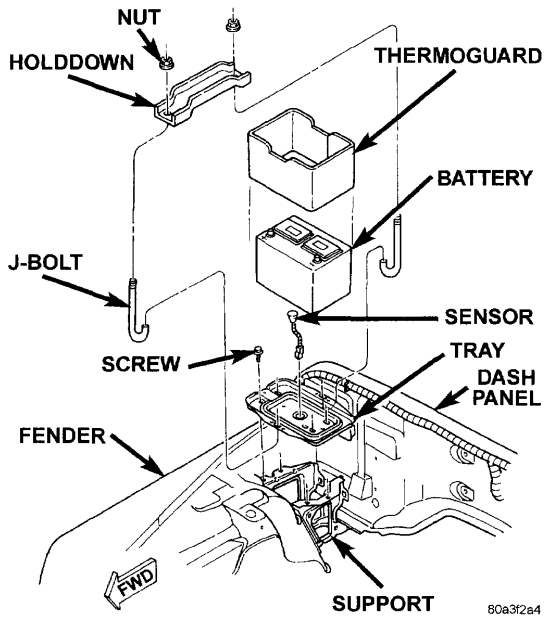
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### Battery Replacement (Article 2023931)

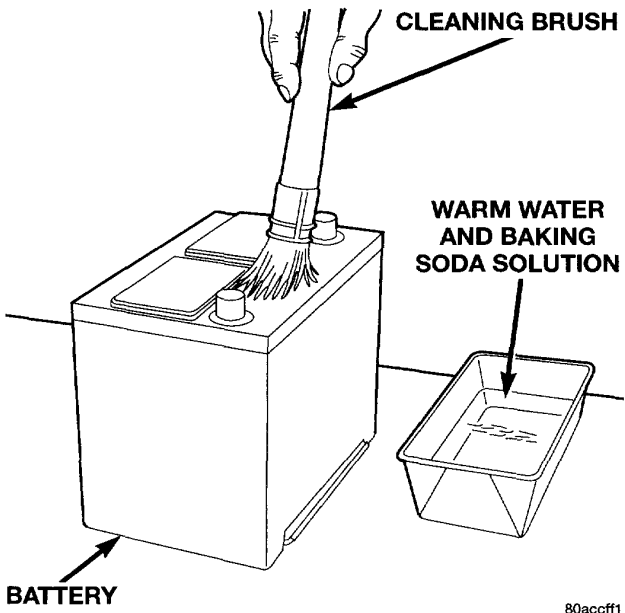
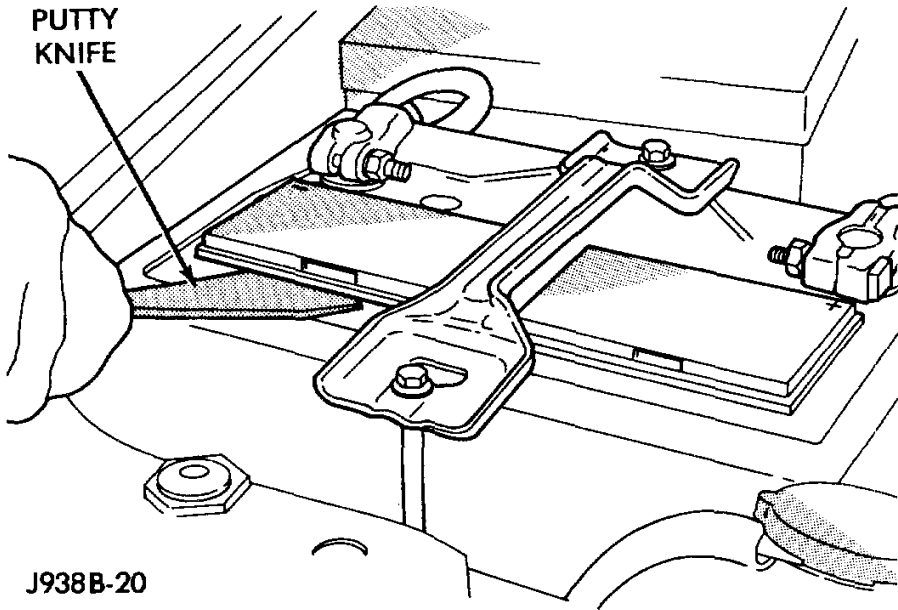


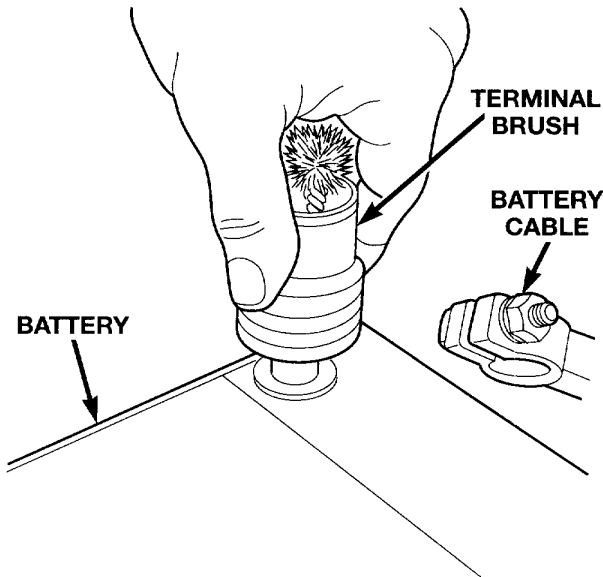


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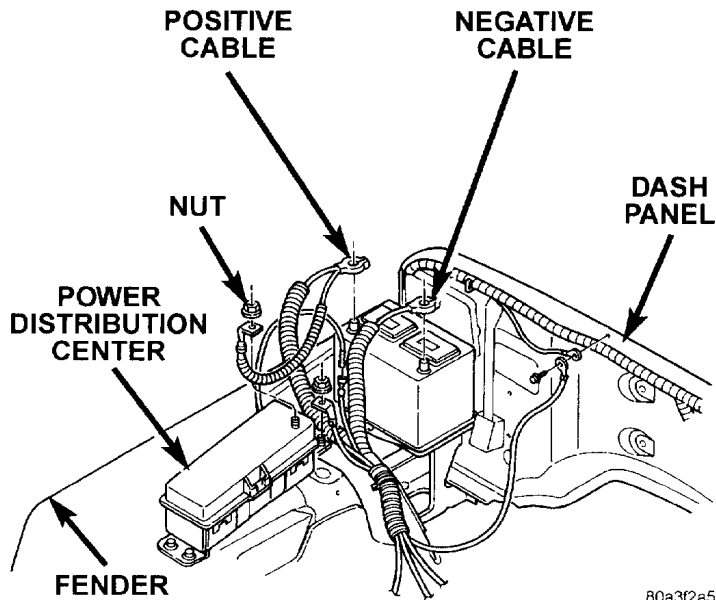


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### Technician Safety Information (itype\_15)

**WARNING:**

- IF THE BATTERY

SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

- EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

- THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

- IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

- WEAR A SUITABLE PAIR OF RUBBER GLOVES (NOT THE HOUSEHOLD TYPE) WHEN REMOVING A BATTERY BY HAND. SAFETY GLASSES SHOULD ALSO BE WORN. IF THE BATTERY IS CRACKED OR LEAKING, THE ELECTROLYTE CAN BURN THE SKIN AND EYES.

- NEVER EXCEED TWENTY AMPERES WHEN CHARGING A COLD (-1° C or 30° F) BATTERY. THE BATTERY MAY ARC INTERNALLY

AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT

.  
CAUTION

- :  
- Battery electrolyte will bubble inside the battery case during normal battery charging. Electrolyte boiling or being discharged from the battery vents indicates a battery overcharging condition. Immediately reduce the charging rate or turn off the charger to evaluate the battery condition. Damage to the battery may result from overcharging.  
- The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.

**Vehicle Damage Warnings (itype\_16)**

WARNING:

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SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

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CAUTION

- :  
- Always disconnect and isolate the battery negative cable before charging a battery. Do not exceed sixteen volts while charging a battery. Damage to the vehicle electrical system components may result.

**Voltage & Amperage (Article 2026041)**

- Part Number =  
56027960  
Cold Cranking Amperage .....  
500 amp  
Reserve Capacity .....  
110 Minutes  
Ampere Hours .....  
60  
Load Test Amperage .....  
250 amp  
56041003  
600 amp  
120 Minutes  
66  
300 amp

**Parasitic Draw (Article 2026042)**

- Ignition-Off Draw .....  
5 to 25 milliampere

**Mechanical (including Torque) (itype\_28)**

Tighten the hold downs to  
4 Nm (35 in. lbs.)

.  
Tighten both  
battery cable  
terminal clamp bolts to  
6.2 Nm (55 in. lbs.)  
Description = Torque  
Battery

Terminal Nut -  
8.5 Nm (75 in. lbs.)

## About Battery Testing (Start Here) (Article 2023916)

The battery, starting, and charging system

operate with one another, and must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components involved in these systems must perform within specifications.

The diagnostic procedures used include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD)

built into the Powertrain Control Module (PCM)

. Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt

test lamp may be required.

All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC)

. The PCM will store a DTC in electronic memory for any failure it detects. Refer to On-Board Diagnostic Test For Charging System in the Diagnosis and Testing of Charging System for more information.

The battery must be completely charged and the top, posts, and terminal clamps should be properly cleaned and inspected before diagnostic procedures are performed. Refer to Battery/Service and Repair for the proper battery cleaning and inspection procedures. Refer to Battery Charging in the Service Procedures for the proper charging procedures.

WARNING:

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The condition of a battery is determined by two criteria:

1. State-Of-Charge - This can be determined by checking the specific gravity of the battery electrolyte (built-in test indicator or hydrometer test), or by checking the battery voltage (open-circuit voltage test).

2. Cranking Capacity - This can be determined by performing a battery load test, which measures the ability of the battery to supply high-amperage current.

First, determine the battery state-of-charge. This can be done in one of three ways. If the battery has a built-in test indicator, view the test indicator to determine the state-of-charge. If the battery has no test indicator, but has removable cell caps, perform the hydrometer test to determine the state-of-charge. If the cell caps are not removable, or a hydrometer is not available, perform the open-circuit voltage test to determine the state-of-charge.

The battery must be charged before proceeding with a load test if:

- The battery built-in test indicator has a black or dark color visible.

- The temperature corrected specific gravity of the battery electrolyte is less than 1.235.

- The battery open-circuit voltage is less than

12.4 volts

A battery that will not accept a charge is faulty, and must be replaced. Further testing is not required. A fully-charged battery must be load tested to determine its cranking capacity. A battery that is fully-charged, but does not pass the load test, is faulty and must be replaced.

NOTE

: Completely discharged batteries may take several hours to accept a charge. Refer to Battery Charging - Charging A Completely Discharged Battery in the Service Procedures for more information.

A battery is fully-charged when:

- All cells are gassing freely during charging.
- A green color is visible in the sight glass of the built-in test indicator.
- Three corrected specific gravity tests, taken at one-hour intervals, indicate no increase in the specific gravity.
- Open-circuit voltage is or greater.

### Abnormal Battery Discharging (Article 2023917)

Any of the following conditions can result in abnormal battery discharging:

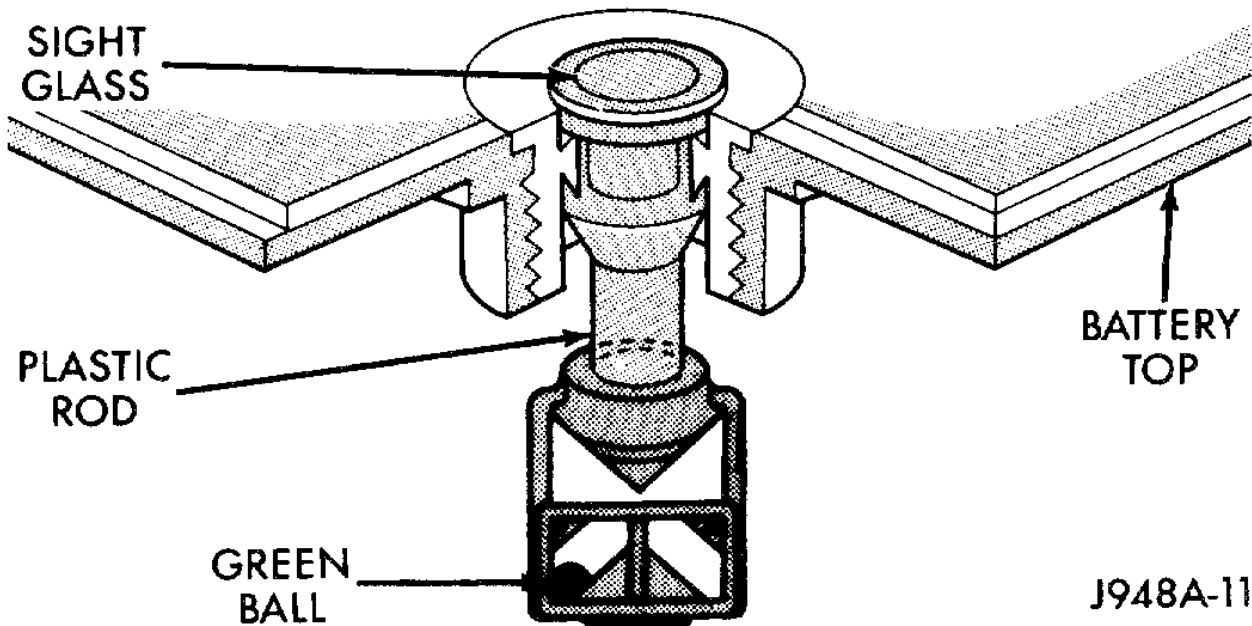
1. Corroded or loose battery posts and terminal clamps.
2. A loose or worn generator drive belt.
3. Electrical loads that exceed the output of the charging system  
. This can be due to equipment installed after manufacture, or repeated short trip use.
4. Slow driving speeds (heavy traffic conditions) or prolonged idling, with high-amperage draw systems in use.
5. A faulty circuit or component causing excessive ignition-off draw. Refer to Ignition-Off Draw Test in the Diagnosis and Testing for more information.
6. A faulty or incorrect charging system component. Refer to Diagnosis and Testing of Charging System for more information.
7. A faulty or incorrect battery

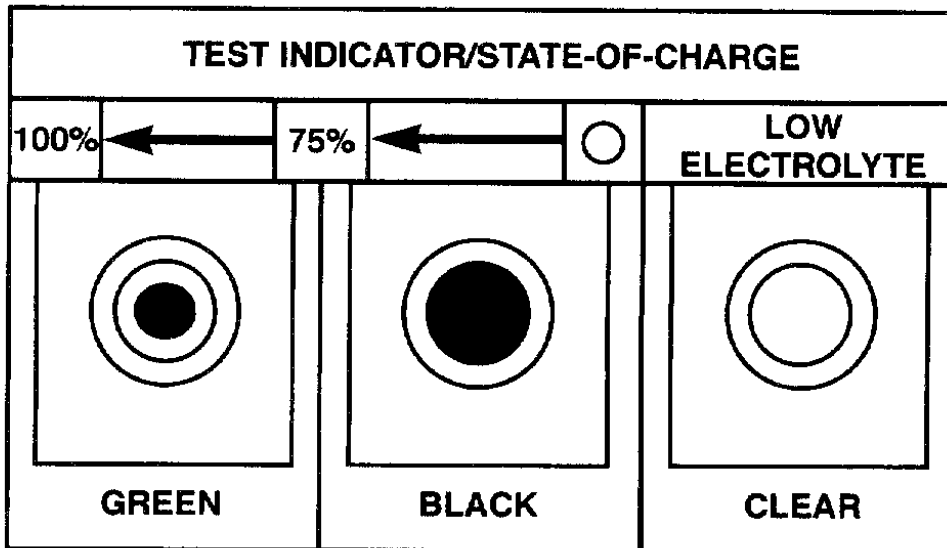
### Battery Diagnostic Chart (Article 2023918)

Battery Diagnosis		
Condition	Possible Causes	Correction
The battery seems weak or dead when attempting to start the engine.	<ol style="list-style-type: none"> <li>1. The battery has an incorrect size or rating for this vehicle.</li> <li>2. The battery is physically damaged.</li> <li>3. The battery terminal connections are loose or corroded.</li> <li>4. The battery is discharged.</li> <li>5. The electrical system ignition-off draw is excessive.</li> <li>6. The battery is faulty.</li> <li>7. The starting system is faulty.</li> <li>8. The charging system is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refer to Battery in the Specifications. Replace an incorrect battery with the correct battery.</li> <li>2. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the battery, if damaged.</li> <li>3. Refer to Voltage Drop Test in the Diagnosis and Testing . Clean and tighten the battery terminal connections, if required.</li> <li>4. Determine the battery state-of-charge. Refer to Built-In Test Indicator, Hydrometer Test, or Open-Circuit Voltage Test in the Diagnosis and Testing. Charge the battery, if required.</li> <li>5. Refer to Ignition-Off Draw Test in the Diagnosis and Testing. Repair the electrical system, if required.</li> <li>6. Determine the battery cranking capacity. Refer to Load Test in the Diagnosis and Testing. Replace the battery, if required.</li> <li>7. Determine if the starting system is performing to specifications. Refer to Diagnosis and Testing of Starting System for more information. Repair the starting system, if required.</li> <li>8. Determine if the charging system is performing to specifications. Refer to Diagnosis and Testing of Charging System for more information. Repair the charging system, if required.</li> </ol>

Battery Diagnosis		
Condition	Possible Causes	Correction
The battery state-of-charge cannot be maintained.	<ol style="list-style-type: none"> <li>1. The battery has an incorrect size or rating for this vehicle.</li> <li>2. The battery terminal connections are loose or corroded.</li> <li>3. The generator drive belt is slipping.</li> <li>4. The electrical system ignition-off draw is excessive.</li> <li>5. The battery is faulty.</li> <li>6. The starting system is faulty.</li> <li>7. The charging system is faulty.</li> <li>8. Electrical loads exceed the output of the charging system.</li> <li>9. Slow driving or prolonged idling with high-ampere draw systems in use.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refer to Battery in the Specifications section of this group. Replace an incorrect battery with the correct battery.</li> <li>2. Refer to Voltage Drop Test in the Diagnosis and Testing. Clean and tighten the battery terminal connections, if required.</li> <li>3. Replace or adjust the generator drive belt, if required.</li> <li>4. Refer to Ignition-Off Draw Test in the Diagnosis and Testing. Repair the electrical system, if required.</li> <li>5. Determine the battery cranking capacity. Refer to Load Test in the Diagnosis and Testing. Replace the battery, if required.</li> <li>6. Determine if the starting system is performing to specifications. Refer to Diagnosis and Testing of Starting Systems for more information. Repair the starting system, if required.</li> <li>7. Determine if the charging system is performing to specifications. Refer to Diagnosis and Testing of Charging System for more information. Repair the charging system, if required.</li> <li>8. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads.</li> <li>9. Advise the vehicle operator, as required.</li> </ol>
The battery will not accept a charge.	<ol style="list-style-type: none"> <li>1. The battery is faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refer to Battery Charging in the Service Procedures. Replace the faulty battery, if required.</li> </ol>

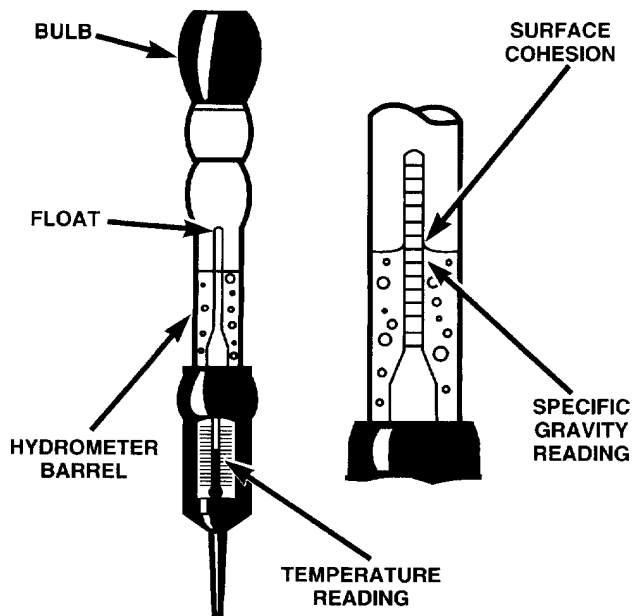
### Built-In Test Indicator (Article 2023919)





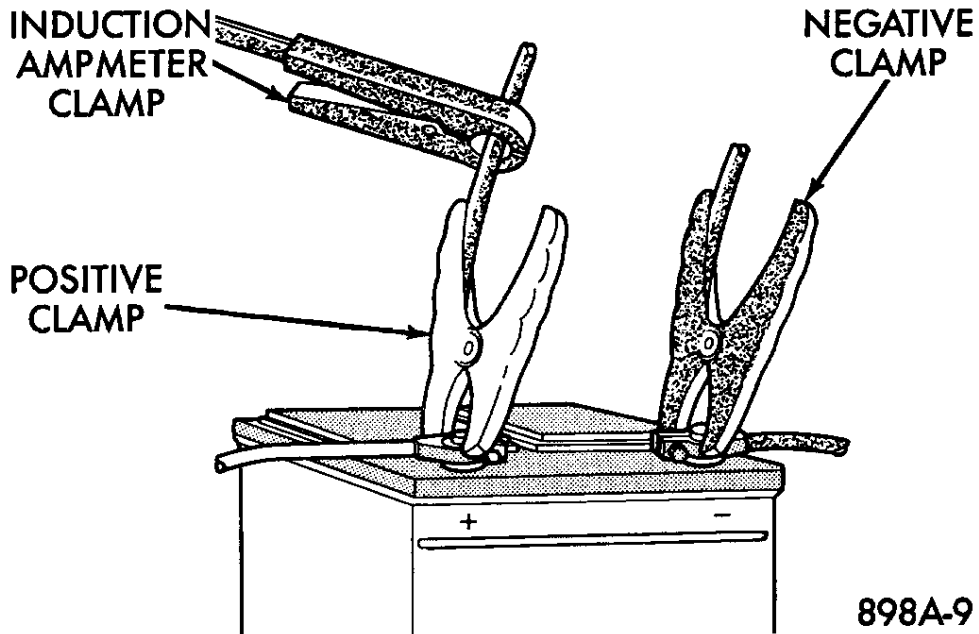
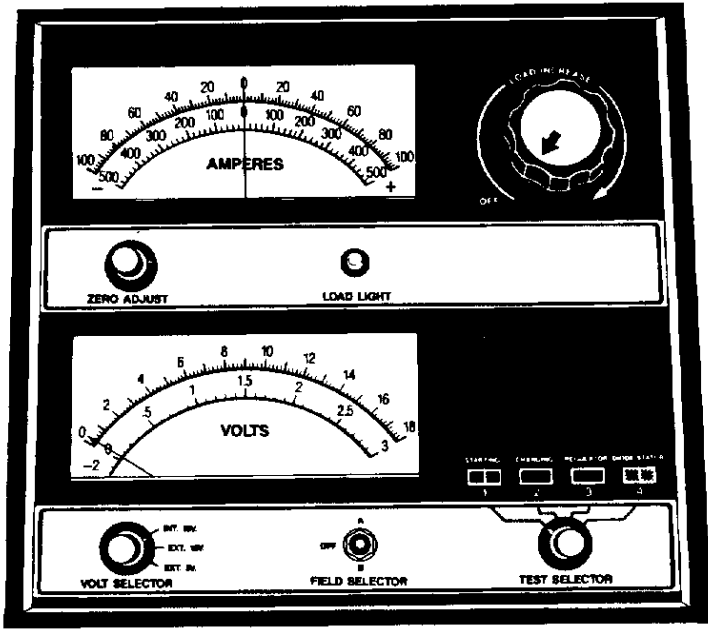
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**Hydrometer Test (Article 2023920)**

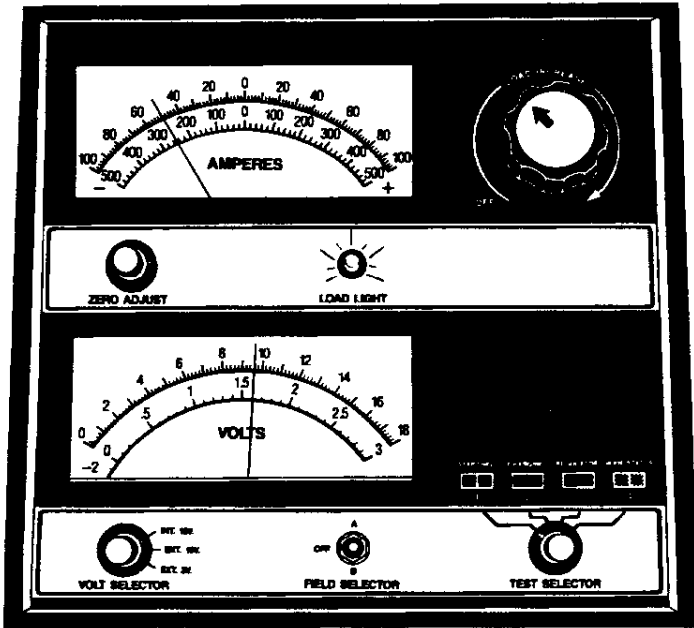
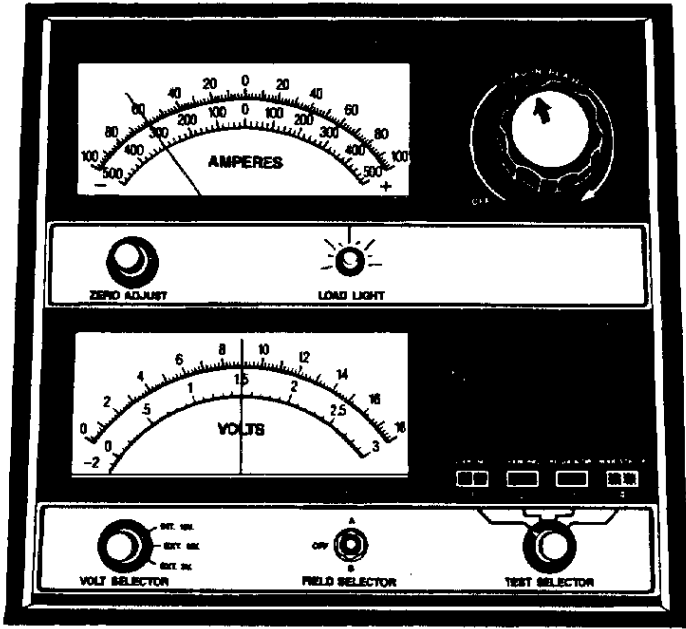


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**Battery Load Test (Article 2023912)**

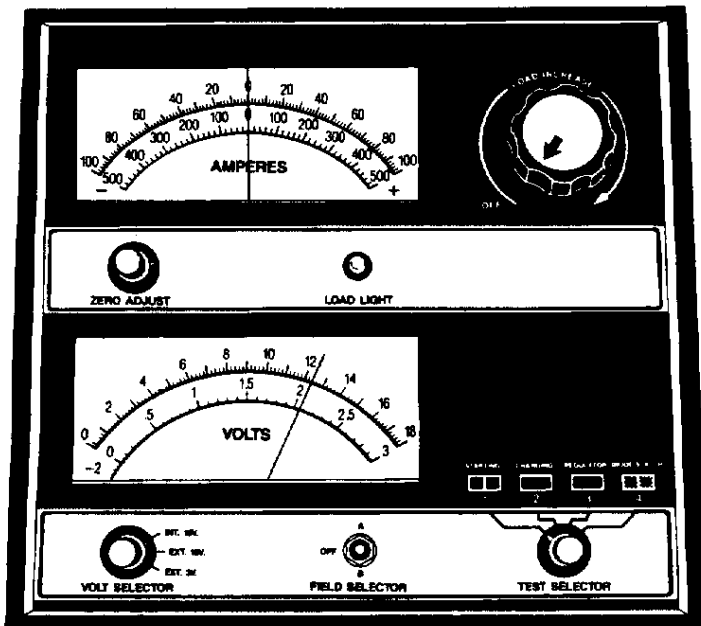


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Load Test Temperature		
Minimum Voltage	Temperature	
	°F	°C
9.6 volts	70° and above	21° and above
9.5 volts	60°	16°
9.4 volts	50°	10°
9.3 volts	40°	4°
9.1 volts	30°	-1°
8.9 volts	20°	-7°
8.7 volts	10°	-12°
8.5 volts	0°	-18°

### Battery Open Circuit Voltage Test (Article 2023921)



### Ignition Off Draw (IOD) Tests (Article 2023922)

The term Ignition-Off Draw

(  
IOD  
)

identifies a normal condition where power is being drained from the battery

with the  
ignition switch

in the Off position. A normal vehicle electrical system will draw from five to twenty-five milliamperes (0.005 to 0.025 ampere)

ignition sw

itch in the Off position, and all non-ignition controlled circuits in proper working order. The twenty-five milliamperes

are needed to enable the memory functions for the Powertrain Control Module

(PCM)

, digital clock, electronically tuned radio, and other modules which may vary with the vehicle equipment.

A vehicle that has not been operated for approximately twenty days, may discharge the battery to an inadequate level. When a vehicle will not be used for twenty days or more (stored), remove the IOD fuse from the junction block

. This will reduce battery discharging.

Excessive IOD can be caused by:

- Electrical items left on
- Faulty or improperly adjusted switches
- Faulty or shorted electronic modules and components
- An internally shorted generator
- Intermittent shorts in the wiring.

If the IOD is over

, the problem must be found and corrected before replacing a battery. In most cases, the battery can be charged and returned to service after the excessive IOD condition has been corrected.

1. Verify that all electrical accessories are off. Turn off all lamps, remove the ignition key, and close all doors. If the vehicle is equipped with an illuminated entry system or an electronically tuned radio, allow the electronic timer function of these systems to automatically shut off (time out). This may take up to three minutes

.

2. Determine that the under-hood lamp is operating properly, then disconnect the lamp wire harness connector or remove the lamp bulb.

3. Disconnect the battery negative cable.

4. Set an electronic digital multi-meter to its highest amperage scale. Connect the multi-meter between the disconnected battery negative cable clamp and the battery negative terminal post. Make sure that the doors remain closed so that the illuminated entry system is not activated. The multi-meter amperage reading may remain high for up to three minutes, or may not give any reading at all while set in the highest amperage scale, depending upon the electrical equipment on the vehicle. The multi-meter leads must be securely clamped to the battery negative cable clamp and the battery negative terminal post. If continuity between the battery negative terminal post and the negative cable clamp is lost during any part of the IOD test, the electronic timer function will be activated and all of the tests will have to be repeated.

5. After about

, the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment on the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the

Power Distribution Center

PDC

), the junction block, and then in the relay and fuse block

(refer to Power Distribution Center, Junction Block, and Relay And Fuse Block in the Component Index Wiring Diagrams for fuse and circuit breaker identification) one at a time until the amperage reading becomes very low, or nonexistent. This will isolate each circuit and identify the source of the high-amperage IOD. If the amperage reading remains high after removing and replacing each fuse and circuit breaker, disconnect the wire harness from the generator. If the amperage reading now becomes very low or nonexistent, refer to Diagnosis and Testing in the Charging System

to diagnose the condition. After the high-amperage IOD has been corrected, switch the multi-meter to progressively lower amperage scales and, if necessary, repeat the fuse and circuit breaker remove-and-replace process to identify and correct all sources of excessive IOD. It is now safe to select the lowest milliampere scale of the multi-meter to check the low-amperage IOD.

CAUTION

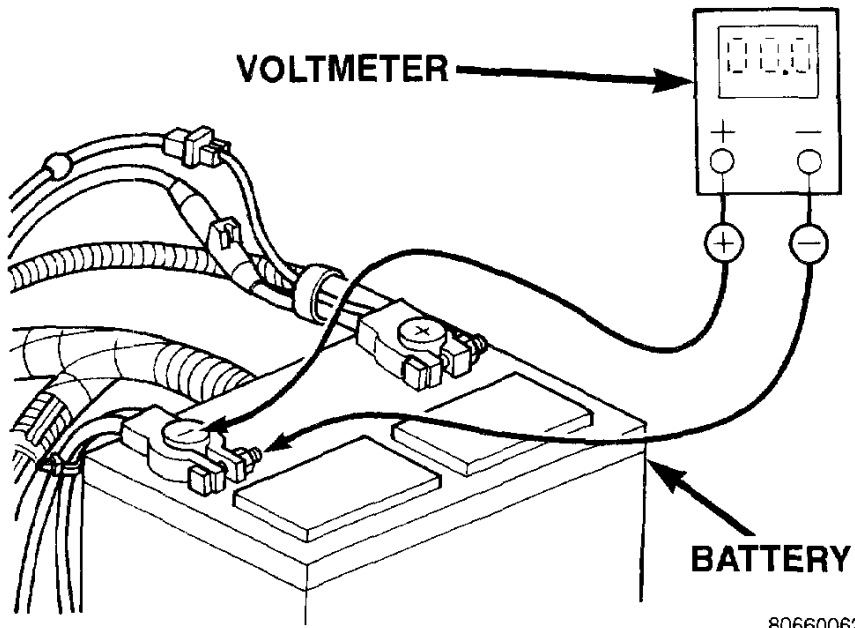
: Do not open any doors, or turn on any electrical accessories with the lowest milliampere scale selected, or the multi-meter may be damaged.

6. Observe the multi-meter reading. The low-amperage IOD should not exceed twenty-five milliamperes (0.025 ampere)

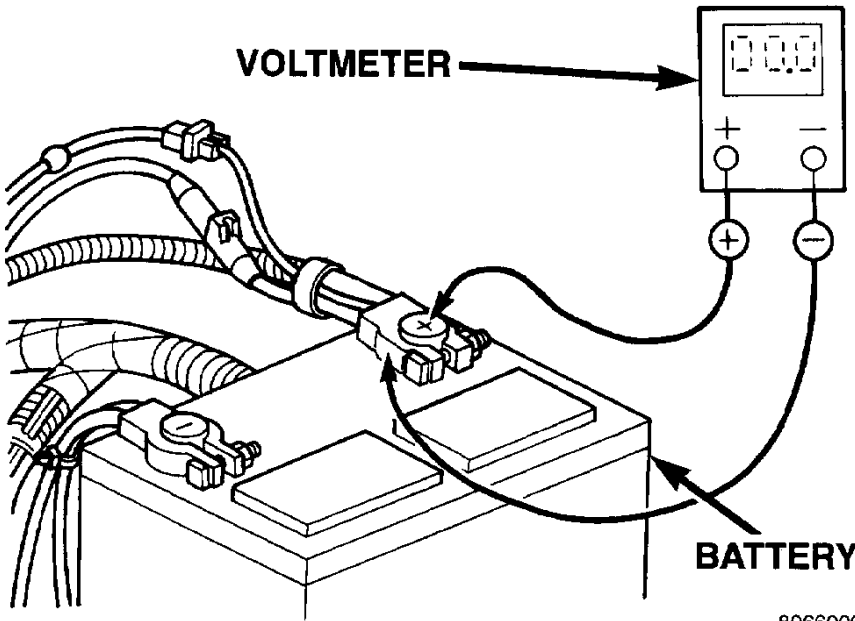
. If the draw exceeds

, isolate each circuit using the fuse and circuit breaker remove-and-replace process. The multi-meter reading will drop to within the acceptable limit when the source of the excessive draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or a component failure is at fault.

Voltage Drop Test (Article 2023923)



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