ENGINE SYSTEMS

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BATTERY SYSTEM

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BATTERY SYSTEM

DESCRIPTION

A single 12-volt battery is standard factory-installed equipment on this model. All of the components of the battery system are located within the engine compartment of the vehicle. The battery system is comprised of the following related components, which are covered in further detail later in this section of the service manual:

- **Battery** - The maintenance-free 12 volt automotive battery provides a reliable means of storing a renewable source of electrical energy within the vehicle.
- **Battery Cables** - The color-coded positive and negative battery cables connect the positive and negative battery terminal posts to the vehicle electrical system.
- **Battery Holddown** - The battery holddown secures the battery in the battery tray.
- **Battery Thermowrap** - The battery thermowarp insulates the battery from engine compartment temperature extremes.
- **Battery Tray** - The battery tray provides a secure mounting location in the engine compartment

for the battery and an anchor point for the battery holddown.

For battery maintenance schedules and jump starting procedure, see the owner's manual in the vehicle glove box. Optionally, refer to the Lubrication and Maintenance section of this manual for the battery maintenance schedules and proper battery jump starting procedure. While battery charging can be considered a maintenance procedure, the battery charging procedure and related information are located later in this section.

OPERATION

The battery system is designed to provide a safe, efficient and reliable means of delivering and storing electrical energy. This electrical energy is required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or charging system are not operating. The battery system is also designed to provide a reserve of electrical energy to supplement the charging system for short durations while the engine is running and the electrical current demands of the vehicle exceed the output of the charging system. In addition to delivering, and storing electrical energy for the vehicle, the battery system serves as a capacitor and voltage stabilizer for the vehicle electrical system. It absorbs most abnormal or transient voltages caused by the switching ON/OFF of any of the electrical components or circuits in the vehicle.

DIAGNOSIS AND TESTING - BATTERY SYSTEM

The battery, starting, and charging systems in the vehicle operate with one another and must be tested as a complete system. In order for the engine to start and the battery to maintain its charge properly, all of the components that are used in these systems must perform within specifications. It is important that the battery, starting, and charging systems be thoroughly tested and inspected any time a battery needs to be charged or replaced. The cause of abnormal battery discharge, overcharging or early battery failure must be diagnosed and corrected before a battery is replaced and before a vehicle is returned to service. The service information for these systems has been separated within this service manual to make it easier to locate the specific information you are seeking. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used for the battery, starting, and charging systems 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, a volt/ohmmeter, a battery charger, a carbon pile rheostat (load tester) and a 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 Charging System for the proper charging system onboard diagnostic test procedures.

MICRO 420 BATTERY TESTER

The Micro 420 automotive battery tester is a special service tool, designed to help the dealership technician diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro 420 battery tester.

BATTERY SYSTEM (Continued)

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY SEEMS WEAK OR DEAD WHEN ATTEMPTING TO START THE ENGINE.	1. The electrical system ignition-off draw is excessive.	1. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the excessive ignition-off draw, as required.
	2. The charging system is faulty.	2. Determine if the charging system is performing to specifications. Refer to Charging System for additional charging system diagnosis and testing procedures. Repair the faulty charging system, as required.
	3. The battery is discharged.	3. Determine the battery state-of-charge using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Charge the faulty battery, as required.
	4. The battery terminal connections are loose or corroded.	4. Refer to Battery Cables for the proper battery cable diagnosis and testing procedures. Check and clean and tighten the battery terminal connections, as required.
	5. The battery has an incorrect size or rating for this vehicle.	5. Refer to Battery System Specifications for the proper size and rating. Replace an incorrect battery, as required.
	6. The battery is faulty.	6. Test the battery using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Replace the faulty battery, as required.
	7. The starting system is faulty.	7. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required.
	8. The battery is physically damaged.	8. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the damaged battery, as required.

BATTERY SYSTEM (Continued)

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY STATE OF CHARGE CANNOT BE MAINTAINED.	1. The battery has an incorrect size or rating for this vehicle.	1. Refer to Battery System Specifications for the proper specifications. Replace an incorrect battery, as required.
	2. The battery terminal connections are loose or corroded.	2. Refer to Battery Cable for the proper cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required.
	3. The electrical system ignition-off draw is excessive.	3. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the faulty electrical system, as required.
	4. The battery is faulty.	4. Test the battery using the Micro 420 battery tester. Refer to Standard Procedures for additional test procedures. Replace the faulty battery, as required.
	5. The starting system is faulty.	5. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required.
	6. The charging system is faulty.	6. Determine if the charging system is performing to specifications. Refer to Charging System for charging system diagnosis and testing procedures. Repair the faulty charging system, as required.
	7. Electrical loads exceed the output of the charging system.	7. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads.
	8. Slow driving or prolonged idling with high-amperage draw loads in use.	8. Advise the vehicle operator, as required.
THE BATTERY WILL NOT ACCEPT A CHARGE.	1. The battery is faulty.	1. Test the battery using the Micro 420 battery tester.. Charge or replace the faulty battery, as required.

ABNORMAL BATTERY DISCHARGING

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

1. A faulty or incorrect charging system component. Refer to Charging System for additional charging system diagnosis and testing procedures.
2. A faulty or incorrect battery. Use Micro 420 tester and refer to Standard Procedures for additional battery diagnosis and testing procedures.
3. A faulty circuit or component causing excessive ignition-off draw.
4. Electrical loads that exceed the output of the charging system. This can be due to equipment installed after manufacture, or repeated short trip use.
5. A faulty or incorrect starting system component. Refer to Starting System for the proper starting system diagnosis and testing procedures.
6. Corroded or loose battery terminals.
7. Slow driving speeds (heavy traffic conditions) or prolonged idling, with high-amperage draw loads in use.

CLEANING

The following information details the recommended cleaning procedures for the battery and related components. In addition to the maintenance schedules

BATTERY SYSTEM (Continued)

found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

(1) Clean the battery cable terminal clamps of all corrosion. Remove any corrosion using a wire brush or a post and terminal cleaning tool, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 1).

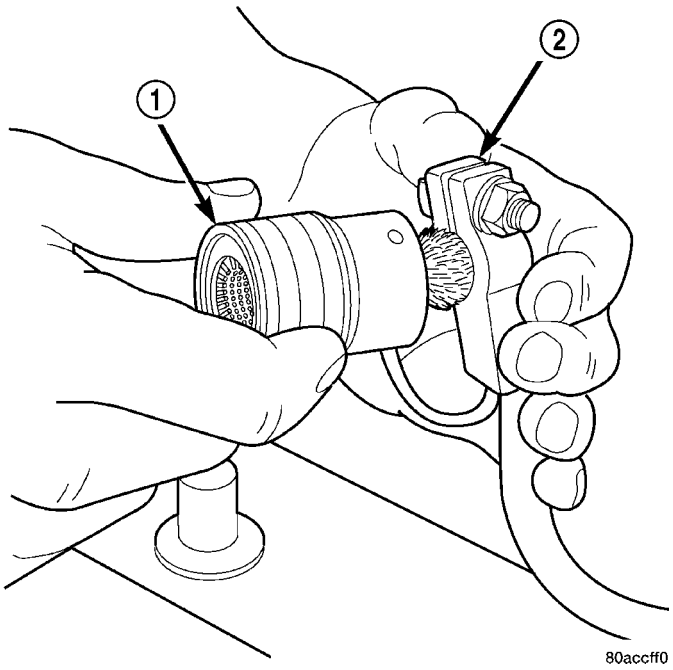


Fig. 1 Cleaning Battery Cable Terminal Clamp - Typical

1 - Terminal Brush
2 - Battery Cable

(2) Clean the battery tray and battery holddown hardware of all corrosion. Remove any corrosion using a wire brush and a sodium bicarbonate (baking soda) and warm water cleaning solution. Paint any exposed bare metal.

(3) If the removed battery is to be reinstalled, clean the outside of the battery case and the top cover with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush to remove any acid film (Fig. 2). Rinse the battery with clean water. Ensure that the cleaning solution does not enter the battery cells through the vent holes.

(4) Clean the battery thermowrap with a sodium bicarbonate (baking soda) and warm water cleaning solution using a soft bristle parts cleaning brush to remove any acid film.

(5) Clean any corrosion from the battery terminal posts with a wire brush or a post and terminal cleaner, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 3).

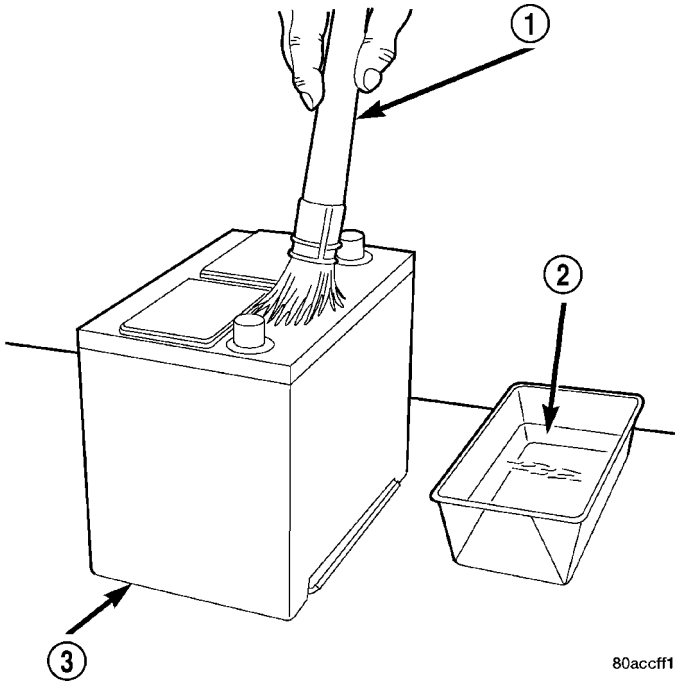


Fig. 2 Cleaning Battery - Typical

1 - Cleaning Brush
2 - Warm Water and Baking Soda Solution
3 - Battery

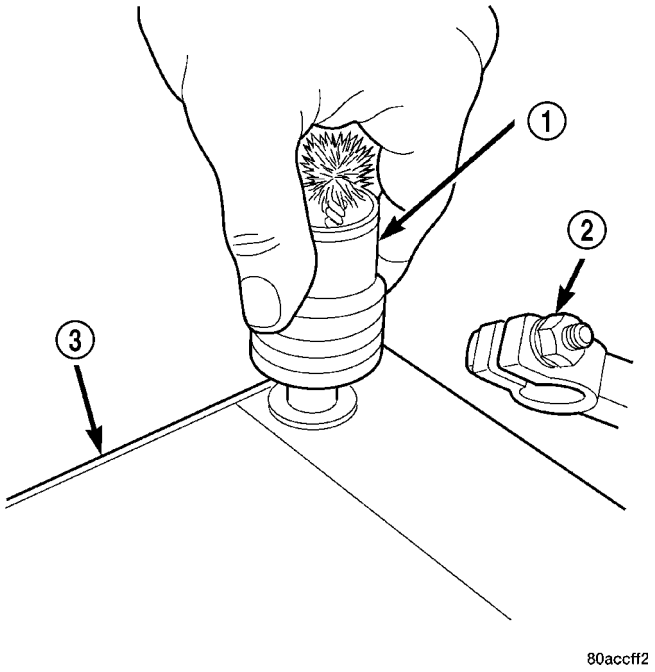


Fig. 3 Cleaning Battery Terminal Post - Typical

1 - Terminal Brush
2 - Battery Cable
3 - Battery

INSPECTION

The following information details the recommended inspection procedures for the battery and related

components. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

(1) Inspect the battery cable terminal clamps for damage. Replace any battery cable that has a damaged or deformed terminal clamp.

(2) Inspect the battery tray and battery holddown hardware for damage. Replace any damaged parts.

(3) Slide the thermowrap off of the battery case. Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also, check the battery terminal posts for looseness. Batteries with damaged cases or loose terminal posts must be replaced.

(4) Inspect the battery thermowrap for tears, cracks, deformation or other damage. Replace any battery thermal guard that has been damaged.

(5) Inspect the battery built-in test indicator sight glass(if equipped) for an indication of the battery condition. If the battery is discharged, charge as required. Refer to Standard Procedures for the proper battery built-in indicator test procedures. Also refer to Standard Procedures for the proper battery charging procedures.

SPECIFICATIONS

The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced. Battery sizes and ratings are discussed in more detail below.

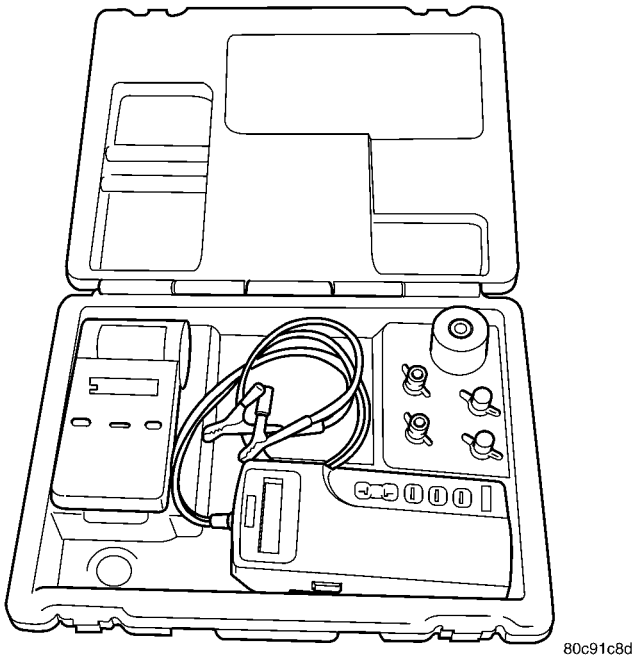
- **Group Size** - The outside dimensions and terminal placement of the battery conform to standards established by the Battery Council International (BCI). Each battery is assigned a BCI Group Size number to help identify a correctly-sized replacement.
- **Cold Cranking Amperage** - The Cold Cranking Amperage (CCA) rating specifies how much current (in amperes) the battery can deliver for thirty seconds at -18° C (0° F). Terminal voltage must not fall below 7.2 volts during or after the thirty second discharge period. The CCA required is generally higher as engine displacement increases, depending also upon the starter current draw requirements.
- **Reserve Capacity** - The Reserve Capacity (RC) rating specifies the time (in minutes) it takes for battery terminal voltage to fall below 10.5 volts, at a discharge rate of 25 amperes. RC is determined with the battery fully-charged at 26.7° C (80° F). This rating estimates how long the battery might last after a charging system failure, under minimum electrical load.
- **Ampere-Hours** - The Ampere-Hours (AH) rating specifies the current (in amperes) that a battery can deliver steadily for twenty hours, with the voltage in the battery not falling below 10.5 volts. This rating is also sometimes identified as the twenty-hour discharge rating.

BATTERY CLASSIFICATIONS & RATINGS					
Part Number	BCI Group Size Classification	Cold Cranking Amperage	Reserve Capacity	Ampere - Hours	Load Test Amperage
4686158AD	34	500	110 Minutes	60	250

BATTERY SYSTEM (Continued)

SPECIAL TOOLS

BATTERY SYSTEM SPECIAL TOOLS



Micro 420 Battery Tester

BATTERY

DESCRIPTION

Maintenance-free batteries are standard factory-installed equipment on this model. Male post type terminals made of a soft lead material protrude from the top of the molded plastic battery case (Fig. 4) to provide the means for connecting the battery to the vehicle electrical system. The battery positive terminal post is visibly larger in diameter than the negative terminal post. The letters **POS** and **NEG** are also molded into the top of the battery case adjacent to their respective positive and negative terminal posts for additional identification confirmation.

This battery is designed to provide a safe, efficient and reliable means of storing electrical energy in a chemical form. This means of energy storage allows the battery to produce the electrical energy required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating. The battery is made up of six individual cells that are connected in series. Each cell contains positively charged plate groups that are connected with lead straps to the positive terminal post, and negatively charged plate groups that are connected with lead straps to the negative terminal post. Each plate consists of a stiff mesh framework or grid coated with lead dioxide

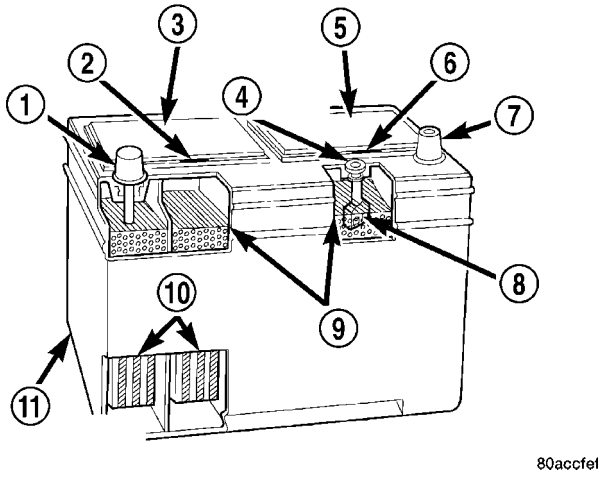


Fig. 4 Maintenance-Free Battery

1 - Positive Post
2 - Vent
3 - Cell Cap
4 - Vent
5 - Cell Cap
6 - Vent
7 - Negative Post
8 - Indicator Eye (if equipped)
9 - Electrolyte Level
10 - Plate Groups
11 - Maintenance-Free Battery

(positive plate) or sponge lead (negative plate). Insulators or plate separators made of a non-conductive material are inserted between the positive and negative plates to prevent them from contacting or shorting against one another. These dissimilar metal plates are submerged in a sulfuric acid and water solution called electrolyte.

The chemical composition of the metal coated plates within the low-maintenance battery reduces battery gassing and water loss, at normal charge and discharge rates. Therefore, the battery should not require additional water in normal service. However, rapid loss of electrolyte can be caused by an overcharging condition. Be certain to diagnose the charging system after replacing the battery for a low electrolyte condition and before returning the vehicle to service. Refer to **Charging** for additional information.

The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced. Refer to **Battery Specifications** in this group for the proper factory-installed battery specifications.

BATTERY (Continued)

OPERATION

The battery is designed to store electrical energy in a chemical form. When an electrical load is applied to the terminals of the battery, an electrochemical reaction occurs. This reaction causes the battery to discharge electrical current from its terminals. As the battery discharges, a gradual chemical change takes place within each cell. The sulfuric acid in the electrolyte combines with the plate materials, causing both plates to slowly change to lead sulfate. At the same time, oxygen from the positive plate material combines with hydrogen from the sulfuric acid, causing the electrolyte to become mainly water. The chemical changes within the battery are caused by the movement of excess or free electrons between the positive and negative plate groups. This movement of electrons produces a flow of electrical current through the load device attached to the battery terminals.

As the plate materials become more similar chemically, and the electrolyte becomes less acid, the voltage potential of each cell is reduced. However, by charging the battery with a voltage higher than that of the battery itself, the battery discharging process is reversed. Charging the battery gradually changes the sulfated lead plates back into sponge lead and lead oxide, and the water back into sulfuric acid. This action restores the difference in the electron charges deposited on the plates, and the voltage potential of the battery cells. For a battery to remain useful, it must be able to produce high-amperage current over an extended period. A battery must also be able to accept a charge, so that its voltage potential may be restored.

The battery is vented to release excess hydrogen gas that is created when the battery is being charged or discharged. However, even with these vents, hydrogen gas can collect in or around the battery. If hydrogen gas is exposed to flame or sparks, it may ignite.

DIAGNOSIS AND TESTING - BATTERY

The battery must be completely charged and the terminals should be properly cleaned and inspected before diagnostic procedures are performed. Refer to Battery System Cleaning for the proper cleaning procedures, and Battery System Inspection for the proper battery inspection procedures. Refer to Standard Procedures for the proper battery charging procedures.

MICRO 420 BATTERY TESTER

The Micro 420 automotive battery tester is designed to help the dealership technicians diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro 420 battery tester.

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

WARNING: 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.

WARNING: 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.

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 tested to determine its condition. A battery that is fully-charged, but does not pass the load test or Micro 420 test, is faulty and must be replaced.

NOTE: Completely discharged batteries may take several hours to accept a charge.

STANDARD PROCEDURE

STANDARD PROCEDURE - CONVENTIONAL BATTERY CHARGING

Battery charging is the means by which the battery can be restored to its full voltage potential. A battery is fully-charged when:

- Micro 420 battery tester indicates battery is OK.
- Three hydrometer tests, taken at one-hour intervals, indicate no increase in the temperature-corrected specific gravity of the battery electrolyte.
- Passes Load Test
- Open-circuit voltage of the battery is 12.64 volts or above.

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

BATTERY (Continued)

WARNING: 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.

WARNING: 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.

WARNING: 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.

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.

CAUTION: 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.

After the battery has been charged to 12.4 volts or greater, retest the battery with the Micro 420 tester or perform a load test to determine the battery cranking capacity.

Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing battery service. Refer to Battery System Cleaning for the proper battery cleaning procedures, and Battery System Inspection for the proper battery inspection procedures.

CHARGING A COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.

(1) Measure the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt (Fig. 5). If the reading is below ten volts, the battery charging current will be low. It could take some time before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on the ammeters built into many battery chargers.

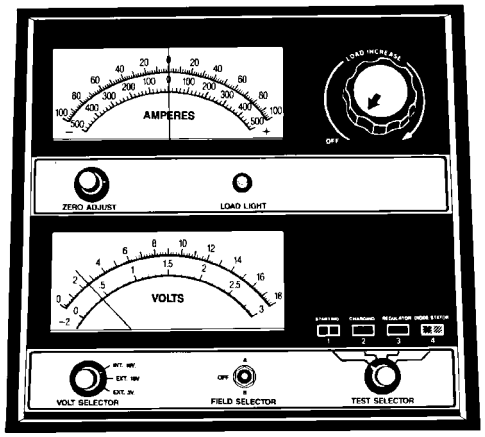


Fig. 5 Voltmeter Accurate to 1/10 Volt (Connected)

(2) Disconnect and isolate the battery negative cable. Connect the battery charger leads. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and 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 battery 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.

(3) Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charging current at various voltages is shown in the Charge Rate Table. If the charging current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

BATTERY (Continued)

CHARGE RATE TABLE	
Voltage	Minutes
16.0 volts maximum	up to 10 min.
14.0 to 15.9 volts	up to 20 min.
13.9 volts or less	up to 30 min.

CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- **Battery Capacity** - A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.
- **Temperature** - A longer time will be needed to charge a battery at -18° C (0° F) than at 27° C (80° F). When a fast battery charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).
- **Charger Capacity** - A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies twenty amperes or more will require a shorter charging time.
- **State-Of-Charge** - A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

The Conventional Battery Charging Time Table gives an indication of the time required to charge a typical battery at room temperature based upon the battery state-of-charge and the charger capacity.

CONVENTIONAL BATTERY CHARGING TIME TABLE			
Charging Amperage	5 Amps	10 Amps	20 Amps
Open Circuit Voltage	Hours Charging @ 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

STANDARD PROCEDURE - OPEN-CIRCUIT VOLTAGE TEST

A battery open-circuit voltage test will show the approximate state-of-charge of a battery. This test can be used if no other battery tester is available.

Before proceeding with this test, completely charge the battery. Refer to Standard Procedures for the proper battery charging procedures.

(1) Before measuring the open-circuit voltage, the surface charge must be removed from the battery. Turn on the headlamps for fifteen seconds, then allow up to five minutes for the battery voltage to stabilize.

(2) Disconnect and isolate both battery cables, negative cable first.

(3) Using a voltmeter connected to the battery posts (see the instructions provided by the manufacturer of the voltmeter), measure the open-circuit voltage (Fig. 6).

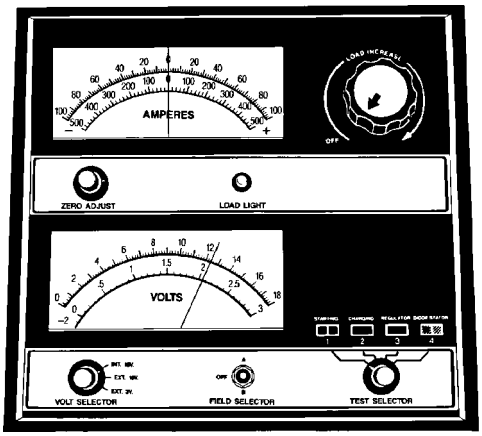


Fig. 6 Testing Open Circuit Voltage

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 tested to reveal its cranking capacity. Refer to Standard Procedures for the proper Micro 420 battery test procedures.

OPEN CIRCUIT VOLTAGE TABLE	
Open Circuit Voltage	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.2 volts	50%
12.45 volts	75%
12.65 volts or more	100%

BATTERY (Continued)

STANDARD PROCEDURE - IGNITION-OFF DRAW TEST

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 forty-five milliamperes (0.005 to 0.045 ampere) with the ignition switch in the Off position, and all non-ignition controlled circuits in proper working order. Up to forty-five milliamperes are needed to enable the memory functions for the Powertrain Control Module (PCM), radio, and other modules which may vary with the vehicle equipment.

A vehicle that has not been operated for approximately twenty-one days, may discharge the battery to an inadequate level. When a vehicle will not be used for twenty-one days or more (stored), remove the IOD fuse from the Integrated Power Module (IPM). 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 forty-five milliamperes, 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 twenty minutes.

(2) Disconnect the battery negative cable.

(3) Set an electronic digital multi-meter to its highest amperage scale. Connect the multi-meter between the disconnected battery negative cable terminal 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 in the vehicle. The multi-meter leads must be securely clamped to the battery negative cable terminal clamp and the battery negative terminal post. If continuity between the battery negative terminal post and the negative cable terminal 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.

(4) After about three minutes, the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment in the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the Integrated Power Module (IPM), one at a time until the amperage reading becomes very low, or nonexistent. Refer to the appropriate wiring information in this service manual for complete Integrated Power Module fuse, circuit breaker, and circuit identification. This will isolate each circuit and identify the circuit that is 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 Charging System for the proper charging system diagnosis and testing procedures. 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.

(5) Allow twenty minutes for the IOD to stabilize and observe the multi-meter reading. The low-amperage IOD should not exceed forty-five milliamperes (0.045 ampere). If the current draw exceeds forty-five milliamperes, isolate each circuit using the fuse and circuit breaker remove-and-replace process in Step 4. The multi-meter reading will drop to within the acceptable limit when the source of the excessive current draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or a component failure is at fault.

REMOVAL - BATTERY

WARNING: A SUITABLE PAIR OF HEAVY DUTY RUBBER GLOVES AND SAFETY GLASSES SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY.

WARNING: REMOVE METALLIC JEWELRY TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT.

(1) Verify that the ignition switch and all accessories are OFF.

BATTERY (Continued)

(2) Disconnect the battery cables from the battery posts, negative first (Fig. 7).

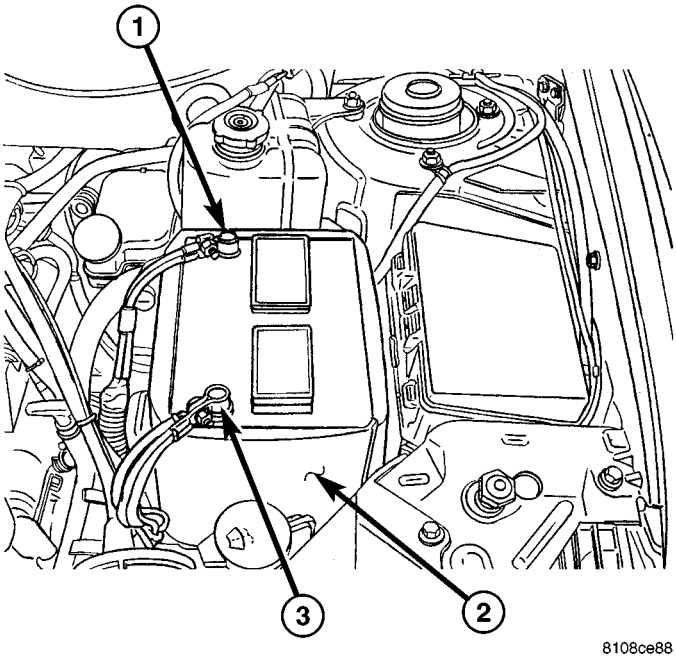


Fig. 7 CS Battery/Thermowrap

1 - Positive Battery Cable
2 - Thermowrap
3 - Negative Battery Cable

(3) Remove the battery hold down retaining nut.
(4) Remove the battery hold down bracket.
(5) Remove the thermowrap from the battery by sliding straight up and off (Fig. 7).
(6) Remove the battery from the vehicle.

INSTALLATION

(1) Position the battery in the battery tray.
(2) Install the battery hold down bracket and retaining nut. Torque the nut to 20 N·m (180 in. lbs.).
(3) Connect the battery cables to the battery posts, positive cable first. Torque terminal fasteners to 40 in. lbs.

BATTERY HOLDDOWN

DESCRIPTION

The battery hold down hardware consists of a molded plastic lip that is integral to the outboard edge of the battery tray and support unit, a molded steel hold down bracket and a single hex nut with a coned washer.

When installing a battery into the battery tray, be certain that the hold down hardware is properly installed and that the fasteners are tightened to the proper specifications. Improper hold down fastener tightness, whether too loose or too tight, can result in damage to the battery, the vehicle or both.

OPERATION

The battery holddown secures the battery in the battery tray. This holddown is designed to prevent battery movement during the most extreme vehicle operation conditions. Periodic removal and lubrication of the battery holddown hardware is recommended to prevent hardware seizure at a later date.

NOTE: Never operate a vehicle without a battery holddown device properly installed. Damage to the vehicle, components and battery could result.

REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.
(2) Remove the negative battery cable from the negative battery post.
(3) Remove the nut that secures the battery hold down bracket to the battery tray.
(4) Remove the battery hold down bracket from the battery tray.

INSTALLATION

(1) Install the battery hold down bracket in the battery tray. Be certain the battery and battery hold down are properly positioned.
(2) Install the nut that secures the battery hold down bracket to the battery tray. Torque to 20 N·m (180 in. lbs.).
(3) Connect the negative battery cable. Torque to 40 in. lbs.

BATTERY CABLES

DESCRIPTION

The battery cables are large gauge, stranded copper wires sheathed within a heavy plastic or synthetic rubber insulating jacket. The wire used in the battery cables combines excellent flexibility and reliability with high electrical current carrying capacity.

A clamping type female battery terminal made of stamped metal is attached to one end of the battery cable wire. A pinch-bolt and hex nut are installed at the open end of the female battery terminal clamp. Large eyelet type terminals are crimped onto the opposite end of the battery cable wire and then solder-dipped. The battery positive cable wires have a red insulating jacket to provide visual identification and feature a larger female battery terminal clamp to allow connection to the larger battery positive terminal post. The battery negative cable wires have a

BATTERY CABLES (Continued)

black insulating jacket and a slightly smaller female battery terminal clamp.

Both the battery positive and negative cables are available for service replacement only as a unit with the battery wire harness, which may include portions of the wiring circuits for the generator and other components on some models. Refer to **Wiring** for the location of more information on the various wiring circuits included in the battery wire harness for the vehicle being serviced.

OPERATION

The battery cables connect the battery terminal posts to the vehicle electrical system. These cables also provide a path back to the battery for electrical current generated by the charging system to restore the voltage potential of the battery. The female battery terminal clamps on the ends of the battery cable wires provide a strong and reliable connection of the battery cable to the battery terminal posts. The terminal pinch bolts allow the female terminal clamps to be tightened around the male terminal posts on the top of the battery. The eyelet terminals secured to the opposite ends of the battery cable wires from the female battery terminal clamps provide secure and reliable connection of the battery cables to the vehicle electrical system.

The positive battery cable wire has an eyelet terminal that connects to the B(+) terminal stud of the Integrated Power Module (IPM), and an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the engine starter motor solenoid. The battery negative cable terminal clamp is attached to the ends of two wires. One wire has an eyelet terminal that connects the battery negative cable to the vehicle powertrain through a stud on the engine cylinder block. The other wire has an eyelet terminal that connects the battery negative cable to the vehicle body through a ground screw in the engine compartment.

DIAGNOSIS AND TESTING - BATTERY CABLE

A voltage drop test will determine if there is excessive resistance in the battery cable terminal connections or the battery cable. If excessive resistance is found in the battery cable connections, the connection point should be disassembled, cleaned of all corrosion or foreign material, then reassembled. Following reassembly, check the voltage drop for the battery cable connection and the battery cable again to confirm repair.

When performing the voltage drop test, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached. **EXAMPLE:** When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable terminal clamp and to the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud. If you probe the battery positive terminal post and the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud, you are reading the combined voltage drop in the battery positive cable terminal clamp-to-terminal post connection and the battery positive cable.

VOLTAGE DROP TEST

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing this test, be certain that the following procedures are accomplished:

- The battery is fully-charged and tested. Refer to Standard Procedures for the proper battery charging and test procedures.
- Fully engage the parking brake.
- Place the gearshift selector lever in the Park position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic Shut Down (ASD) relay. The ASD relay is located in the Intelligent Power Module (IPM), in the engine compartment. See the fuse and relay layout label affixed to the underside of the IPM cover for ASD relay identification and location.

(1) Connect the positive lead of the voltmeter to the battery negative terminal post. Connect the negative lead of the voltmeter to the battery negative cable terminal clamp (Fig. 8). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery negative cable terminal clamp and the battery negative terminal post.

BATTERY CABLES (Continued)

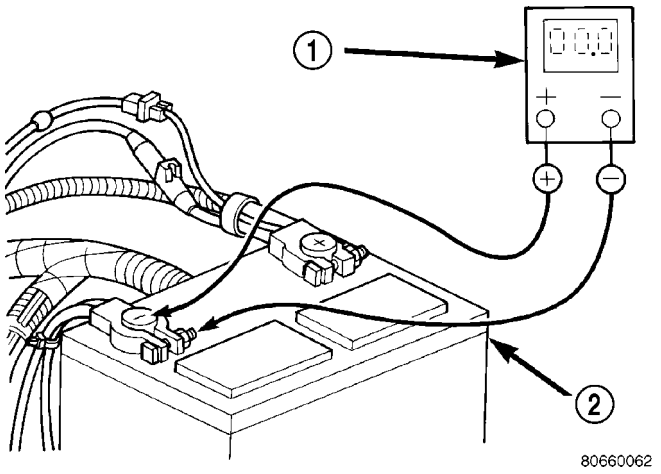


Fig. 8 Test Battery Negative Connection Resistance - Typical

1 - Voltmeter
2 - Battery

(2) Connect the positive lead of the voltmeter to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable terminal clamp (Fig. 9). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery positive cable terminal clamp and the battery positive terminal post.

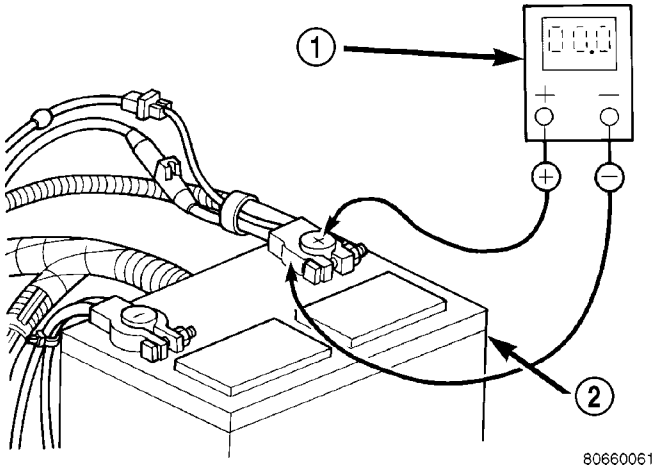


Fig. 9 Test Battery Positive Connection Resistance - Typical

1 - Voltmeter
2 - Battery

(3) Connect the voltmeter to measure between the battery positive cable terminal clamp and the starter solenoid B(+) terminal stud (Fig. 10). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery positive cable eyelet terminal connection at the starter solenoid B(+) terminal stud. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

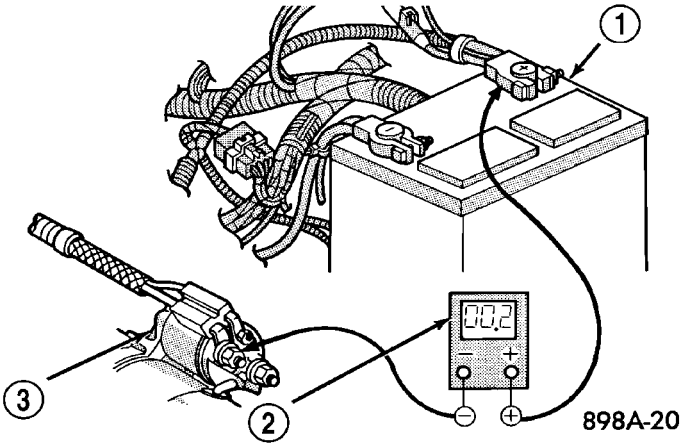


Fig. 10 Test Battery Positive Cable Resistance - Typical

1 - Battery
2 - Voltmeter
3 - Starter Motor

(4) Connect the voltmeter to measure between the battery negative cable terminal clamp and a good clean ground on the engine block (Fig. 11). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable eyelet terminal connection to the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

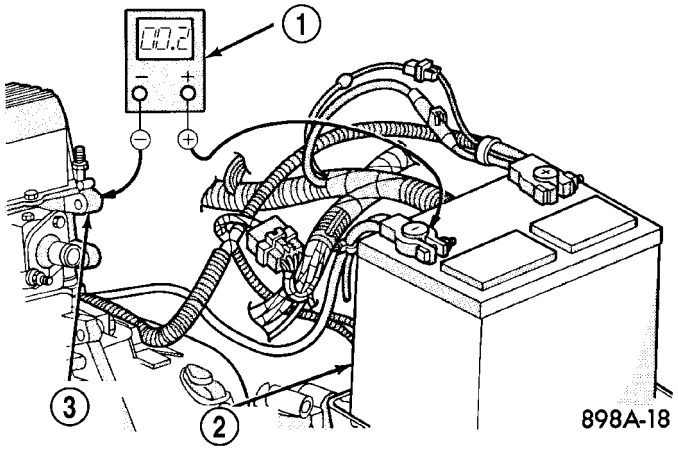


Fig. 11 Test Ground Circuit Resistance - Typical

1 - Voltmeter
2 - Battery
3 - Engine Ground

REMOVAL

The battery cables on this model may include portions of wiring circuits for the generator and other components on the vehicle. If battery cable replacement is required, it will be necessary to extract the

BATTERY CABLES (Continued)

cables out of the engine wire harness assembly. Use care not to damage the other wires and circuits which are also packaged into the engine wire harness assembly.

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Disconnect and isolate the negative battery cable terminal.

(3) Remove the tape from the engine wire harness assembly, to access the desired battery cable.

(4) One at a time, trace and disconnect the battery cable retaining fasteners and routing clips until the desired cable is free from the vehicle.

(5) Feed the battery cable out of the vehicle.

INSTALLATION

(1) Position the battery cable in the vehicle.

(2) One at a time, trace and install the battery cable retaining fasteners and routing clips until the desired cable is properly installed in the engine wire harness assembly.

(3) Install the tape on the engine wire harness assembly.

(4) Connect the positive battery cable terminal. Torque to 40 in. lbs.

(5) Connect the negative battery cable terminal. Torque to 40 in. lbs.

BATTERY TRAY

DESCRIPTION

The battery is mounted in a molded plastic battery tray and support unit located in the left front corner of the engine compartment. The battery tray and support unit is secured with three fasteners, Two are located directly under the battery and the other is located on the right side of the tray.

The battery tray and support unit also includes a drainage hose, located in the front of the unit.

OPERATION

The battery tray provides a secure mounting location and supports the battery. The battery tray also provides the anchor point for the battery holddown hardware. The battery tray and the battery holddown hardware combine to secure and stabilize the battery in the engine compartment, which prevents battery movement during vehicle operation. Unrestrained battery movement during vehicle operation could result in damage to the vehicle, the battery, or both.

The battery tray used on this model also includes a drainage hose, which provides means for any liquid that might collect in the bottom of the battery tray to drain under the vehicle.

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the battery from the vehicle. Refer to the procedure in this section.

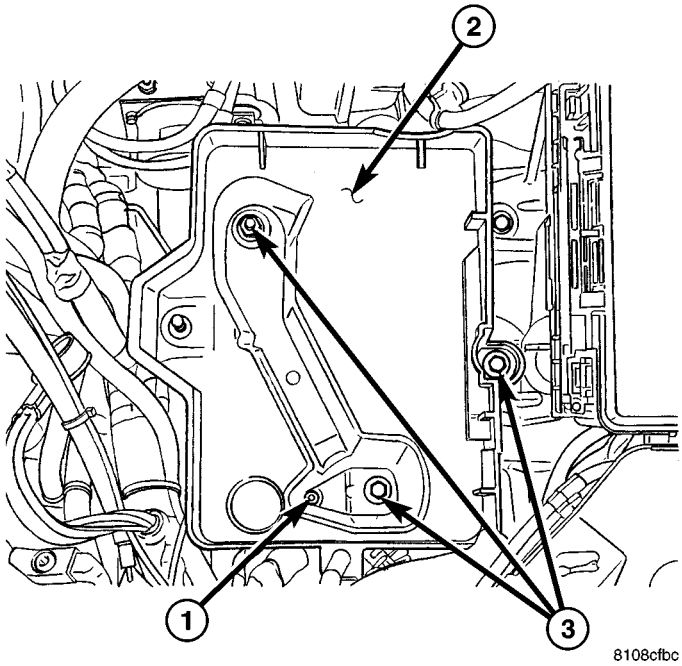


Fig. 12 CS Battery Tray

1 - Battery Tray Drain Hole/Hose Attachment
2 - Battery Tray
3 - Retaining Fasteners

(3) Remove the battery tray retaining fasteners (Fig. 12).

(4) Pull battery tray up far enough to disconnect the drain hose assembly.

(5) Remove the battery tray from the vehicle.

INSTALLATION

(1) Position the battery tray in the vehicle.

(2) Position drainage hose and install the battery tray retaining fasteners.

(3) Install the battery in the vehicle. Refer to the procedure in this section.

(4) Connect the negative battery cable.

THERMOWRAP

DESCRIPTION

A one-piece slip-on thermowrap unit shields the battery case from engine compartment heat. The thermowrap slips over the battery case (Fig. 13) and acts like a protective jacket.

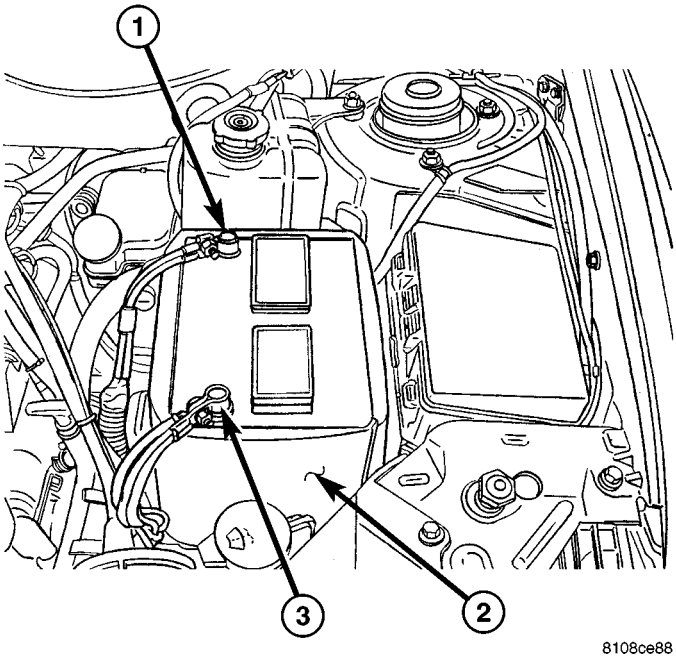


Fig. 13 CS Battery/Thermowrap

1 - Positive Battery Cable
2 - Thermowrap
3 - Negative Battery Cable

OPERATION

The thermowrap protects the battery from engine compartment temperature extremes. The temperature of the battery can affect battery life. The air trapped in the padded material of the thermowrap creates a dead air space, which helps to insulate the sides of the battery case from the air temperature found in the surrounding engine compartment.

REMOVAL

(1) Disconnect and isolate the negative battery cable.
(2) Disconnect the positive battery cable.
(3) Lift the battery thermowrap straight up to remove from the battery.

INSTALLATION

(1) Position the thermowrap on the battery.
(2) Connect the positive then, negative battery cables. Torque to 40 in. lbs.

CHARGING

TABLE OF CONTENTS

CHARGING

SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Generator Mounting Bolts	54.2	40	
Generator Upper Bracket Bolts	28.2	20.8	250
Generator Decoupler	110	81	
Generator B+ Nut	12.5		110
Battery Clamps	4.5		40
Battery Hold Down	20.3		180

BATTERY TEMPERATURE SENSOR

REMOVAL

(1) Disconnect and isolate the battery negative cable then the positive cable.

(2) Remove battery from battery tray.

(3) Disconnect the Battery Temperature Sensor electrical connector (Fig. 1).

(4) Unsnap the Battery Temperature Sensor from the battery tray and remove the sensor by pushing in the snap fits and pushing up out of tray (Fig. 2).

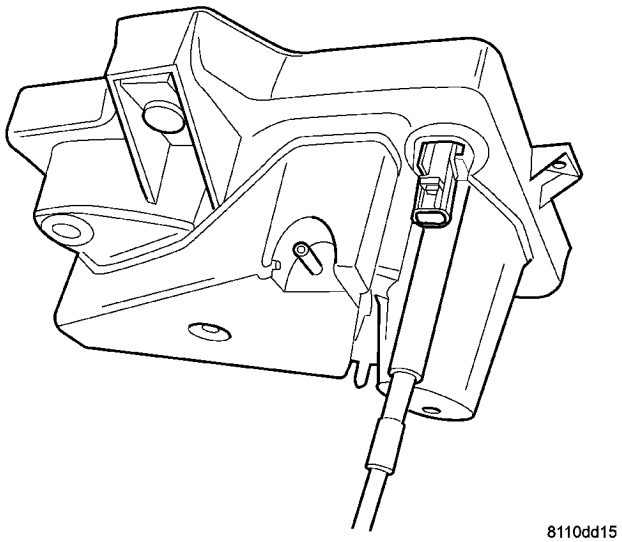


Fig. 1 VACUUM RESERVOIR/BATTERY TEMPERATURE SENSOR

BATTERY TEMPERATURE SENSOR (Continued)

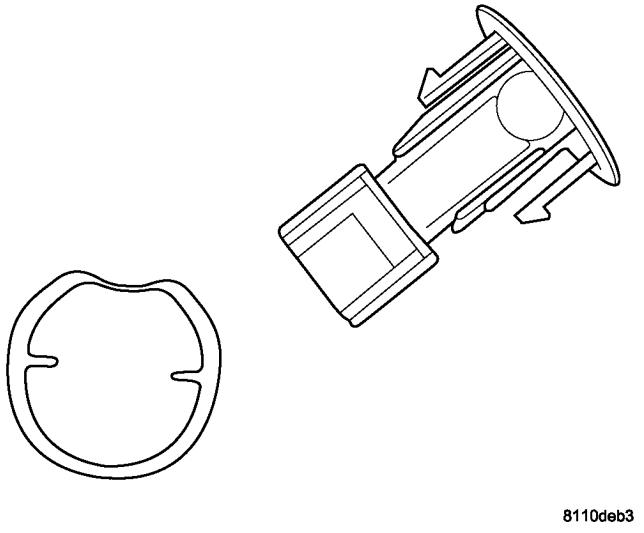


Fig. 2 BATTERY TEMPERATURE SENSOR & SPRING WASHER

INSTALLATION

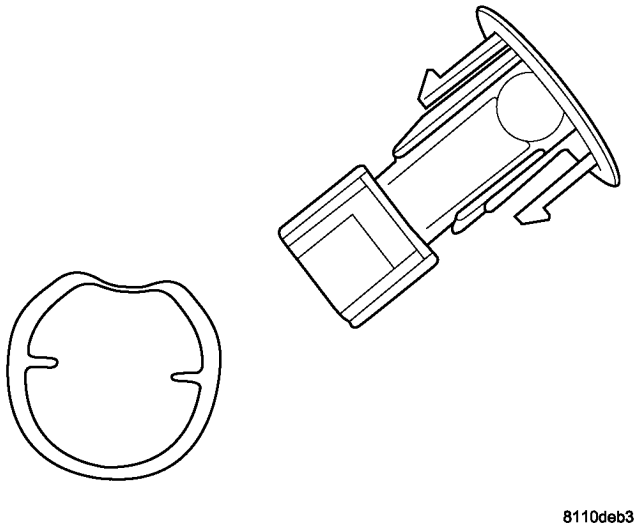


Fig. 3 BATTERY TEMPERATURE SENSOR & SPRING WASHER

(1) Install the Battery Temperature Sensor to the battery tray. Make sure that the spring is installed with the sensor (Fig. 3).

(2) Connect the Battery Temperature Sensor electrical connector (Fig. 4).

(3) Make sure that the sensor moves vertically in the battery tray by pushing on the sensor. The sensor should move with each push and return to the orignal location after pressure is removed.

(4) Install battery to battery tray.

(5) Connect the battery positive cable then the negative cable.

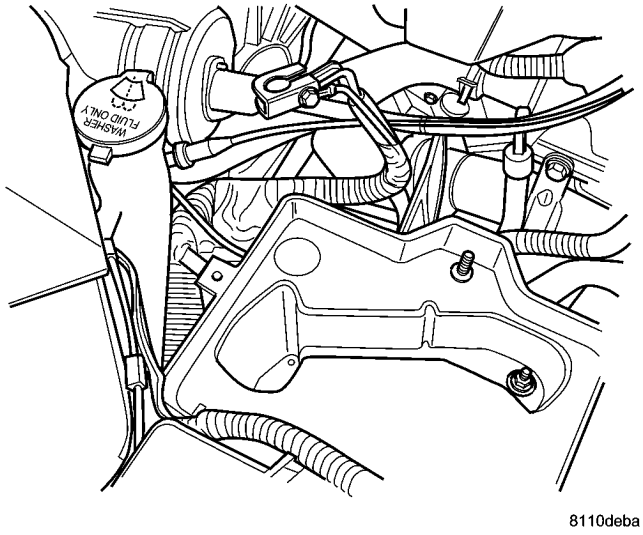


Fig. 4 SENSOR IN BATTERY TRAY

GENERATOR

DESCRIPTION - CHARGING SYSTEM

The charging system consists of:

- Generator
- Decoupler Pulley (If equipped)
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch (refer to the Ignition System section for information)
- Battery (refer to the Battery section for information)
- Ambient Air Temperature (If equipped)
- Inlet Air Temperature (calculated battery temperature)(If equipped)
- Voltmeter (refer to the Instrument Cluster section for information if equipped)
- Wiring harness and connections (refer to the Wiring section for information)
- Accessory drive belt (refer to the Cooling section for more information)
- Battery Temperature sensor (if equipped)

OPERATION - CHARGING SYSTEM

The charging system is turned on and off with the ignition switch. The system is on when the engine is running and the ASD relay is energized. The ASD relay is energized when the PCM grounds the ASD control circuit. This voltage is connected through the PCM or IPM (intelligent power module) (if equipped) and supplied to one of the generator field terminals (Gen. Source +) at the back of the generator.

The generator is driven by the engine through a serpentine belt and pulley or decoupler pulley arrangement.

GENERATOR (Continued)

The amount of DC current produced by the generator is controlled by the EVR (field control) circuitry contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

An Battery temperature sensor is used to calculate the temperature near the battery. This temperature data, along with data from monitored line voltage (battery voltage sense circuit), is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly to maintain system voltage at the targeted system voltage based on battery temperature.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including EVR (field control) circuitry, 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 certain failures it detects and illuminate the (MIL) lamp. Refer to On-Board Diagnostics in the Electronic Control Modules (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DESCRIPTION) section for more DTC information.

The Charging system “Battery” light indicates problems with the charging system (voltage too high/low, generator failure, etc.). If an extreme condition is indicated, the lamp will be illuminated. The signal to activate the lamp is sent via the PCI bus circuits. The lamp is located on the instrument panel. Refer to the Instrument Cluster section for additional information.

The PCM uses the Battery temperature sensor to control the charge system voltage. This temperature, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. The system voltage is higher at cold temperatures and is gradually reduced as the calculated battery temperature increases.

The ambient temperature sensor is used to control the battery voltage based upon ambient temperature (approximation of battery temperature). The PCM maintains the optimal output of the generator by monitoring battery voltage and controlling it to a range of 13.5 - 14.7 volts based on battery temperature.

REMOVAL

3.5L

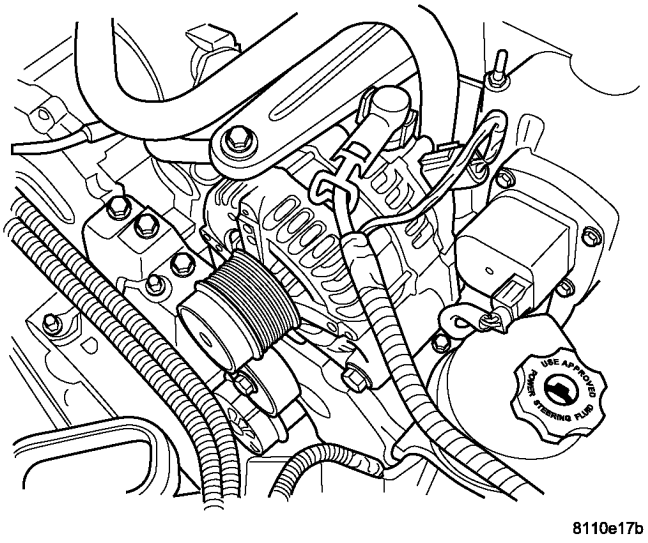


Fig. 5 POSITIVE BATTERY CABLE & FIELD CONNECTOR

(1) Disconnect battery negative cable.
(2) Remove the engine cover.
(3) Remove the generator drive belt.
(4) Remove the B+ terminal nut and wire (Fig. 5).
(5) Disconnect the generator field circuit wiring connector (Fig. 5). Push the **RED** locking tab to release.

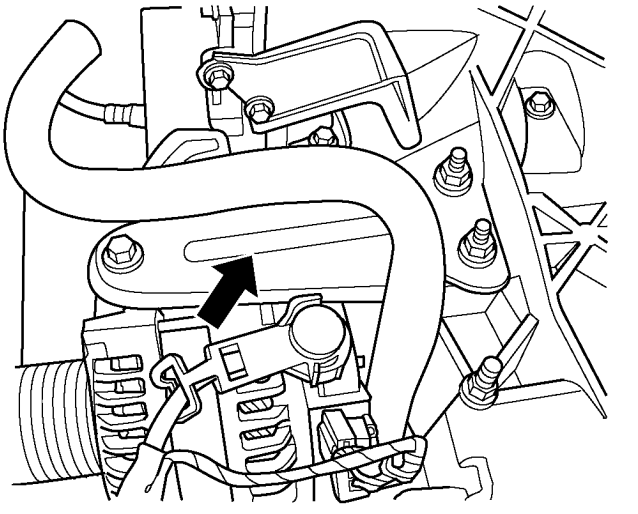


Fig. 6 UPPER MOUNTING BRACKET

GENERATOR (Continued)

(6) Remove the upper mounting bracket (Fig. 6).

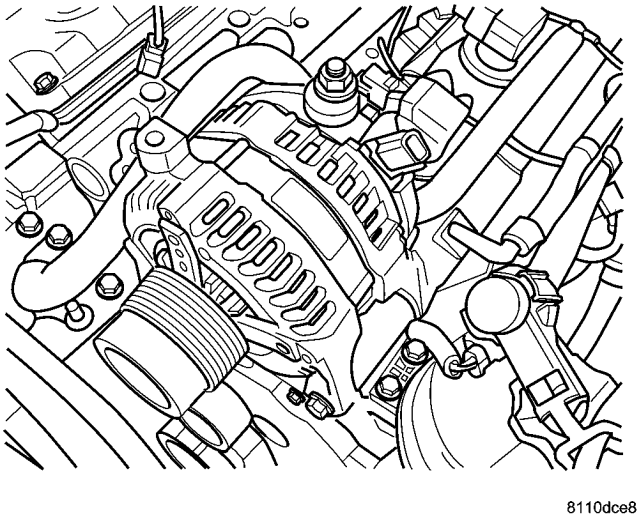


Fig. 7 GENERATOR

(7) Remove the 2 lower mounting bolts (Fig. 7).
(8) Remove generator.

3.8L

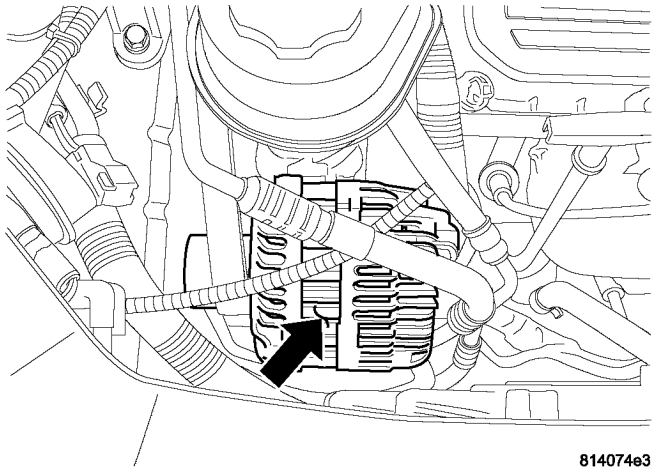


Fig. 8 GENERATOR LOCATION

(1) Disconnect negative battery cable.
(2) Remove the air box assembly, refer to (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
(3) Generator location (Fig. 8).

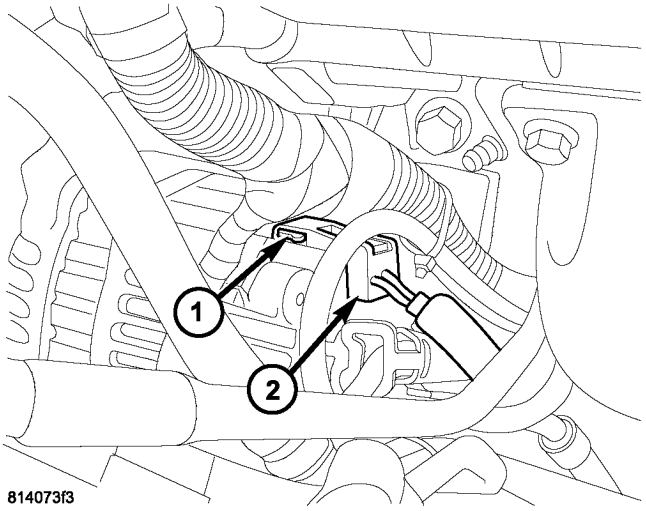


Fig. 9 GENERATOR FIELD CONNECTOR

1 - Connector Lock
2 - Field Connector

(4) Unlock the field electrical connector (Fig. 9).

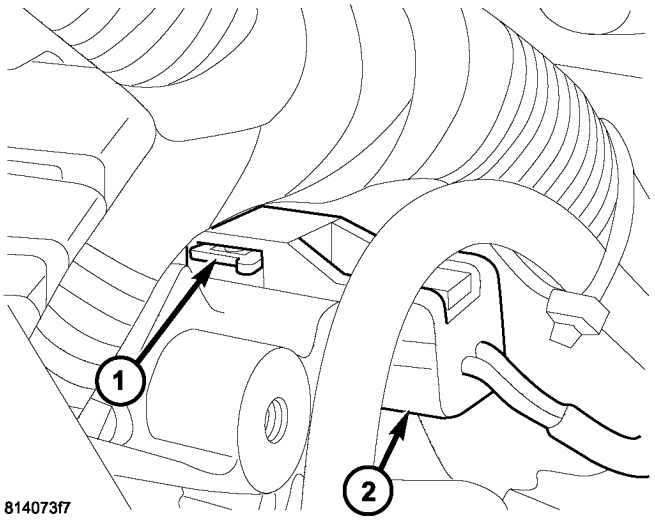


Fig. 10 ELECTRICAL CONNECTOR LOCK

1 - Connector Lock
2 - Field Connector

(5) Disconnect the field electrical connector from rear of generator (Fig. 10).

GENERATOR (Continued)

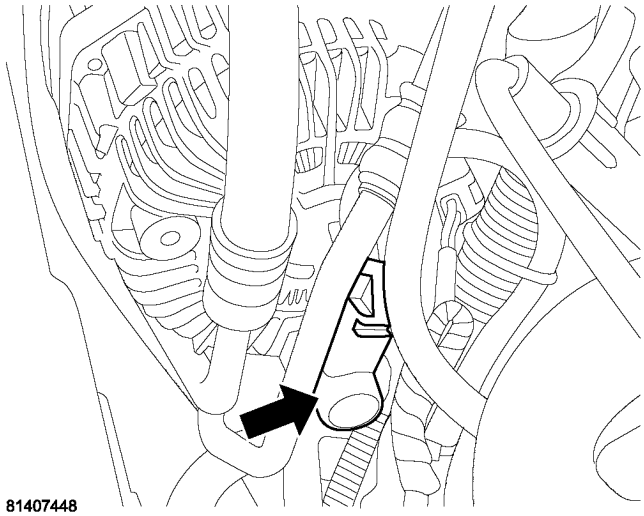


Fig. 11 GENERATOR BATTERY CONNECTION COVER

(6) Remove cover from battery cable on rear of generator (Fig. 11).

(7) Remove the positive battery cable from rear of generator.

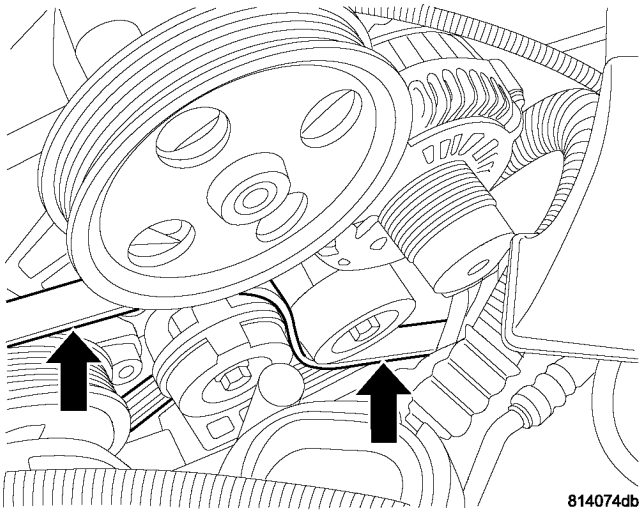


Fig. 12 DRIVE BELT REMOVED

(8) Remove the accessory drive belt (Fig. 12), refer to (Refer to 7 - COOLING/ACCESSORY DRIVE/ DRIVE BELTS - REMOVAL).

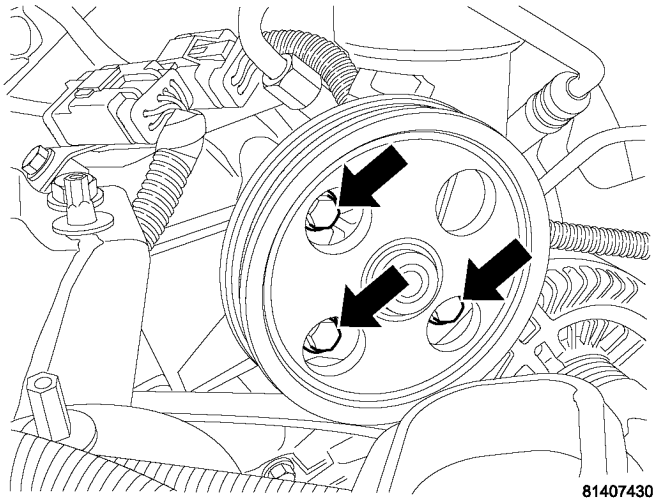


Fig. 13 POWER STEERING PUMP MOUNTING BOLTS

(9) Remove the 3 mounting bolts for the power steering assembly (Fig. 13).

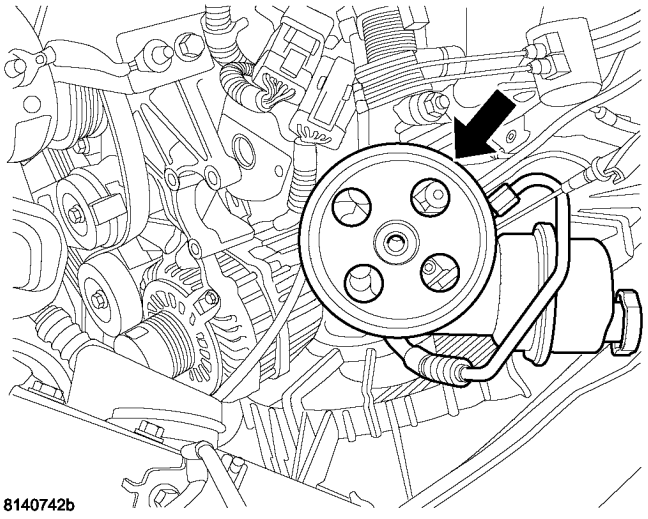


Fig. 14 POWER STEERING PUMP RELOCATION

(10) Relocate the power steering assembly (Fig. 14).

GENERATOR (Continued)

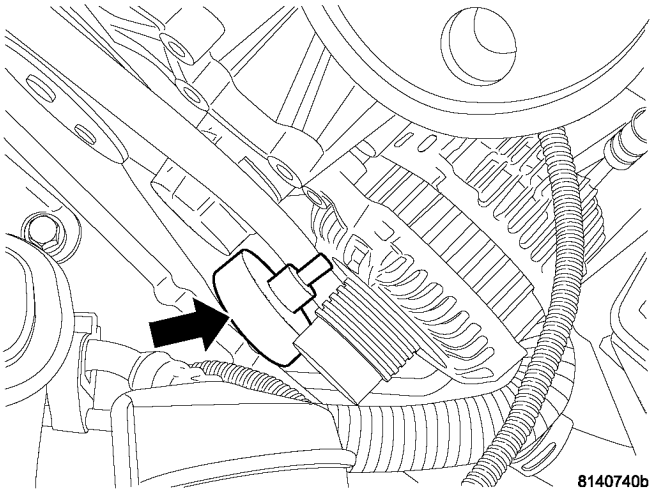


Fig. 15 IDLER PULLEY

(11) Remove the idler pulley/lower mounting bolt for generator (Fig. 15). This will be removed with generator assembly.

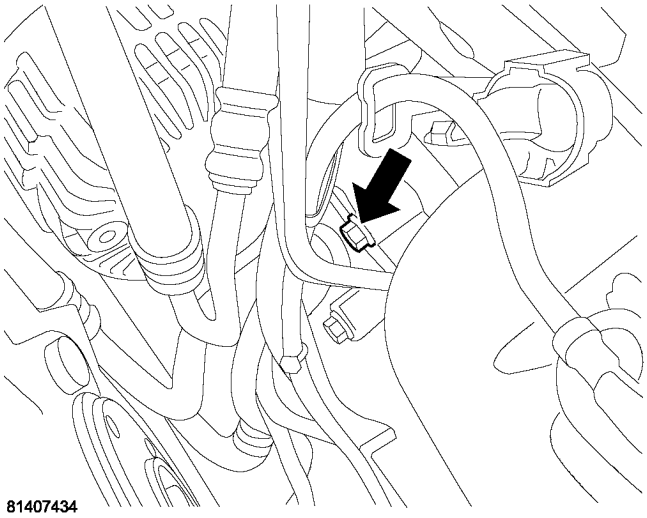


Fig. 16 GENERATOR REAR MOUNTING BOLT

(12) Remove the rear mounting bolt (Fig. 16).

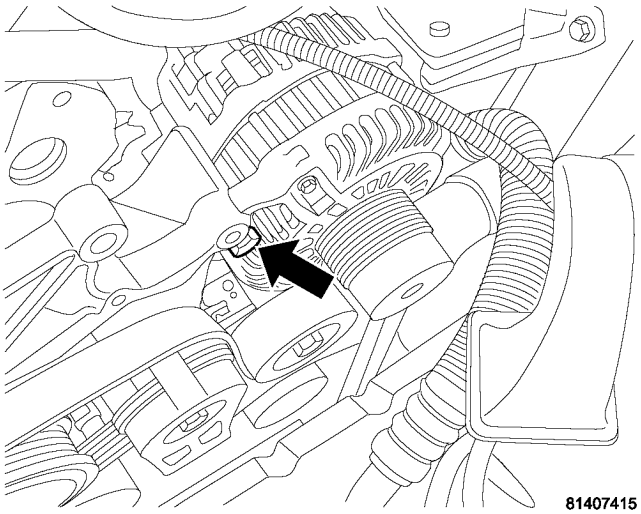


Fig. 17 UPPER MOUNTING BOLT

(13) Remove the upper mounting bolt (Fig. 17).

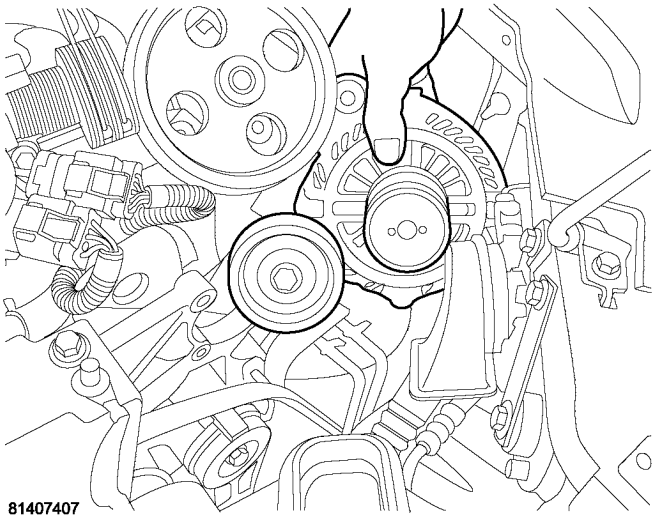


Fig. 18 GENERATOR REMOVE/INSTALL

(14) Remove generator and idler pulley (Fig. 18).

GENERATOR (Continued)

INSTALLATION

3.5L

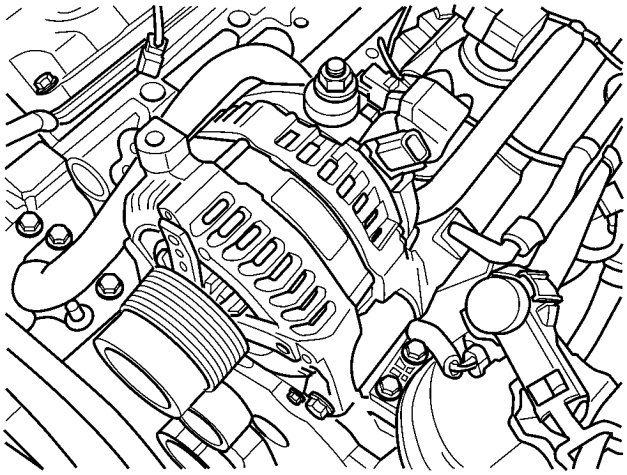


Fig. 19 GENERATOR

(1) Install generator.
(2) Install the 2 lower mounting bolts (Fig. 19).

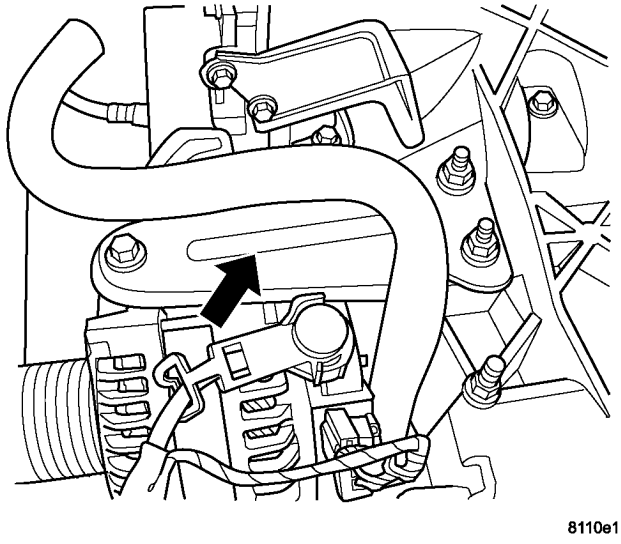


Fig. 20 UPPER MOUNTING BRACKET

(3) Install the upper mounting bracket (Fig. 20).
(4) Tighten the 2 lower bolts first, tighten bolts to 54.2 N·m (40 ft. lbs.) then tighten the 2 upper bolts, tighten bolts to 28.2 N·m (20.8 ft. lbs.)
(5) Connect the generator field circuit wiring connector (Fig. 21). Push the **RED** locking tab to lock connector.
(6) Install the B+ terminal nut and wire making sure the terminal is properly oriented with the anti-rotation tab (Fig. 5).

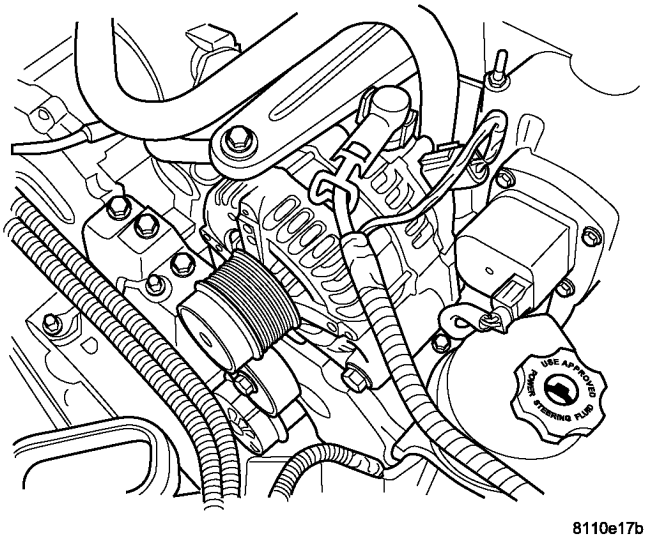


Fig. 21 POSITIVE BATTERY CABLE & FIELD CONNECTOR

(7) Tighten nut to 12.5 N·m (110 in. lbs.).
(8) Install the generator drive belt, refer to (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(9) Install the engine cover.
(10) Connect battery negative cable.

3.8L

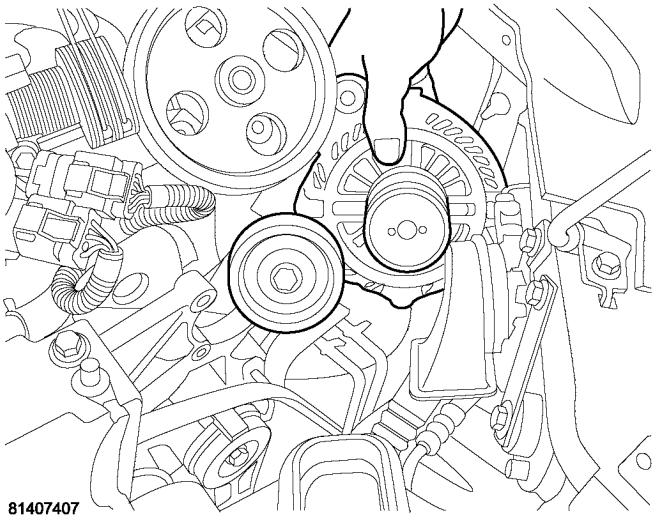


Fig. 22 GENERATOR REMOVE/INSTALL

(1) Install idler pulley to generator (Fig. 22).
(2) Install assembly to vehicle.

GENERATOR (Continued)

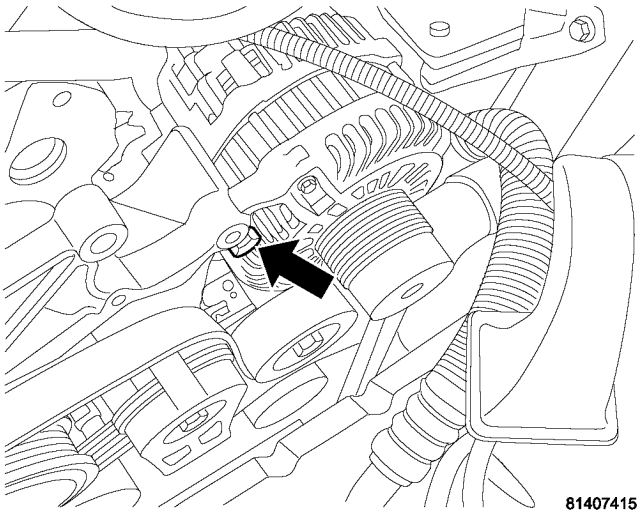


Fig. 23 UPPER MOUNTING BOLT

(3) Loose install upper mounting bolt (Fig. 23).

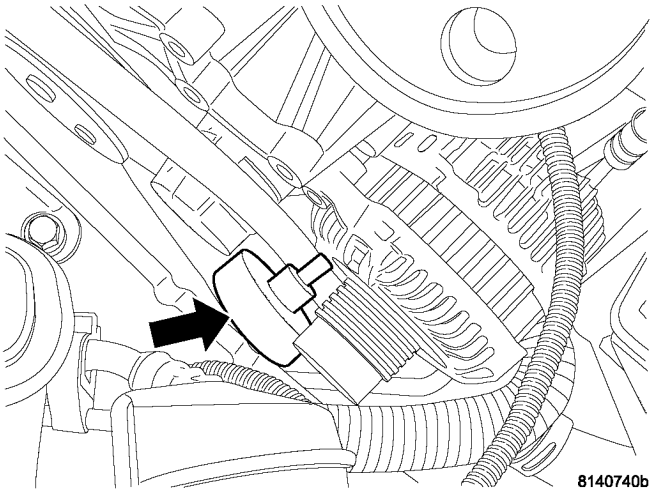


Fig. 25 IDLER PULLEY

(5) Loose install the lower mounting bolt (Fig. 25).

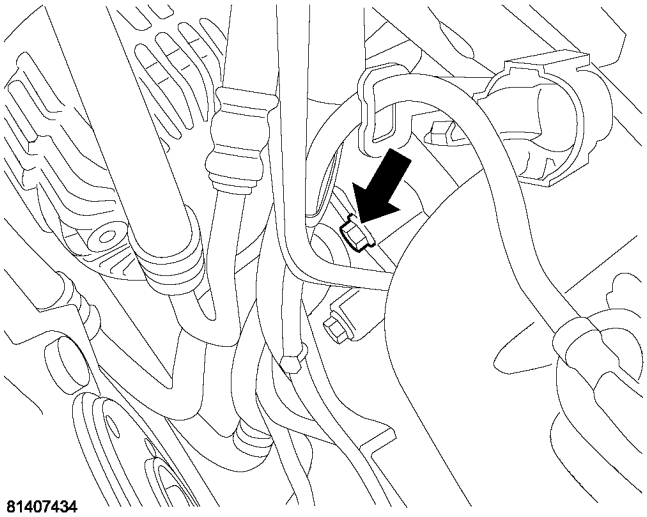


Fig. 24 GENERATOR REAR MOUNTING BOLT

(4) Loose install rear mounting bolt (Fig. 24).

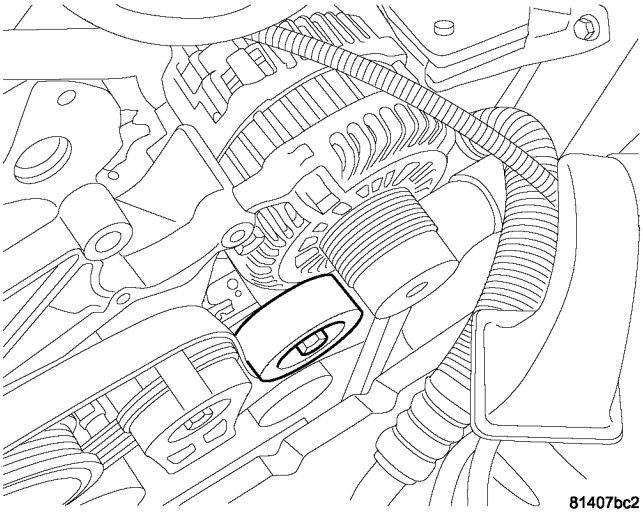


Fig. 26 IDLER PULLEY INSTALLED

(6) Idler pulley installed (Fig. 26).
(7) Tighten bolts to 54.2 N·m (40 ft. lbs.).

GENERATOR (Continued)

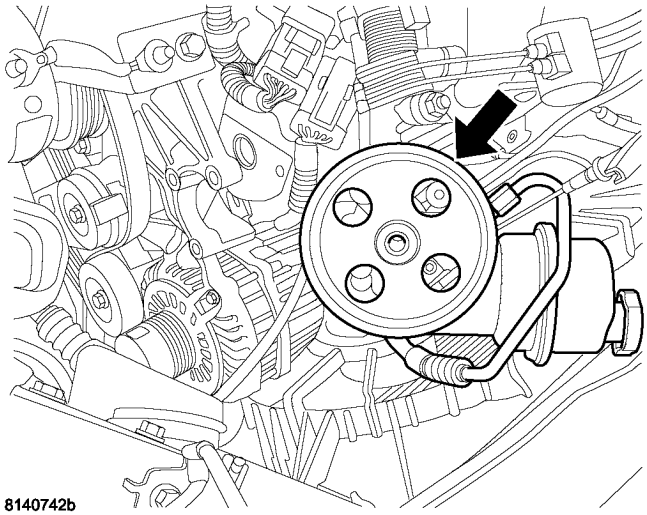


Fig. 27 POWER STEERING PUMP RELOCATION

(8) Relocate the power steering pump assembly (Fig. 27).

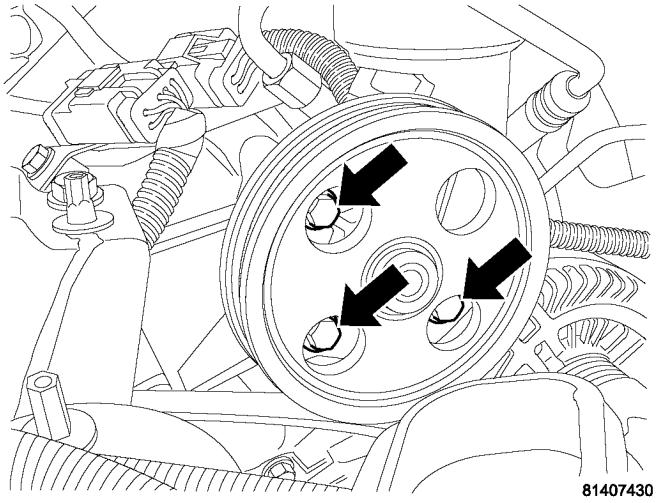


Fig. 28 POWER STEERING PUMP MOUNTING BOLTS

(9) Install the 3 mounting bolts and tighten to 23 N·m (200 in. lbs.) (Fig. 28).

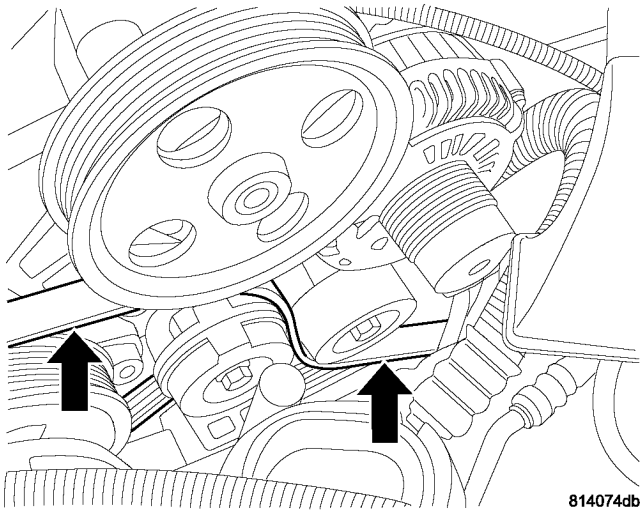


Fig. 29 DRIVE BELT REMOVED

(10) Install the accessory drive belt (Fig. 29), refer to (Refer to 7 - COOLING/ACCESSORY DRIVE/ DRIVE BELTS - INSTALLATION).

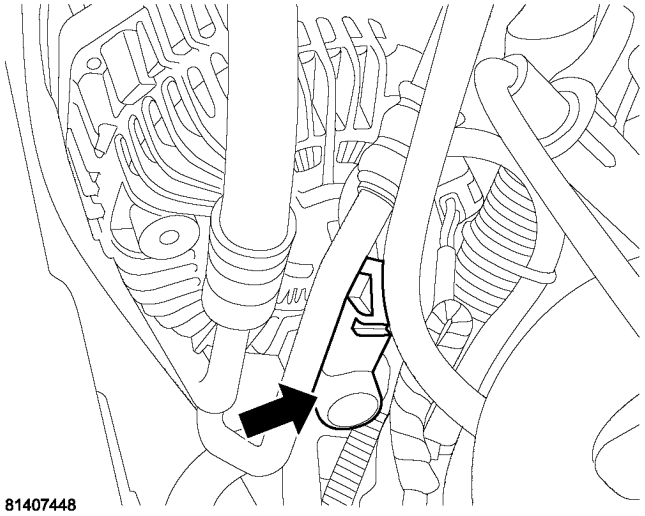


Fig. 30 GENERATOR BATTERY CONNECTION COVER

(11) Connect the battery cable to generator (Fig. 30).

(12) Tighten nut to N·m 12.5 (110 in. lbs.).

(13) Snap cable cover back into place.

GENERATOR (Continued)

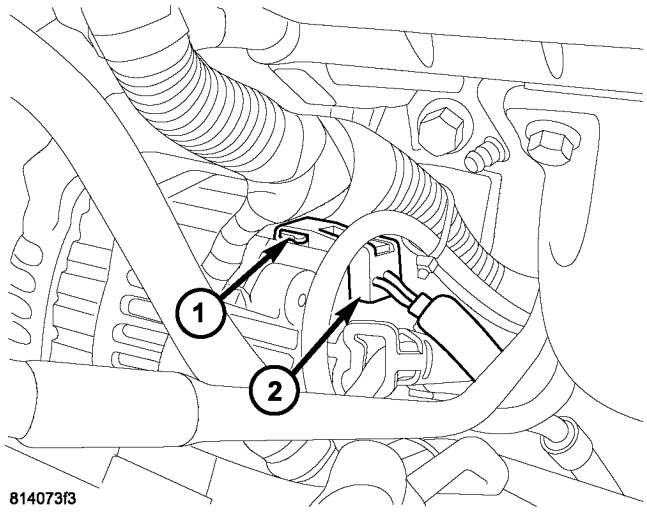


Fig. 31 GENERATOR FIELD CONNECTOR

1 - Connector Lock
2 - Field Connector

(14) Connect the field connector (2) (Fig. 31).

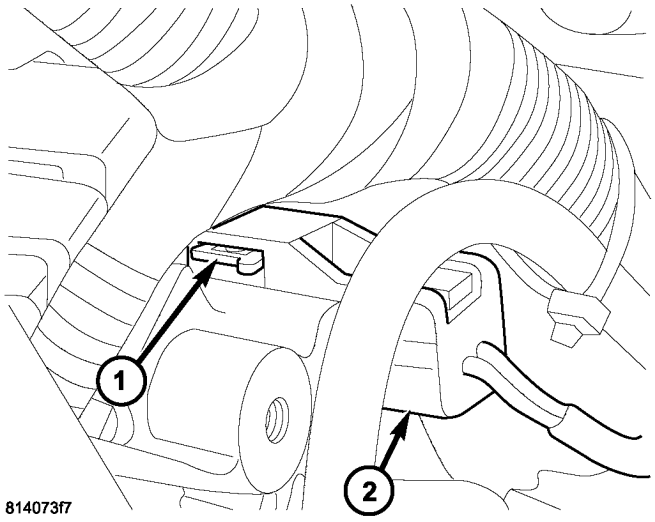


Fig. 32 ELECTRICAL CONNECTOR LOCK

1 - Connector Lock
2 - Field Connector

(15) Lock connector (1) (Fig. 32).
(16) Connect negative battery cable.
(17) Install the air box assembly, refer to (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).