

BATTERY/STARTER/ALTERNATOR SERVICE

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BATTERY

GENERAL INFORMATION

This first section will cover Battery replacement and service procedures only. For Battery diagnostic procedures, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics.

Factory installed batteries (Fig. 1) do not have removable battery cell caps. Water cannot be added to factory installed battery. Battery is sealed, except for small vent holes in the top. Chemical composition inside the battery produces an extremely small amount of gases at normal charging voltages. The factory installed battery is equipped with a test indicator (Fig. 1) that displays a colored ball to show battery state-of-charge.

- Green Indicator = Full charge
- Black Indicator = Discharged
- Yellow Indicator = Battery replacement required.

BATTERY VISUAL INSPECTION AND SERVICE

(1) Make sure ignition switch is in OFF position and all accessories are OFF.

(2) Disconnect and remove the battery terminals from the battery posts. Remove NEGATIVE cable first (Fig. 2).

WARNING: TO PROTECT THE HANDS FROM BATTERY ACID, A SUITABLE PAIR OF HEAVY DUTY RUBBER GLOVES, NOT THE HOUSEHOLD TYPE, SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY. SAFETY GLASSES ALSO SHOULD BE WORN.

(3) Remove battery hold down clamp (Fig. 3) and remove battery from vehicle.

CAUTION: Do not allow baking soda solution to enter vent holes, as damage to battery can result.

(4) Clean top of battery with a solution of warm water and baking soda. Apply solution with a bristle brush and allow to soak until acid deposits loosen (Fig. 4). Rinse with clear water and blot dry with paper toweling. Dispose of toweling in a safe manner. Refer to the WARNINGS on top of battery.

(5) Inspect battery case and cover for cracks or leakage. If leakage is present battery must be replaced.

(6) Inspect battery tray (Fig. 3) for damage caused by acid from battery. If acid damage is present, it will be necessary to clean area with same solution described in Step (4).

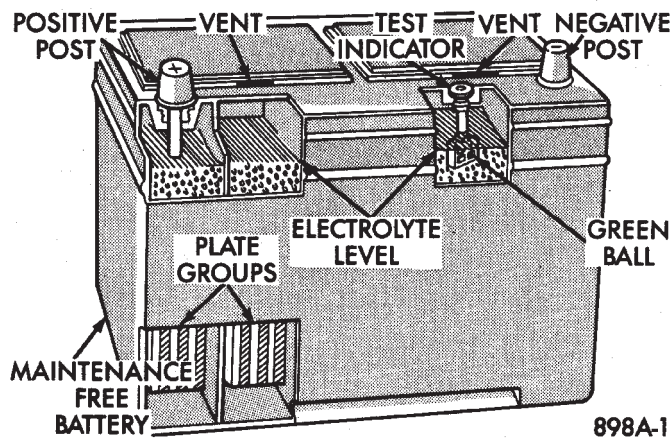


Fig. 1 Maintenance Free Battery—Typical

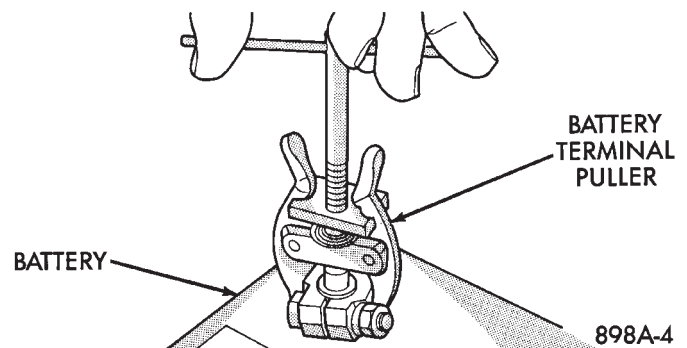


Fig. 2 Remove Battery Cables

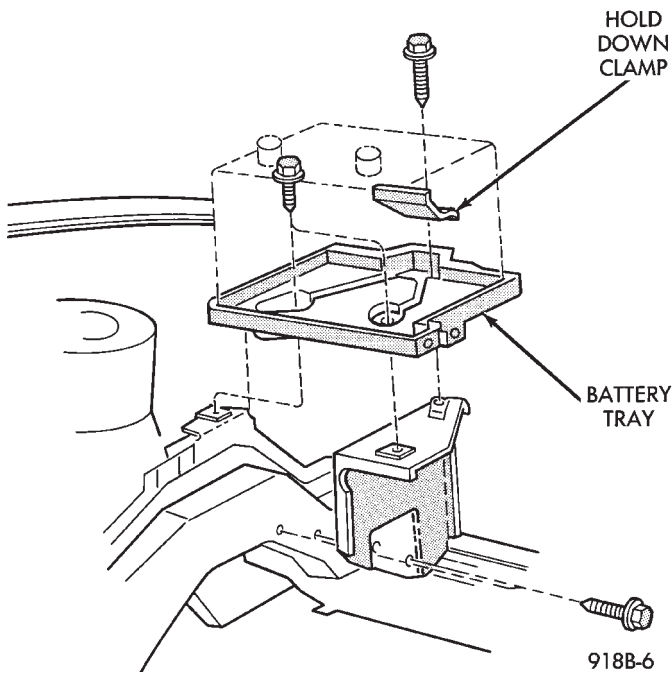


Fig. 3 Battery Hold-Down/Tray

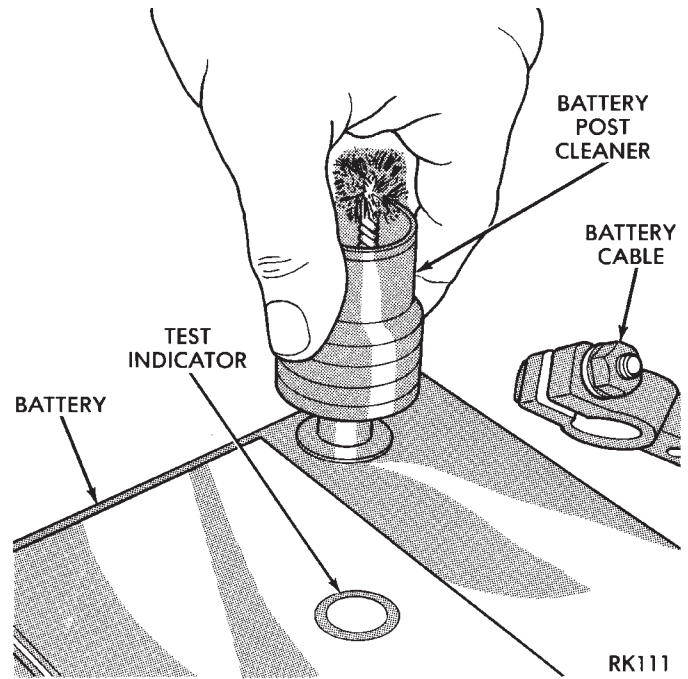


Fig. 5 Cleaning Battery Posts

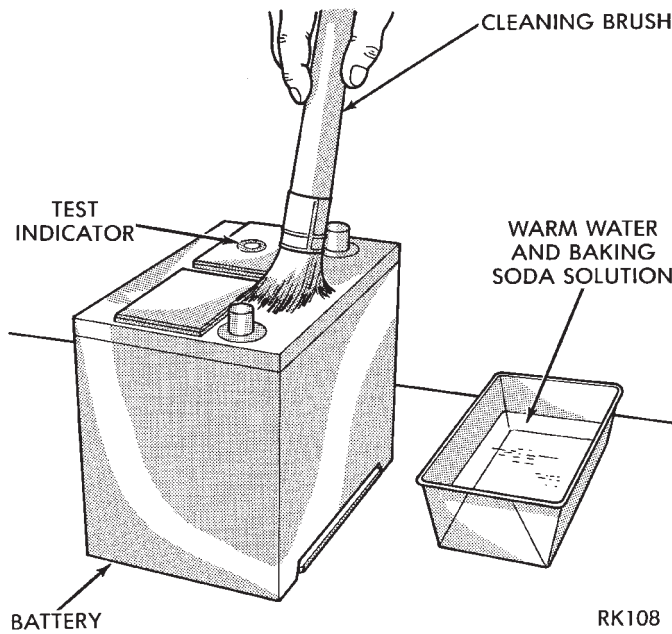


Fig. 4 Cleaning Battery

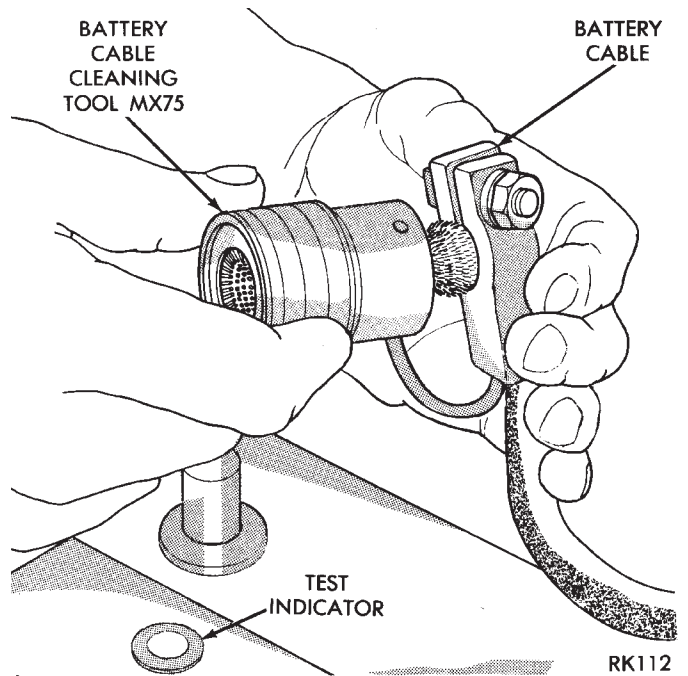


Fig. 6 Cleaning Battery Cable Terminal

(7) Clean battery posts with a suitable battery post cleaning tool (Fig. 5).

(8) Clean inside surfaces of battery terminal clamps with a suitable battery terminal cleaning tool (Fig. 6). Replace damaged or frayed cables and broken terminal clamps.

(9) Inspect battery for proper or damaged hold down ledge.

(10) Install battery in vehicle making sure that battery is properly positioned on battery tray (Fig. 3).

(11) Install battery hold down clamp, making sure that it is properly positioned on battery.

(12) Place felt grease washer onto Positive (+) battery post.

(13) Connect battery cable clamps to battery posts making sure top of clamp is flush with top of post (Fig. 7). Install POSITIVE cable first.

(14) Tighten clamp nuts securely.

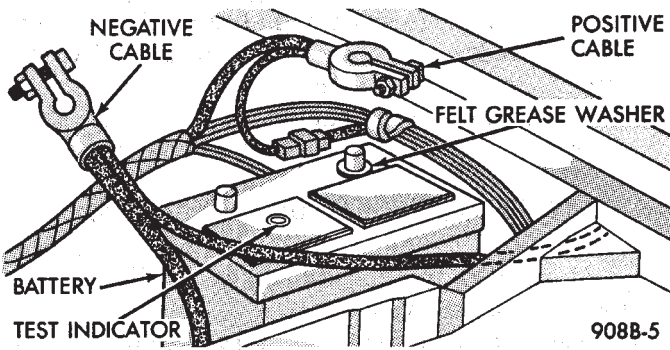


Fig. 7 Battery Cables Disconnected

STARTER

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GENERAL INFORMATION

This section will cover STARTER replacement and service procedures only. For starter diagnostic procedures, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics.

STARTING SYSTEM

The starting system has:

- Ignition switch
- Starter relay
- Neutral starting and back-up switch
- Wiring harness
- Battery
- Starter motor with an integral solenoid

BOSCH STARTERS

- A Bosch permanent magnet starter motor is available on
- 2.5L and 3.0L engines on all vehicles. A planetary gear train transmits power between starter motor and pinion shaft. The fields have six permanent magnets.

NIPPONDENSO STARTERS

- A Nippondenso reduction gear-field coil starter motor is available on 3.0L, and 3.3L engines.

SUPPLY CIRCUIT AND CONTROL CIRCUIT

Both starter systems consists of two separate circuits:

- A high amperage supply to feed the starter motor.
- A low amperage circuit to control the starter solenoid.

For additional information on starter motor supply and control circuits, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics.

STARTER MOTOR REPLACEMENT

BOSCH STARTER 2.5L ENGINE

- (1) Disconnect battery NEGATIVE cable (Fig. 1).

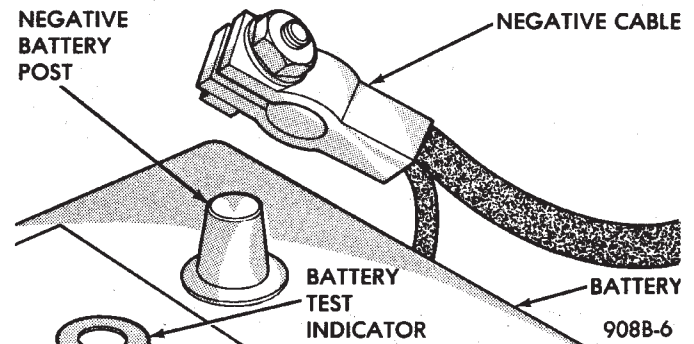


Fig. 1 Remove or Install Battery Cable

- (2) Raise vehicle.
- (3) Remove heat shield clip from the starter and heat shield (Fig. 2).
- (4) Remove two bolts and one nut attaching starter to engine (Fig. 3).
- (5) Remove starter/starter solenoid assembly from engine. Position the starter to gain access to the wiring connectors.
- (6) Disconnect the positive battery cable and wiring at the starter.
- (7) Remove the starter from vehicle.

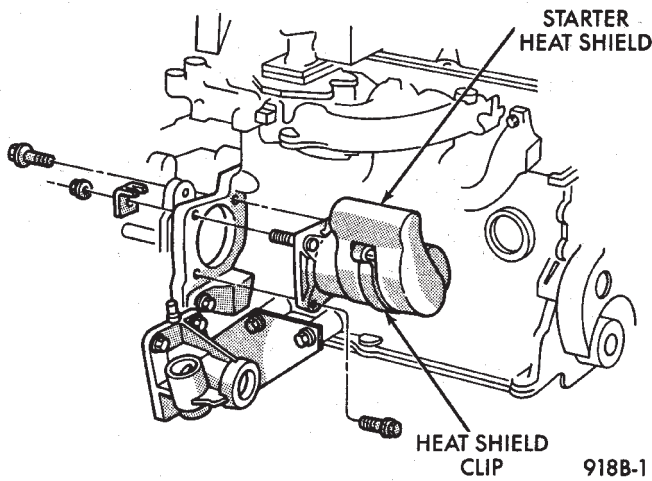


Fig. 2 Starter Heat Shield—4 Cylinder Engines
For easier servicing, do not remove the wiring from starter at this time.

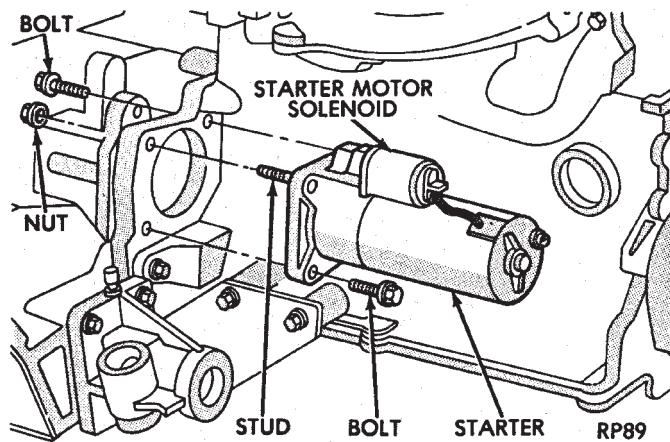


Fig. 3 Bosch Starter—2.5L Engine

(8) For installation, reverse above procedures. Clean corrosion/dirt from the cable and wire terminals before installing wiring to the solenoid.

BOSCH OR NIPPONDENSO STARTER—3.0L OR 3.3L ENGINE

- (1) Disconnect NEGATIVE battery cable (Fig. 1).
- (2) Raise vehicle.
- (3) Remove three starter attaching bolts from engine/transaxle (Fig. 4).
- (3) Remove two wire connector terminal nuts and remove connector (Bosch, Fig. 5) (Nippondenso, Fig. 6 or 7).
- (4) Remove starter from vehicle (Bosch, Fig. 8) (Nippondenso, Fig. 9).
- (5) For installation, reverse above procedures. Clean corrosion/dirt from the cable and wire terminals before installing wiring to the solenoid.

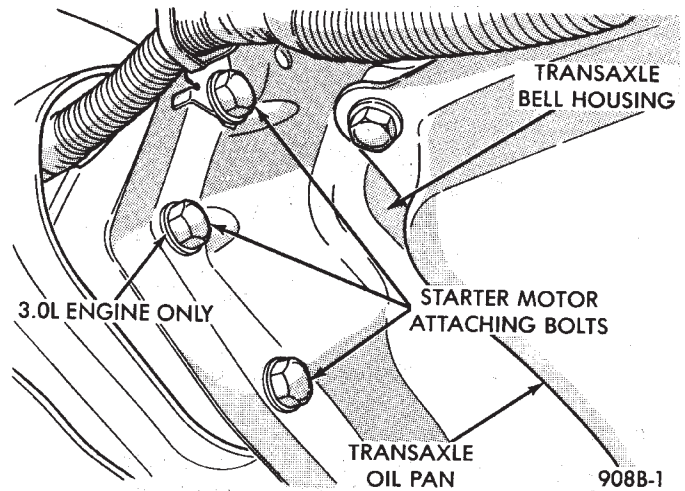


Fig. 4 Remove or Install Attaching Bolts

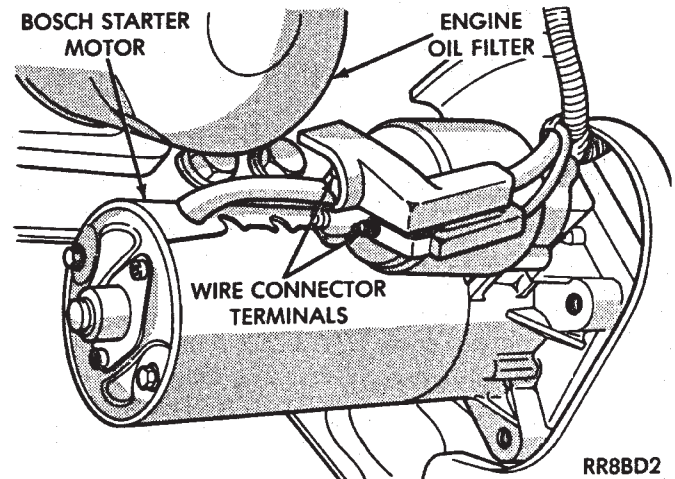


Fig. 5 Wire Terminal Connections—Bosch Starter

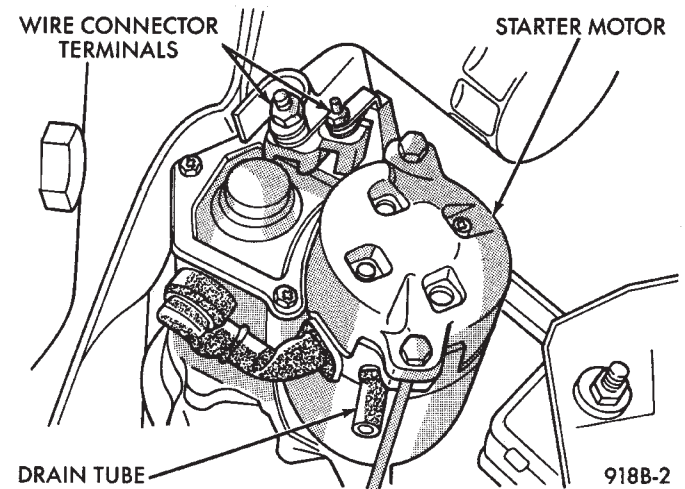


Fig. 6 Wire Terminal Connections—3.0L Engine—Nippondenso Starter

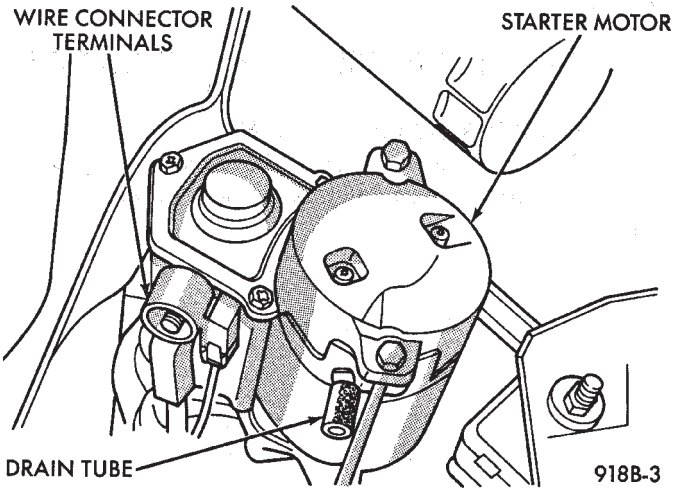


Fig. 7 Wire Terminal Connections—3.3L Engine—Nippondenso Starter

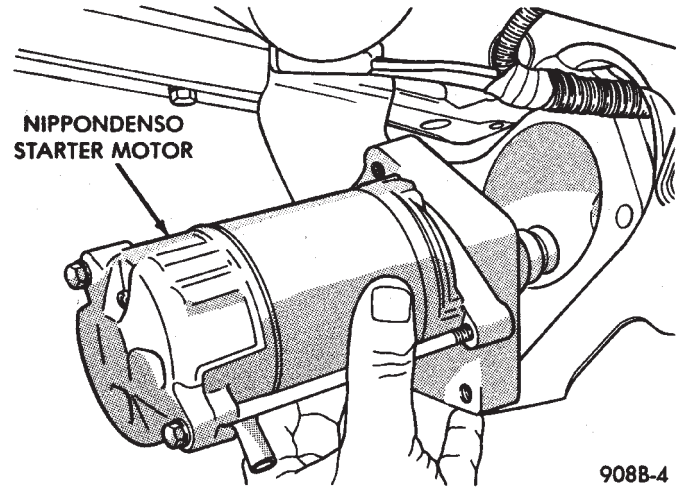


Fig. 9 Remove/Install Starter—Nippondenso—Typical

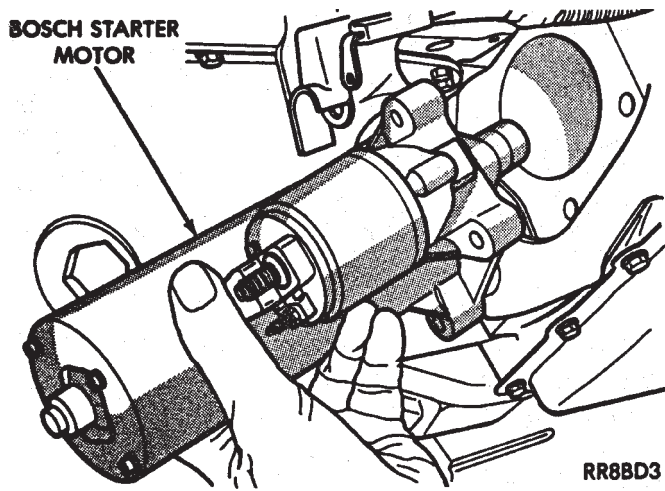


Fig. 8 Remove/Install Starter—Bosch—Typical

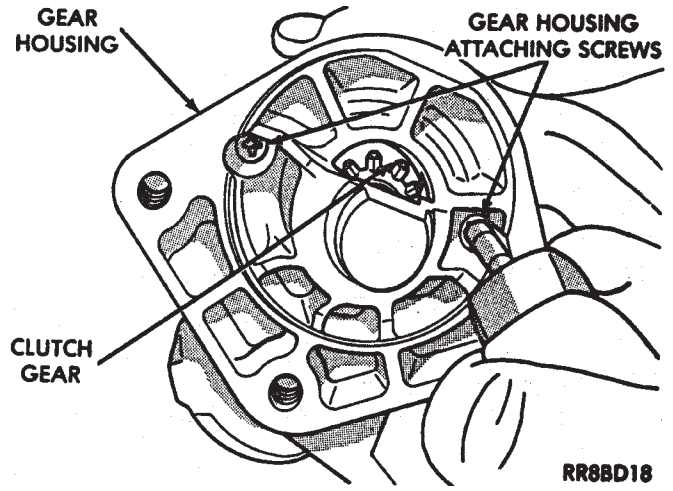


Fig. 10 Remove or Install Gear Housing

STARTER COMPONENT REPLACEMENT

Caution: When servicing the starter assembly off the vehicle, do not clamp the starter to a vice. Internal damage may result.

NIPPONDENSO STARTER GEAR AND CLUTCH

(1) Remove the two gear housing attaching screws and separate the gear housing from the solenoid housing (Fig. 10). The pinion gear, pinion gear bearing, and drive gear will be loose between the solenoid housing and gear housing (Fig. 11). When reinstalling pinion gear and bearing, wipe with a clean rag and coat with lightweight high temperature wheel bearing grease. Place the lubricated bearing and gear over bearing shaft in the gear housing (Fig. 12).

(2) Remove the starter gear and clutch assembly from the solenoid housing (Fig. 13).

(3) For installation, reverse above procedures.

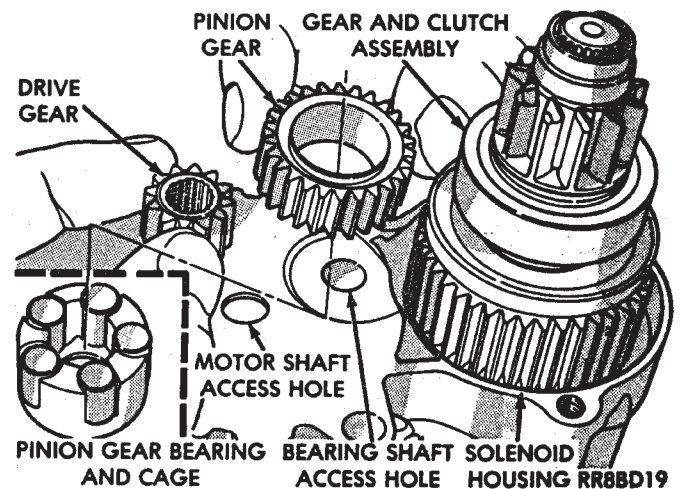


Fig. 11 Remove or Install Drive and Pinion Gears

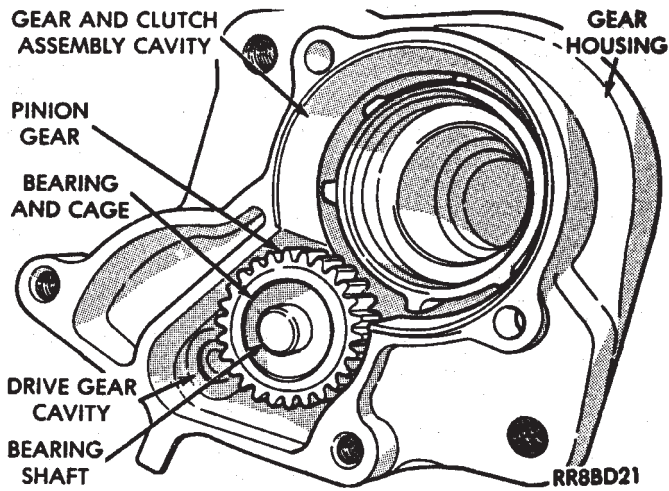


Fig. 12 Lubricate and Install Pinion Gear Bearing

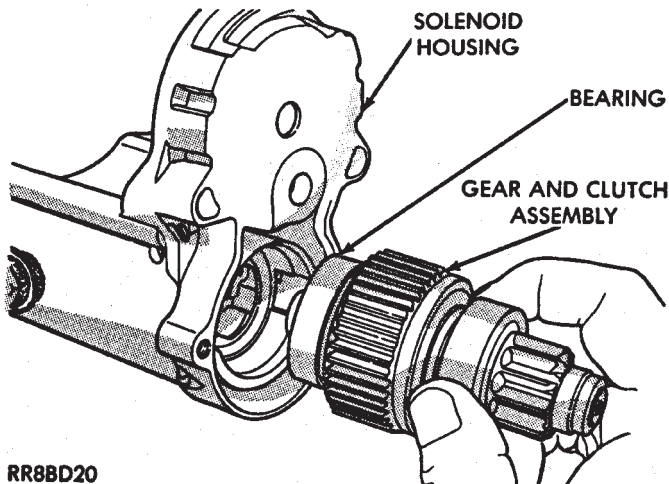


Fig. 13 Gear and Clutch Assembly

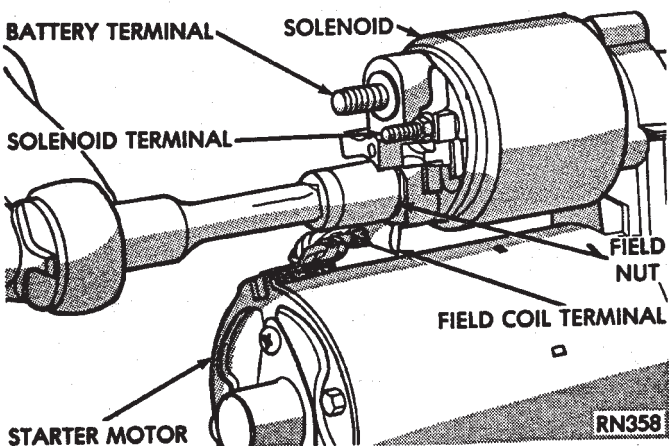


Fig. 14 Field Terminal Nut

BOSCH STARTER SOLENOID REPLACEMENT

- (1) Remove field terminal nut (Fig. 14).
- (2) Remove field terminal (Fig. 15).
- (3) Remove field washer (Fig. 16).

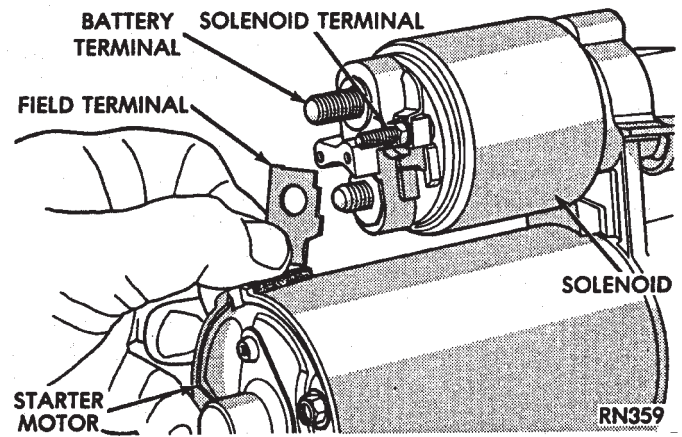


Fig. 15 Field Coil Terminal

- (4) Remove three solenoid mounting screws (Fig. 17).

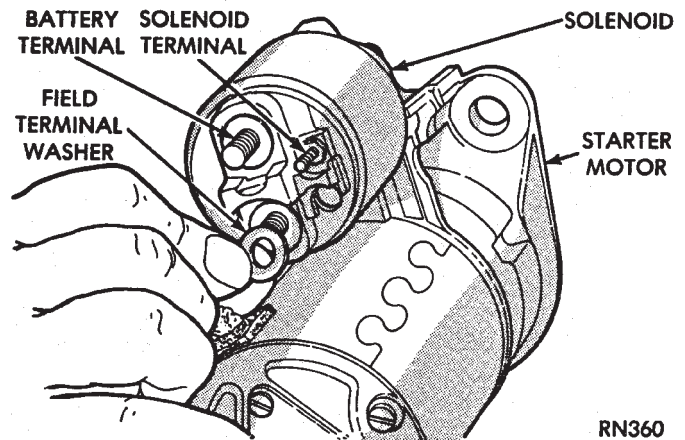


Fig. 16 Field Terminal Washer

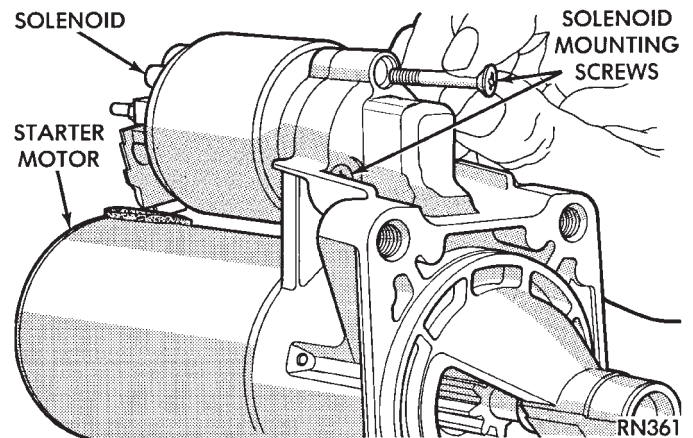


Fig. 17 Solenoid Mounting Screws

- (5) Remove the solenoid from the starter assembly.
- (6) For installation, reverse above procedures.

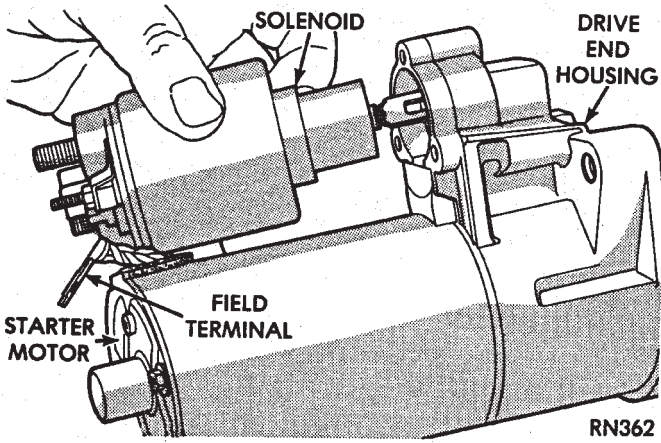


Fig. 18 Solenoid

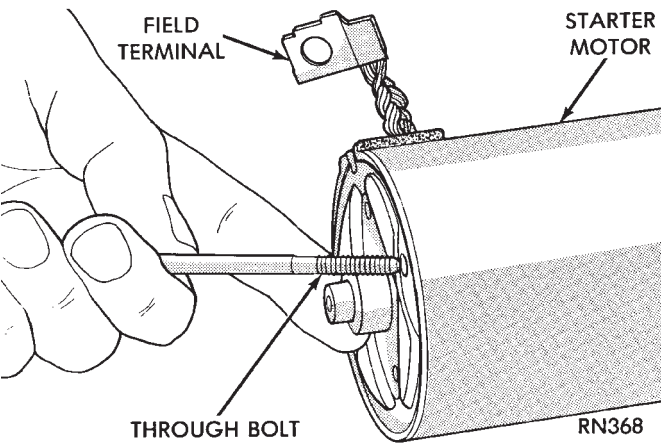


Fig. 19 Through-Bolt

BOSCH STARTER GEAR AND CLUTCH RE-PLACEMENT

- (1) Remove solenoid assembly (Fig. 18).
- (2) Remove the two through-bolts securing the starter drive end housing to the motor housing (Fig. 19) and separate housings.
- (3) Remove rubber seal (Fig. 20).
- (4) Pull the gear and clutch assembly from the drive end housing (Fig. 21).
- (5) For installation, reverse above procedures.

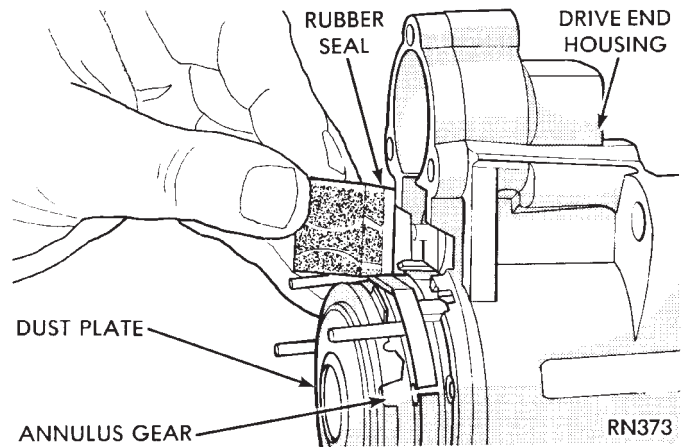


Fig. 20 Rubber Seal

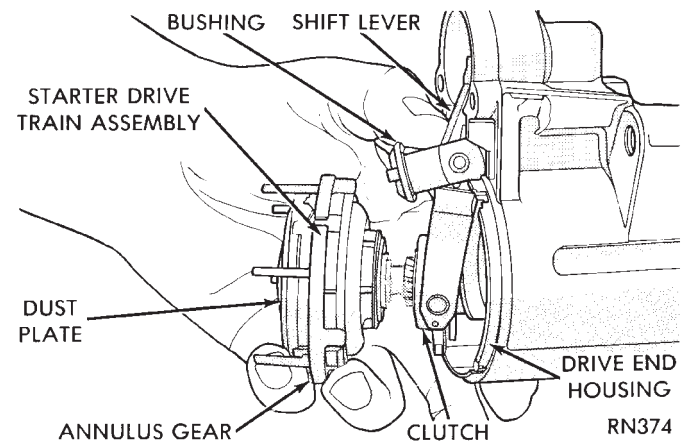


Fig. 21 Starter Drive Gear Train

NEUTRAL STARTING AND BACK-UP SWITCH

For electrical diagnostics, when checking the starter circuits, refer to the STARTER RELAY TESTS chart in Group 8A, Battery/Starting/Charging Systems Diagnostics.

For removal and installation of neutral switch, refer to Neutral Switch Replacement in Group 21, Transaxle.



ALTERNATOR SERVICE PROCEDURES

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GENERAL INFORMATION

This section will cover alternator replacement only. Information covering alternator on-vehicle testing and diagnosis can be found in Group 8A, Battery/Starting/Charging Systems Diagnostics. To identify the alternator, refer to the Alternator Specification chart at the rear of this section.

These alternators are not intended to be disassembled for service. It must be replaced as an assembly.

ALTERNATOR REPLACEMENT—2.5L ENGINE

Removal and repositioning of A/C Compressor without disconnecting refrigerant lines is necessary on some models to gain access to alternator.

- (1) Disconnect battery negative cable (Fig. 1).

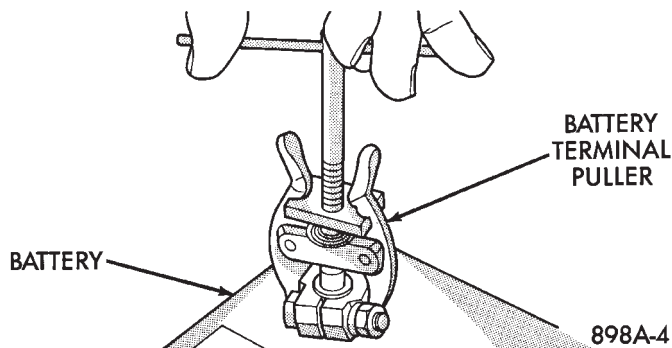


Fig. 1 Remove Battery Negative (-) Cable

- (2) If Equipped With air conditioning:
 - (a) Remove the A/C drive belt. Refer to Group 7, Cooling System.
 - (b) Remove the four bolts retaining the A/C compressor to the mounting bracket (Fig. 2).
 - (c) Do not disconnecting the A/C refrigerant lines, position the A/C compressor to allow alternator removal.

WARNING: THE A/C REFRIGERANT SYSTEM IS UNDER PRESSURE EVEN WHEN THE ENGINE IS OFF. REFER TO THE SAFETY PRECAUTIONS AND WARNINGS SECTION IN HEATING AND A/C, GROUP 24, BEFORE PERFORMING ANY SERVICE OPERATION.

- (3) Remove the alternator drive belt. Refer to Group 7, Cooling System.

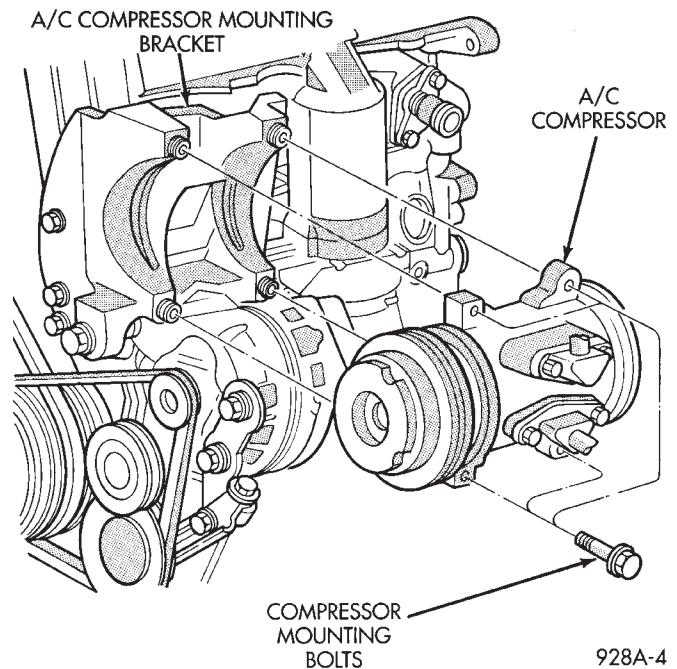


Fig. 2 A/C Compressor Removal and Installation—2.5 L Engine

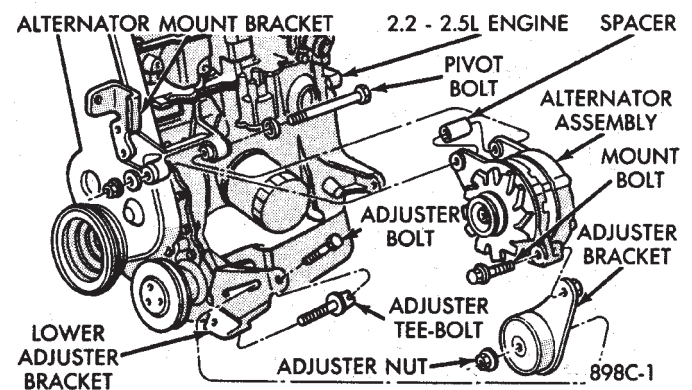


Fig. 3 Remove or Install Mounting Bolts

- (4) Remove the two alternator mounting bolts (Fig. 3) and position the alternator to gain access to all the wire connectors. If equipped with a :
 - BOSCH ALTERNATOR. Remove B+ terminal nut, field terminal nuts, and ground harness hold down nuts (Fig. 4). Remove wire connector assembly.
 - NIPPONDENSO ALTERNATOR. Remove nuts from field terminals, ground terminal, wire harness

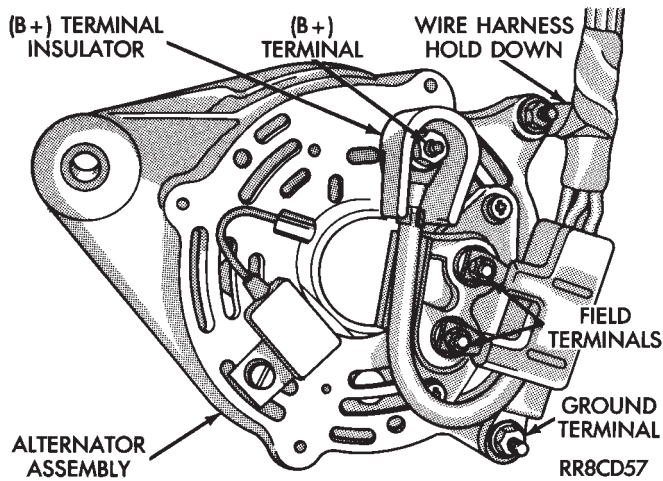


Fig. 4 Remove or Install Wire Connector Assembly—Bosch Alternator

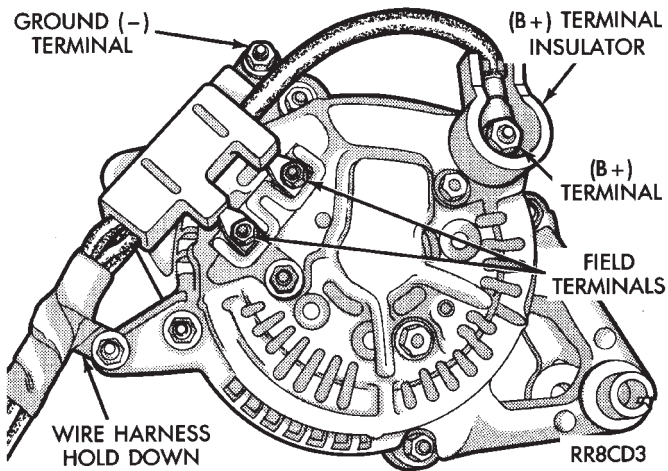


Fig. 5 Remove or Install Wire Connector Assembly—Nippondenso Alternator

and B+ terminal (Fig. 5). B+ terminal nut must be removed last to prevent damage to terminal insulator.

(5) Remove the alternator from the vehicle.

(6) For installation, reverse above procedures. Torque all fasteners. Refer to the TORQUE SPECIFICATIONS chart at the rear of this group.

ALTERNATOR REPLACEMENT—3.0L ENGINE

(1) Disconnect battery negative cable (Fig. 1).

(2) Remove alternator drive belt. Refer to Group 7, Cooling System.

(3) Remove the alternator mounting bolts and separate the alternator from the mounting bracket (Fig. 6).

(4) Remove the B+ terminal nut, field terminal nuts, and ground/wire harness hold-down nuts. Remove wire connectors.

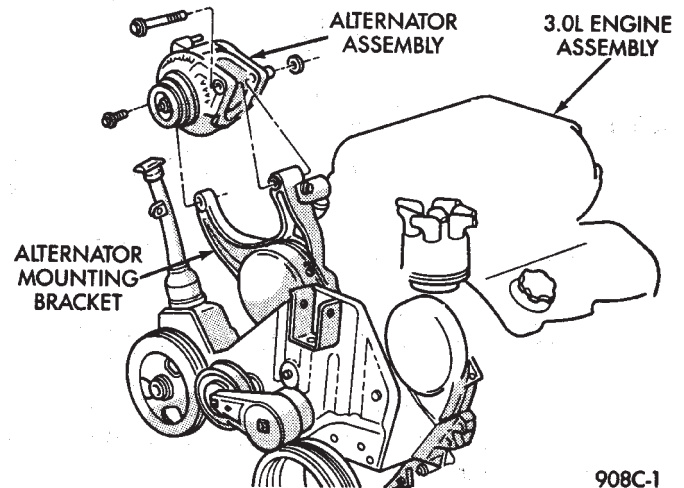


Fig. 6 Remove or Install Alternator Mounting Bolts—3.0L Engine

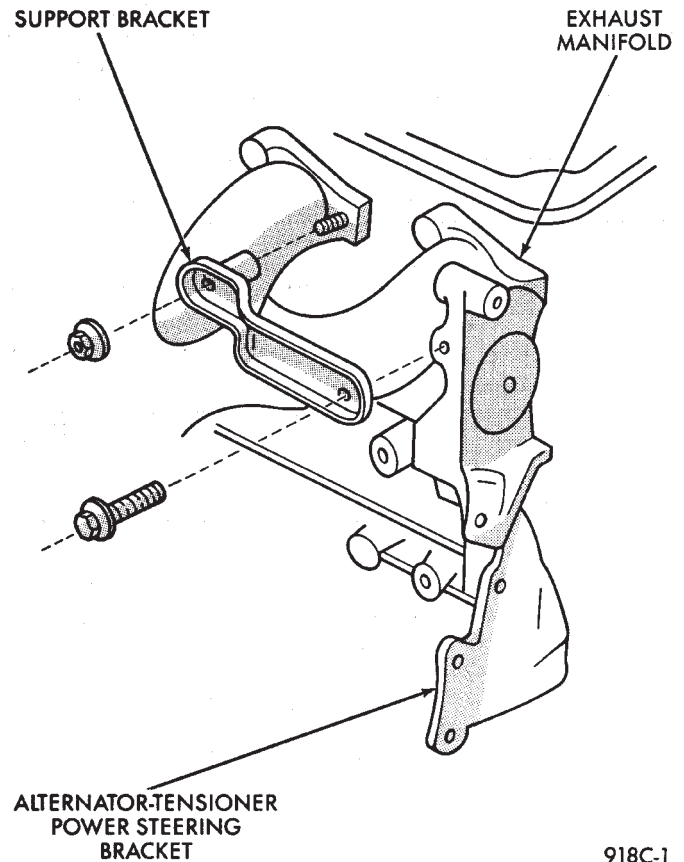


Fig. 7 Support Bracket for Alternator Tensioner Power Steering Bracket

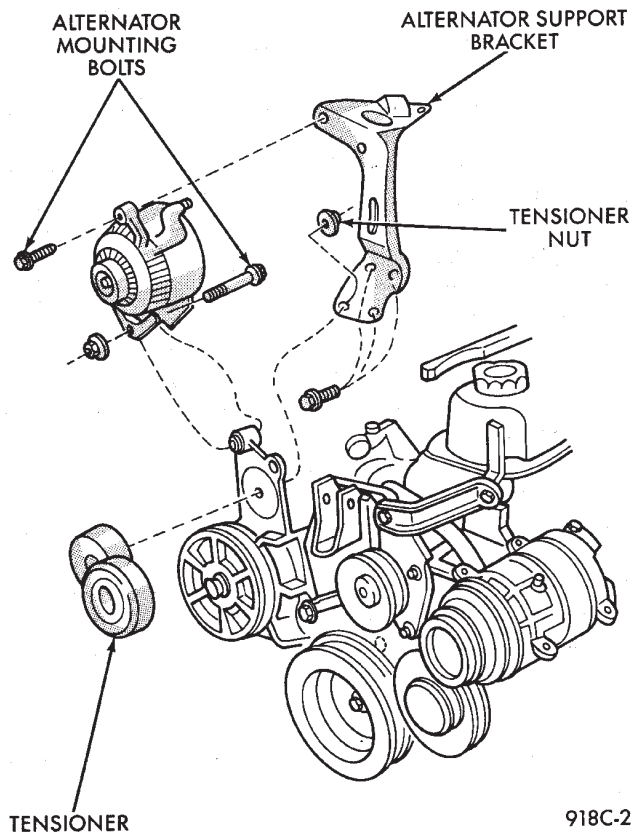
(5) Remove the alternator from the vehicle.

(6) For installation, reverse above procedures. Torque all fasteners. Refer to the Torque Specifications chart at the back of this group.



ALTERNATOR REPLACEMENT—3.3L ENGINE

- (1) Disconnect battery **NEGATIVE** cable (Fig. 1).
- (2) Remove alternator drive belt. Refer to Group 7, Cooling System.
- (3) Loosen, but do not remove the nut on the support bracket at exhaust manifold (Fig. 7).
- (4) Remove the alternator tensioner power steering bracket bolt.
- (5) Remove the tensioner stud nut and the tensioner (Fig. 8).
- (6) Remove the alternator mounting bolts.
- (7) Remove and position the power steering reservoir from the alternator mounting bracket. Do not remove the hoses from the reservoir.
- (8) Remove the three alternator support bracket bolts (Fig. 7).
- (9) Remove intake plenum-to-alternator mounting bracket bolt.
- (10) Remove alternator support bracket (Fig. 8).
- (11) Position alternator and remove alternator wiring.
- (12) Remove alternator.
- (13) For installation, reverse above procedures. Torque all fasteners. Refer to the Torque Specifications chart at the back of this group.



918C-2

Fig. 8 Alternator/Support Bracket—3.3L Engine

SPECIFICATIONS

STARTER/BATTERY

| STARTER | | | | |
|------------------------------|-------------------------|-------------------------|----------------------|----------------------|
| Manufacturer | Nippondenso | | Bosch | |
| Engine Application | 3.0L/3.8L | 3.3L | 3.0L | 2.2-2.5L |
| Part Number and Power Rating | 1.4 Kw | 1.2 Kw | 1.1 Kw | 1.1 Kw |
| Voltage | 12 | 12 | 12 | 12 |
| No. of Fields | 4 | 4 | Permanent Magnet | |
| No. of Poles | 4 | 4 | 6 | 6 |
| Brushes | 4 | 4 | 4 | 4 |
| Drive | Conventional Gear Train | Conventional Gear Train | Planetary Gear Train | Planetary Gear Train |
| Free Running Test | | | | |
| Voltage | 11 | 11 | 11 | 11 |
| Amperage Draw | 73 Amps | 73 Amps | 73 Amps | 69 Amps |
| Minimum Speed RPM | 3601 RPM | 3401 RPM | 3473 RPM | 3447 RPM |
| Solenoid Closing Voltage | 7.5 Volts | 7.5 Volts | 7.5 Volts | 7.5 Volts |
| Cranking Amperage Draw Test | 150-220 Amps* | 150-200 Amps* | 150-220 Amps* | |

*Engine should be up to operating temperature. Extremely heavy oil or tight engine will increase starter amperage draw.

| BATTERY | | |
|------------------|-----------------------------|------------------|
| Load Test (Amps) | Cold Cranking Rating @ 0 °F | Reserve Capacity |
| 200 Amp | 500 Amp | 110 Minutes |
| 250 Amp | 600 Amp | 120 Minutes |
| 315 Amp | 685 Amp | 125 Minutes |

CRANKING RATING is the current a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at specified temperature.

RESERVE CAPACITY RATING is the length of time a battery can deliver 25 amps and maintain a minimum terminal voltage of 10.5 volts at 27 °C (80 °F).

ALTERNATOR AMPERAGE/IDENTIFICATION NUMBERS

| TYPE | **CASE I.D. TAG NUMBER | PULLEY GROOVES | ENGINE USAGE | * AMPERAGE OUTPUT |
|----------------------------------------------------------------|------------------------|----------------|--------------|-------------------|
| BOSCH 90 HS | 4557431 | 4 | 2.5L | 84 AMP |
| DENSO 90 HS | 5234031 | 4 | 2.5L | 86 AMP |
| DENSO 90 HS | 5234032 | 6 | 3.0L-3.3L | 90 AMP |
| DENSO 120 HS | 5234208 | 4 | 2.5L | 98 AMP |
| DENSO 120 HS | 5234033 | 6 | 3.0L-3.3L | 102 AMP |
| | | | | |
| *WITH ALTERNATOR FULL FIELDING AT 1250 RPM | | | | |
| **CASE I.D. TAG NUMBER IS LOCATED ON BOTTOM OF ALTERNATOR CASE | | | | |

928B-3

TORQUE SPECIFICATIONS—ALTERNATOR/STARTER

| Description | Torque |
|----------------------------------------|-----------------------|
| Alternator Mounting Bolts | |
| 2.2L/2.5L Engine | 54 N•m (40 ft. lbs.) |
| 3.3L/3.8L Engine | 54 N•m (40 ft. lbs.) |
| 3.0L Engine—Upper Bolt | 54 N•m (40 ft. lbs.) |
| Lower Bolt | 54 N•m (40 ft. lbs.) |
| Alternator Field Terminal | |
| Nuts | 3 N•m (25 in. lbs.) |
| Alternator B+ Terminal and | |
| Ground Terminal Nuts | 9 N•m (75 in. lbs.) |
| Battery Hold Down Clamp Bolt | 14 N•m (125 in. lbs.) |
| Starter Mounting Bolts/Nuts | 54 N•m (40 ft. lbs.) |

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