

# BATTERY/STARTER/ALTERNATOR SERVICE

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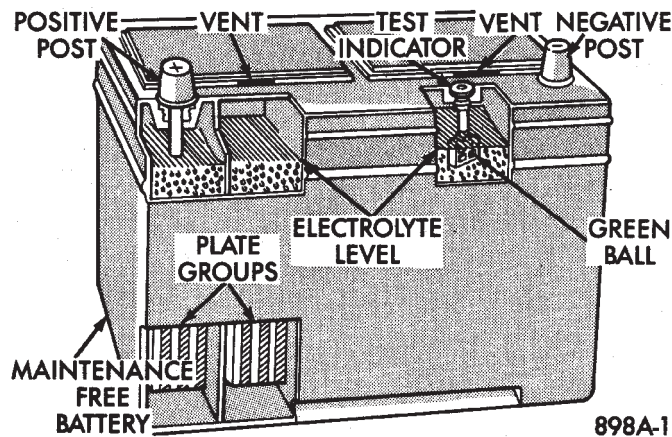
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## BATTERY REMOVAL, INSTALLATION AND SERVICE

### 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 that displays a colored ball to show the battery's state of charge.



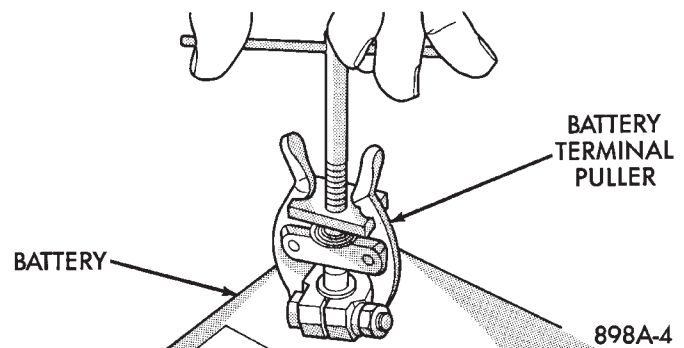
**Fig. 1 Maintenance Free Battery**

- 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.

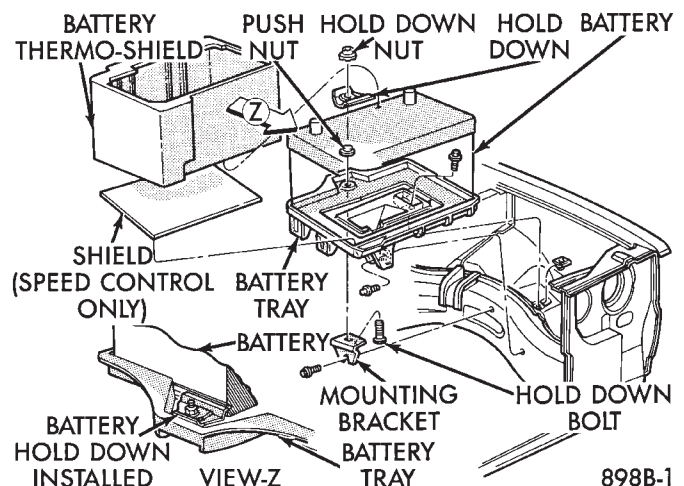
(2) Disconnect and remove the battery cable terminals from the battery posts. Remove negative cable first (Fig. 2).



**Fig. 2 Remove Battery Cables**

**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) Lift battery heat shield off battery, if equipped (Fig. 3).

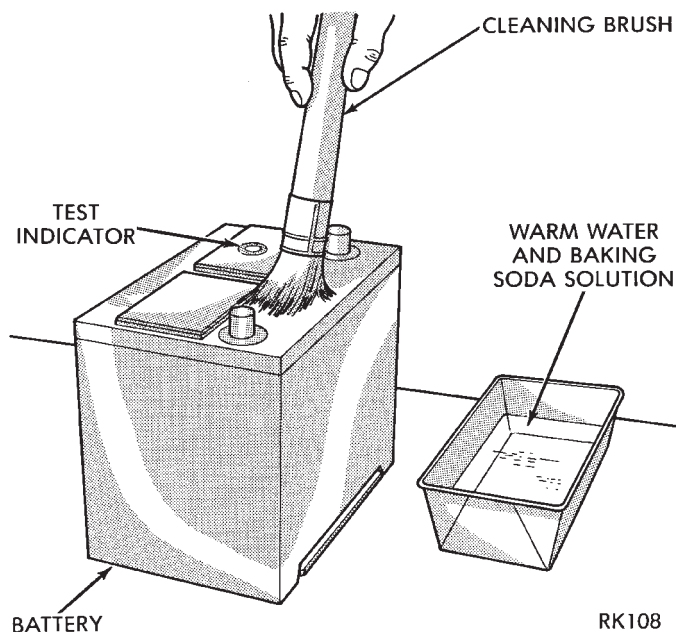


**Fig. 3 Battery Hold-Down**

(4) Remove battery holddown nut and clamp.

(5) Remove the battery from vehicle.

(6) 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 the top of battery.



**Fig. 4 Cleaning Battery**

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

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

(8) Inspect battery tray (Fig. 5) 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 (6).

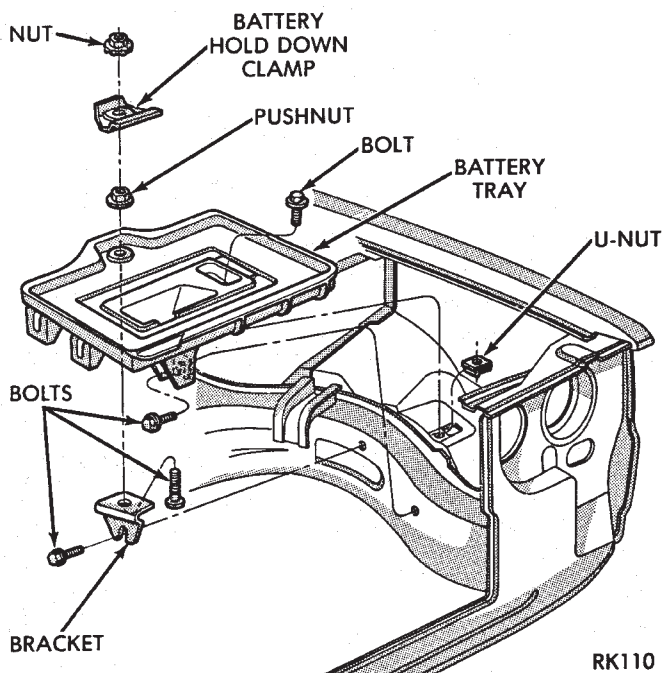
(9) Clean battery posts with a suitable battery post cleaning tool (Fig. 6).

(10) Clean inside surfaces of battery cable terminal clamps with a suitable battery terminal cleaning tool (Fig. 7). Replace damaged or frayed cables and broken terminal clamps.

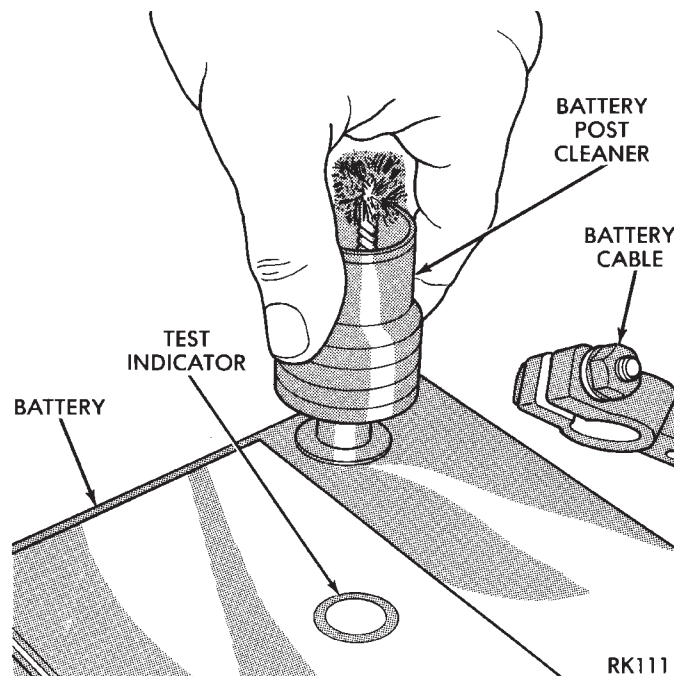
(11) Inspect battery for proper or damaged hold down ledge.

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

(13) Install battery hold down clamp and nut. Be sure that clamp is positioned properly and aligned on battery.



**Fig. 5 Battery Tray**



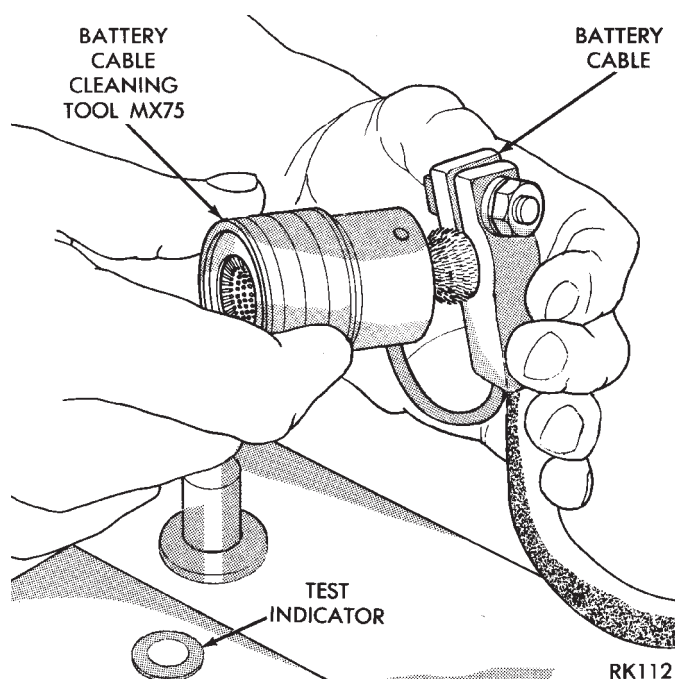
**Fig. 6 Cleaning Battery Posts**

(14) Install battery heat shield.

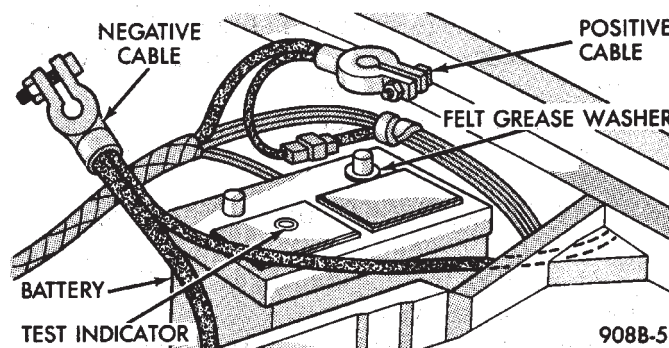
(15) Place felt grease washer onto Positive (+) battery post.

(16) Connect battery cable clamps to battery posts making sure top of clamp is flush with top of post (Fig. 8). Install POSITIVE cable first.

(17) Tighten clamp nuts securely.



**Fig. 7 Cleaning Battery Cable Terminal**



**Fig. 8 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 with automatic transmissions
- Clutch pedal mounted starter interlock switch with manual transmissions
- Wiring harness
- Battery
- Starter motor with an integral solenoid

### BOSCH STARTERS

- A Bosch permanent magnet starter motor is available on
- 2.2L, 2.5L and 3.0L engines on all vehicles. A planetary gear train transmits power between starter motor and pinion shaft. The fields consist of six permanent magnets.

### NIPPONDENSO STARTERS

- A Nippondenso reduction gear-field coil starter motor is available on 3.0L, 3.3L and 3.8L engines.

### SUPPLY CIRCUIT AND CONTROL CIRCUIT

Both starter systems consist of two separate circuits:

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

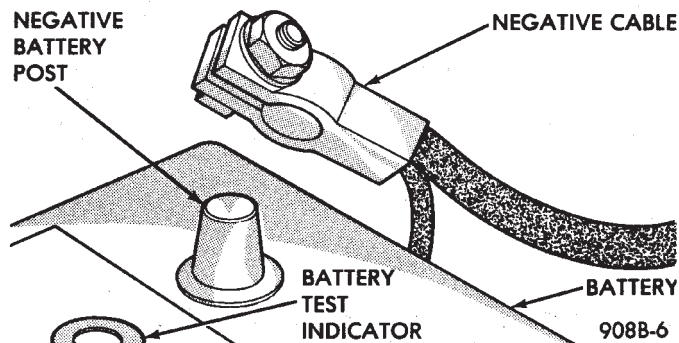
For additional information on starter motor supply and control circuits, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics.



## STARTER MOTOR REPLACEMENT

## BOSCH STARTER—2.2L/2.5L ENGINE

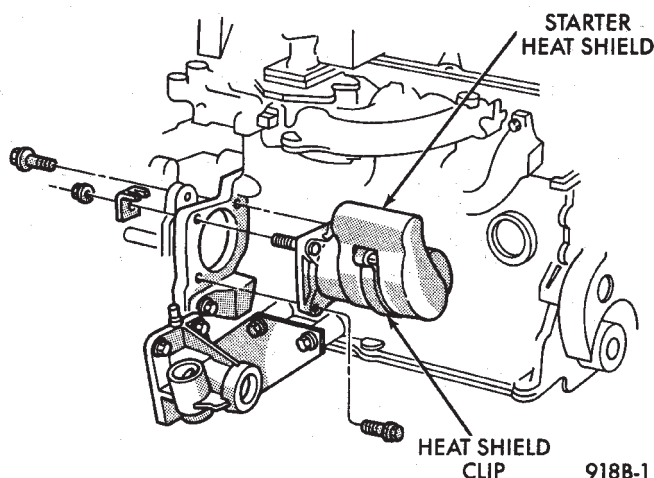
(1) Disconnect battery negative cable (Fig. 1).



**Fig. 1 Remove or Install Battery Cable**

(2) Raise vehicle.

(3) Remove heat shield clip from the starter and heat shield is clipped to starter (Fig. 2). For easier servicing, do not remove the wiring from starter at this time.



**Fig. 2 Starter Heat Shield—4 Cylinder Engines**

(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.

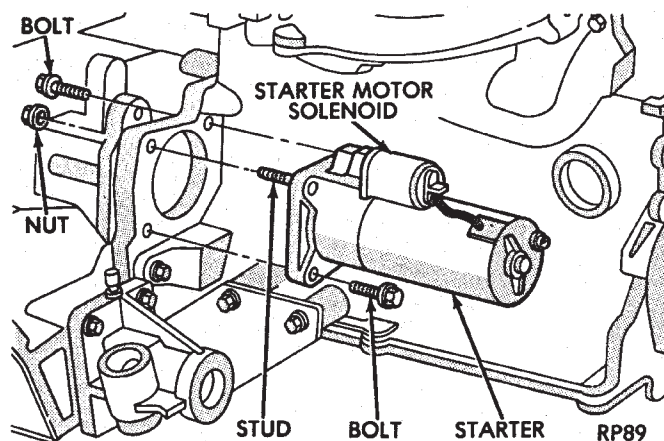
(7) Remove the starter from vehicle.

(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/3.3L/3.8L ENGINE

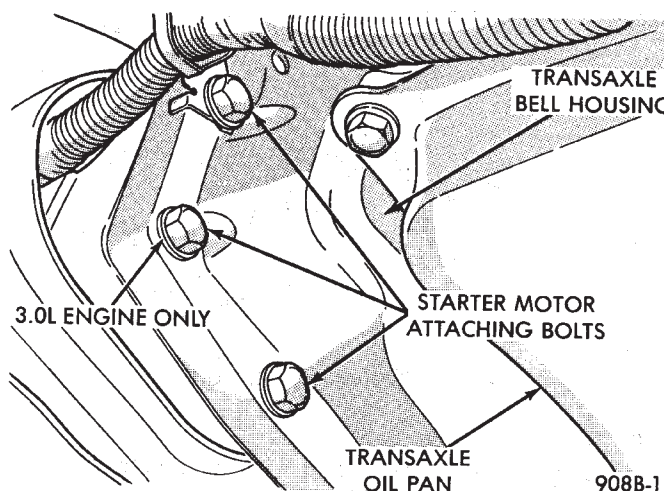
(1) Disconnect NEGATIVE battery cable (Fig. 1).

(2) Raise vehicle.



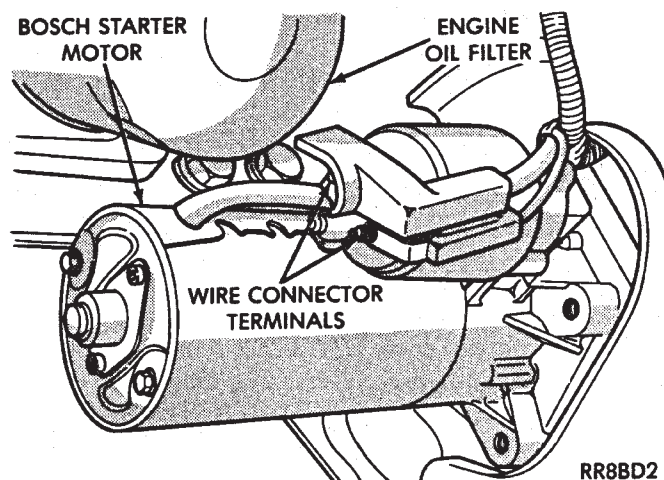
**Fig. 3 Bosch Starter—2.2L/2.5L Engine**

(3) Remove three starter attaching bolts at engine/transaxle (Fig. 4).

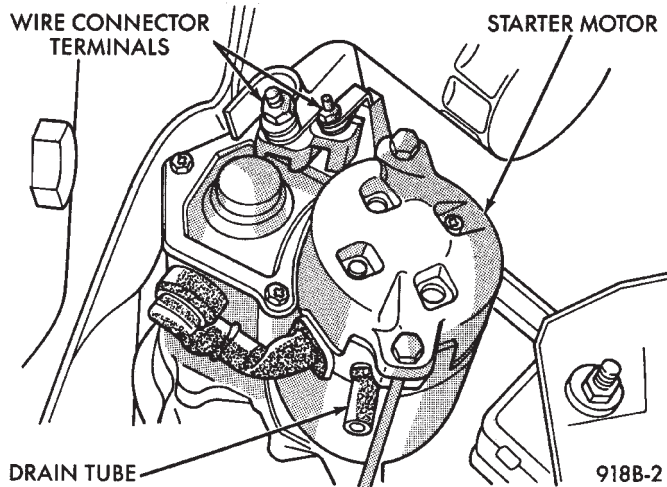


**Fig. 4 Remove or Install Attaching Bolts—Typical**

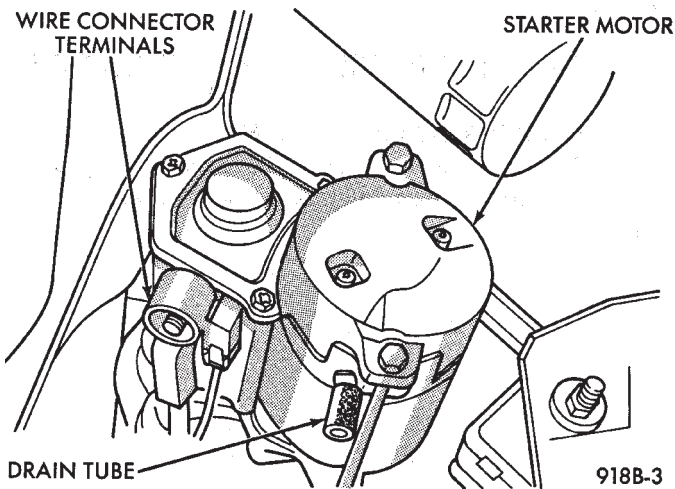
(4) Remove the two wire connector terminal nuts and remove wiring connector (Bosch, Fig. 5) (Nippondenso, Fig. 6 or 7).



**Fig. 5 Wire Terminal Connections—Bosch Starter**

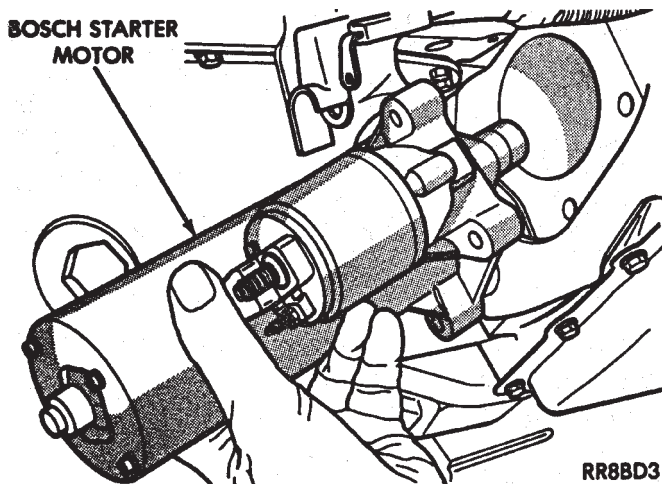


**Fig. 6 Wire Terminal Connections—3.0L Engine—Nippondenso Starter**

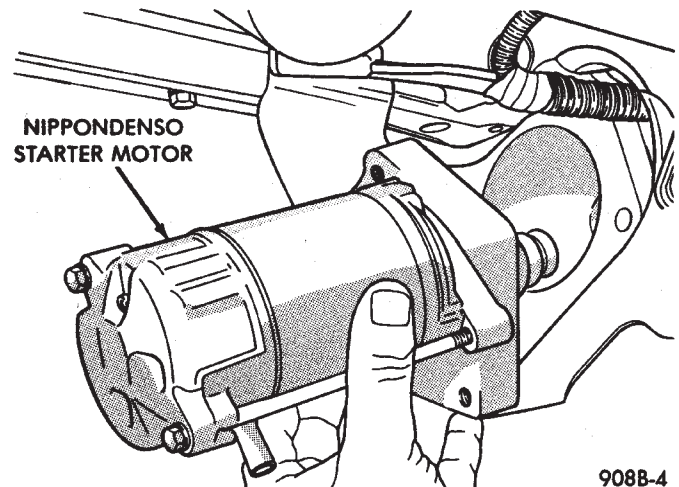


**Fig. 7 Wire Terminal Connections—3.3L/3.8L Engine—Nippondenso Starter**

(5) Remove starter from vehicle (Bosch, Fig. 8) (Nippondenso, Fig. 9).



**Fig. 8 Remove/Install Starter—Bosch—Typical**



**Fig. 9 Remove/Install Starter—Nippondenso—Typical**

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

## 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

#### REMOVAL AND INSTALLATION

(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 the bearing shaft in the gear housing (Fig. 12).

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

(3) For assemble, reverse above procedures.

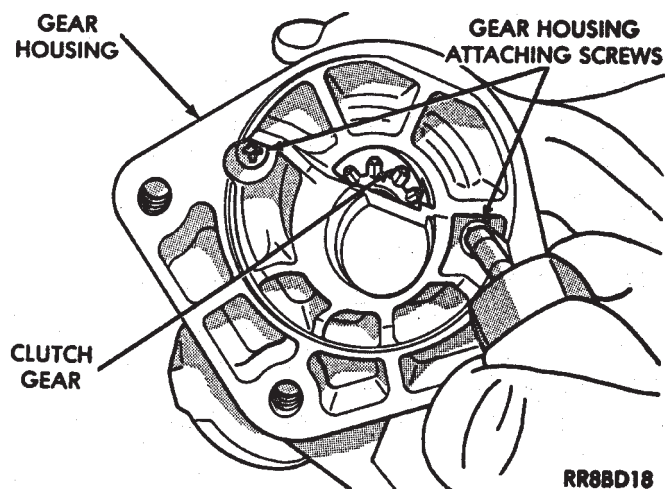
### BOSCH STARTER SOLENOID REPLACEMENT

- (1) Remove field terminal nut (Fig. 14).
- (2) Remove field terminal (Fig. 15).
- (3) Remove field washer (Fig. 16).
- (4) Remove three solenoid mounting screws (Fig. 17).
- (5) Remove the solenoid from the starter assembly.
- (6) For installation, reverse above procedures.

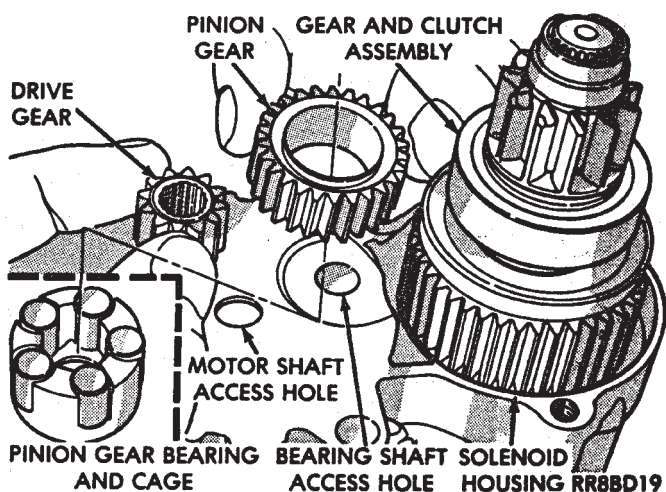
### BOSCH STARTER GEAR AND CLUTCH REPLACEMENT

- (1) Remove solenoid assembly (Fig. 18).

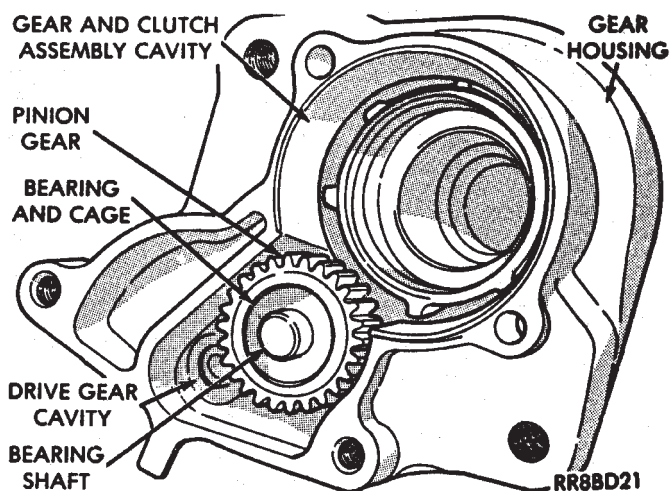




**Fig. 10 Remove or Install Gear Housing**



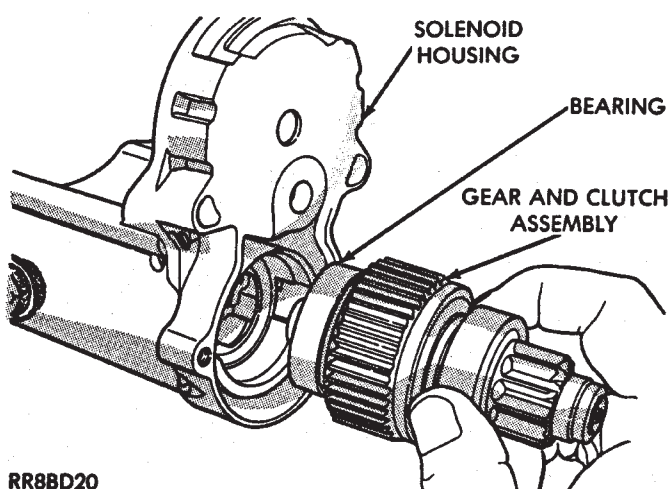
**Fig. 11 Remove or Install Drive and Pinion Gears**



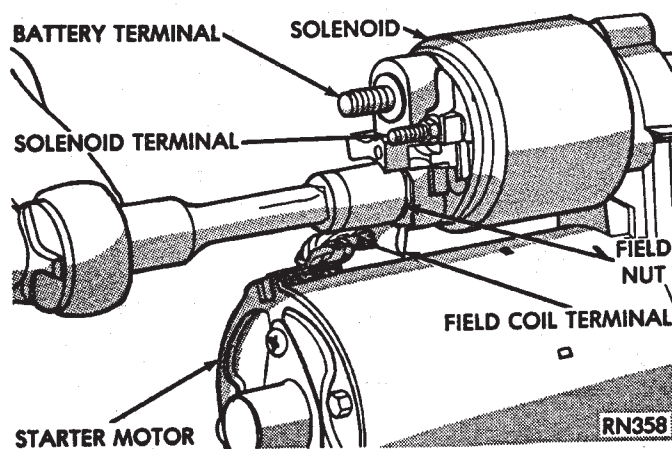
**Fig. 12 Lubricate and Install Pinion Gear Bearing**

(2) Remove the two through-bolts securing the starter drive end housing to the motor housing (Fig. 19) and separate housings.

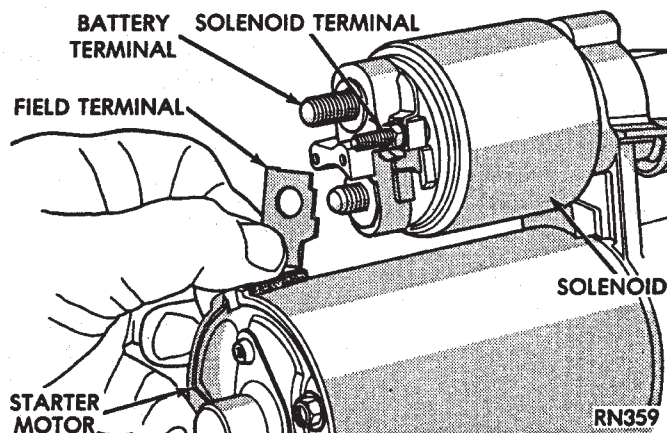
(3) Remove rubber seal (Fig. 20).



**Fig. 13 Gear and Clutch Assembly**



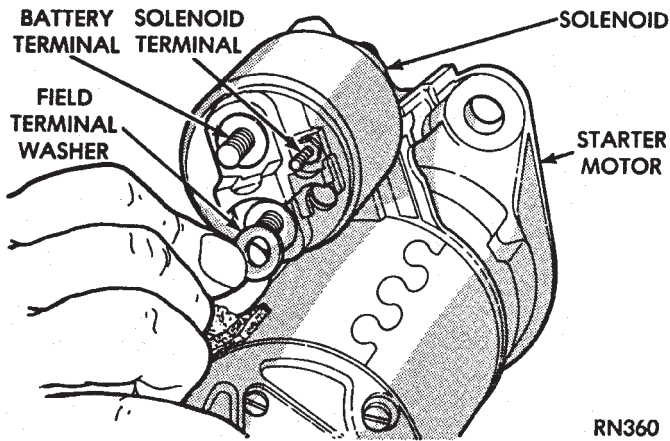
**Fig. 14 Field Terminal Nut**



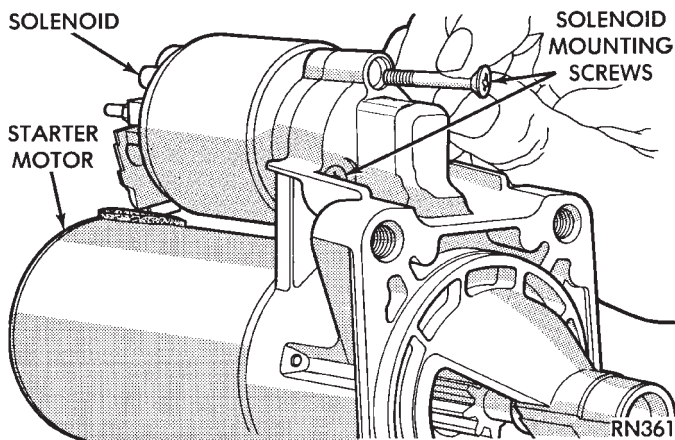
**Fig. 15 Field Coil Terminal**

(4) Pull the gear and clutch assembly from the drive end housing (Fig. 21).

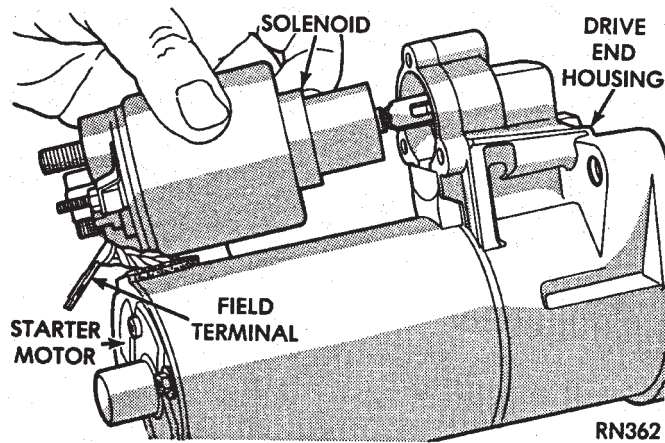
(5) For installation, reverse above procedures.



**Fig. 16 Field Terminal Washer**



**Fig. 17 Solenoid Mounting Screws**

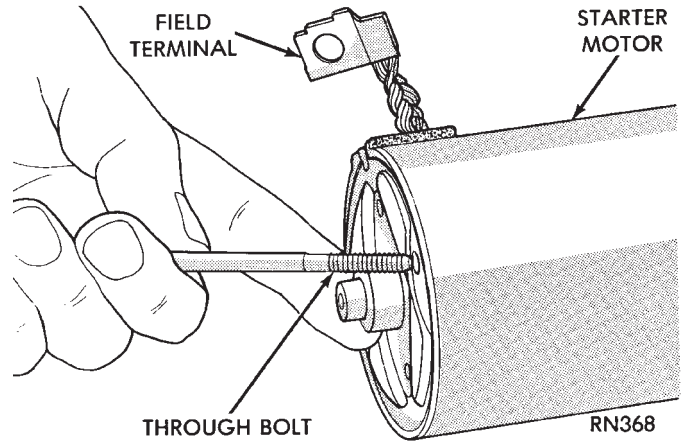


**Fig. 18 Solenoid**

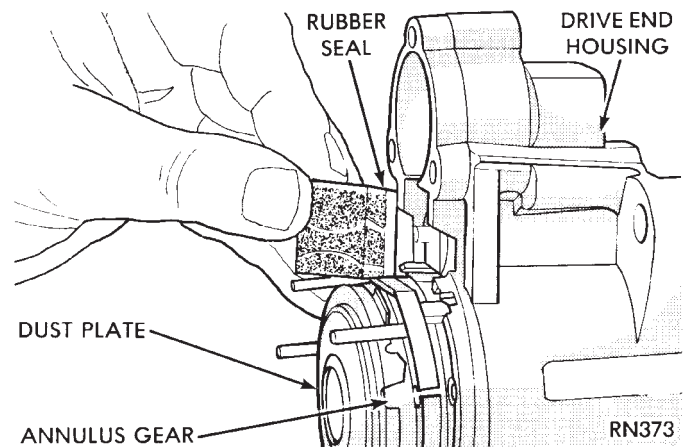
#### STARTER INTERLOCK SWITCH: CLUTCH PEDAL MOUNTED/MANUAL TRANSMISSION ONLY

For electrical diagnostics, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics, Starter relays.

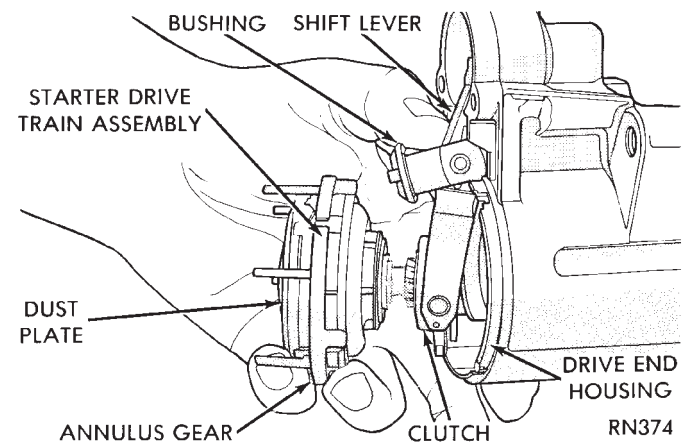
For replacement and adjustment of this switch, refer to Group 6, Manual Transaxle Clutch, Manual Transaxle Starter Interlock Switch.



**Fig. 19 Through-Bolt**



**Fig. 20 Rubber Seal**



**Fig. 21 Starter Drive Gear Train**

#### NEUTRAL STARTER AND BACK-UP SWITCH

For electrical diagnostics when checking the starter circuits, refer to Group 8A, Battery/Starting/Charging Systems Diagnostics, Starter Relays.

For removal and installation of neutral switch, refer to Group 21, Transaxle Neutral Starter and Back-up Switch Replacement.



## ALTERNATOR

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## GENERAL INFORMATION

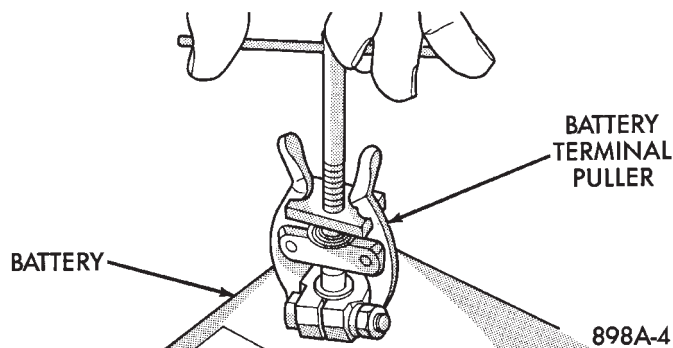
This section will cover alternator removal and installation only. Information covering alternator on-vehicle testing and diagnosis can be found in Group 8A, Battery/Starting/Charging Systems Diagnostics. To identify the alternator, refer to the Alternator Specification chart at the rear of this section.

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

## ALTERNATOR REPLACEMENT—2.2L/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) Without 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.**

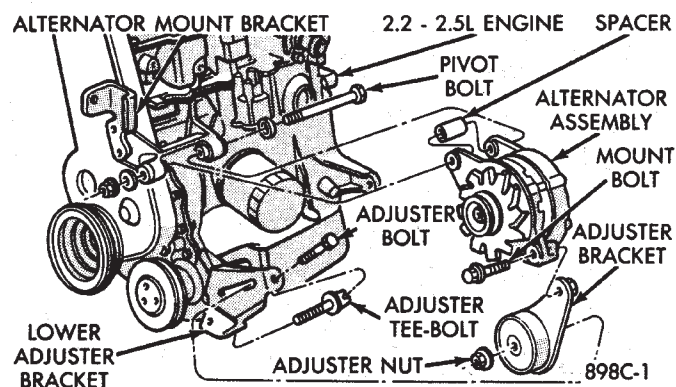
Open Circuit Volts	Percent Charge
11.7 volts or less	0%
12.0	25%
12.2	50%
12.4	75%
12.6 or more	100%

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**Fig. 2 A/C Compressor Replacement—2.2 L/2.5 L Engine**

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

- (3) Remove the two alternator mounting bolts (Fig. 3) and position the alternator to gain access to all the wire connectors. If equipped with:



**Fig. 3 Remove or Install Mounting Bolts**

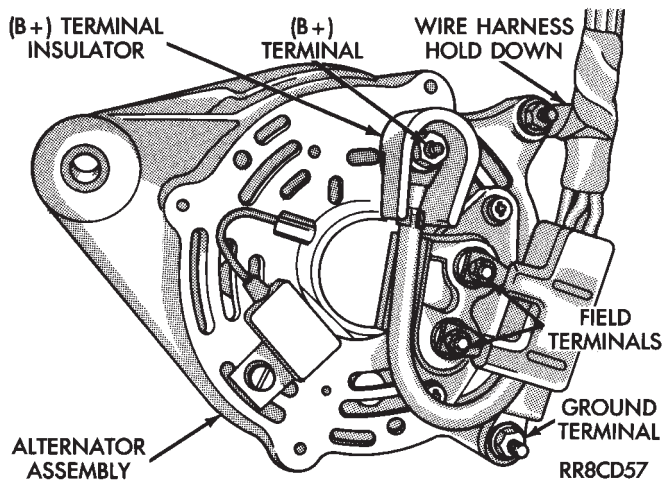
- BOSCH ALTERNATOR: Remove B+ terminal nut, field terminal nuts, and ground harness hold down nuts (Fig. 4). Remove wire connector assembly.

- NIPPONDENSO ALTERNATOR: Remove nuts from field terminals, ground terminal, wire harness and B+ terminal (Fig. 5). B+ terminal nut must be removed last to prevent damage to terminal insulator.

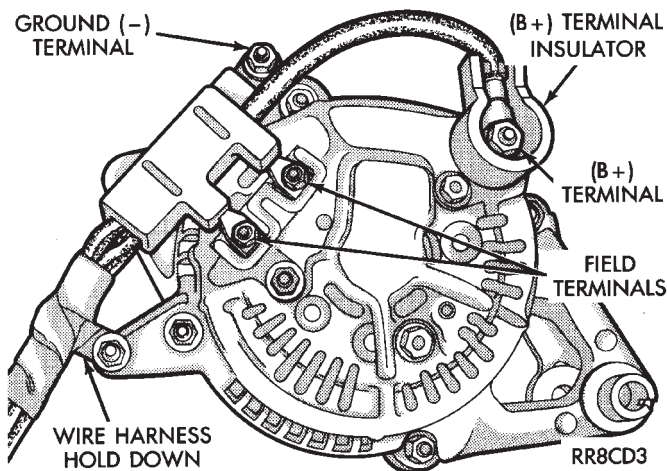
- (4) Remove the alternator from the vehicle.

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





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



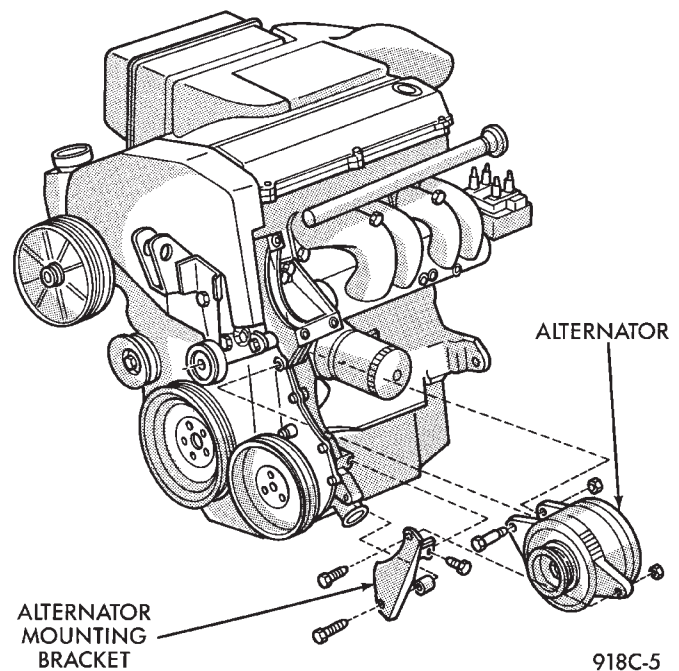
**Fig. 5 Remove or Install Wire Connector Assembly—Nippondenso Alternator**

#### ALTERNATOR REPLACEMENT—2.2L TURBO ENGINE (WITH 16 VALVE CYLINDER HEAD)

- (1) Disconnect battery NEGATIVE cable (Fig. 1).
- (2) Remove alternator/air conditioning drive belt. Refer to Group 7, Cooling System.
- (3) Remove the bolts retaining the A/C compressor to the mounting bracket.
- (4) Without 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.**

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



**Fig. 6 Alternator Mounting—2.2 L Turbo Engine With 16 Valve Cylinder Head**

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

- (7) Remove the alternator from the vehicle.

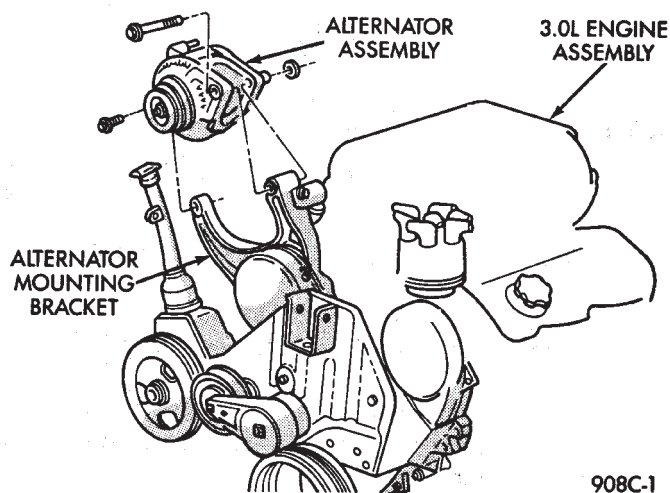
- (8) For installation, reverse above procedures. Torque all fasteners. Refer to the Torque Specifications chart at the rear of this group.

#### ALTERNATOR REPLACEMENT—3.0L ENGINE

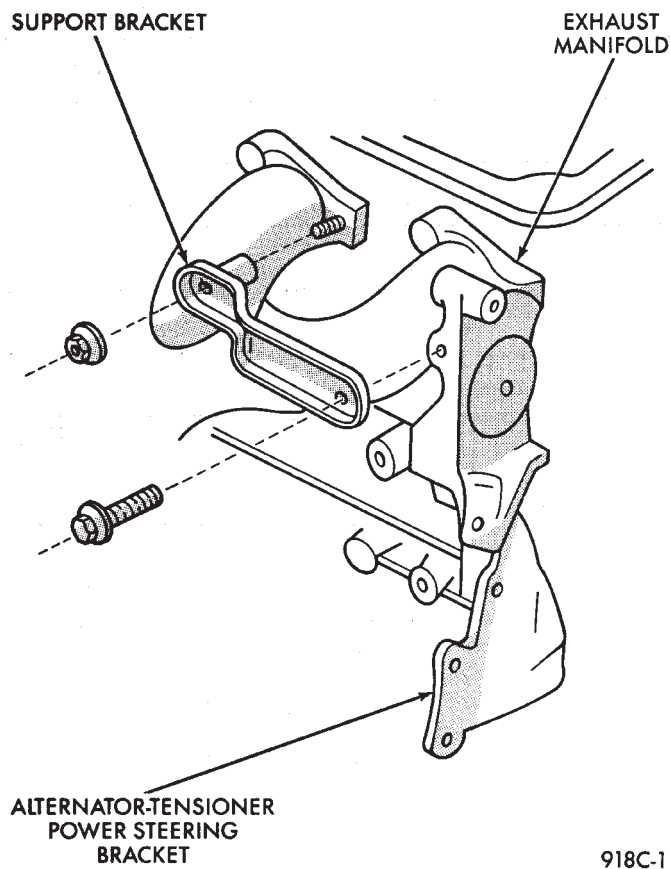
- (1) Disconnect battery negative cable (Fig. 1).
- (2) Remove alternator drive belt. Refer to Group 7, Cooling System.
- (3) Remove the alternator mounting bolts and separate the alternator from the mounting bracket (Fig. 7).
- (4) Remove the B+ terminal nut, field terminal nuts, and ground/wire harness hold-down nuts. Remove wire connectors.
- (5) Remove the alternator from the vehicle.
- (6) For installation, reverse above procedure. Torque all fasteners. Refer to the Torque Specifications chart at the rear of this group.

#### ALTERNATOR REPLACEMENT—3.3L/3.8L 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. 8).
- (4) Remove the alternator tensioner power steering bracket bolt.
- (5) Remove the tensioner stud nut and the tensioner (Fig. 9).

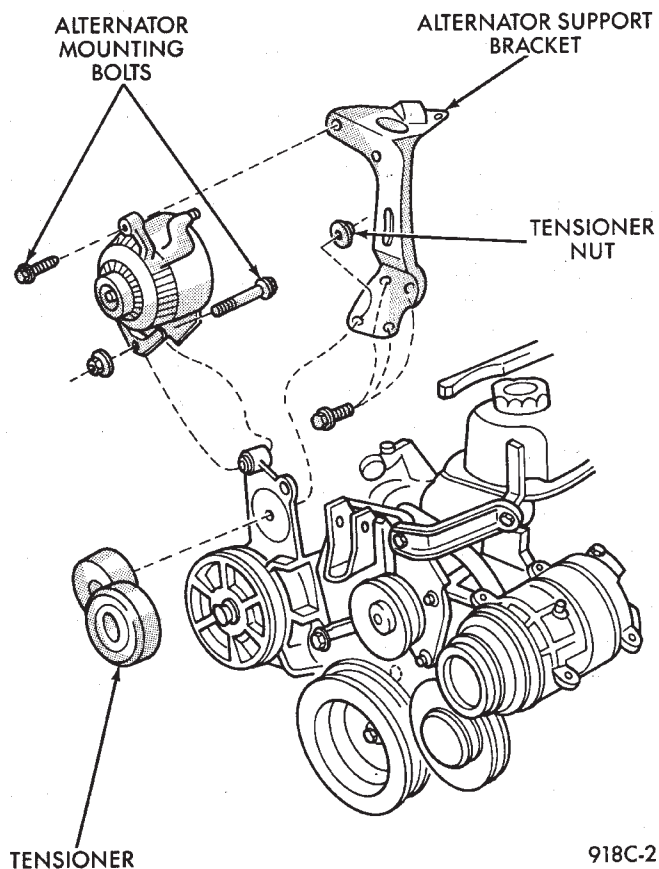


**Fig. 7 Remove or Install Alternator Mounting Bolts—3.0L Engine**



**Fig. 8 Support Bracket for Alternator Tensioner Power Steering Bracket**

(6) Remove the alternator mounting bolts (Fig. 9).



**Fig. 9 Alternator/Alternator Support Bracket—3.3L/3.8L Engine**

(7) Remove the power steering reservoir from the alternator mounting bracket.

(8) Remove the three alternator support bracket bolts (Fig. 8).

(9) Remove intake plenum to alternator mounting bracket bolt.

(10) Remove alternator support bracket (Fig. 9).

(11) Position the alternator to gain access to wiring and remove wiring from alternator.

(12) Remove alternator.

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

## 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).

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## ALTERNATOR AMPERAGE/IDENTIFICATION NUMBERS

Type	**Case I.D. Tag Number	Pulley Grooves	Engine Usage	*Amperage Output
Bosch 90 HS	4557431	4	2.2L-2.5L	84 AMP
Bosch 90 HS	4557432	6	3.0L	86 AMP
Denso 75 HS	4557301	4	2.2L	68 AMP
Denso 90 HS	5234031	4	2.2L-2.5L	86 AMP
Denso 90 HS	5234032	6	3.0L-3.3L-3.8L	90 AMP
Denso 120 HS	5234033	6	3.0L-3.3L-3.8L	102 AMP

\*With Alternator Full Fielded at 1250 RPM

\*\*Case I.D. Tag Number is Located on Bottom of Alternator Case

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## 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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