

IC103
Electrical Systems
IC Lift Trucks



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TECHNICAL TRAINING

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Contents

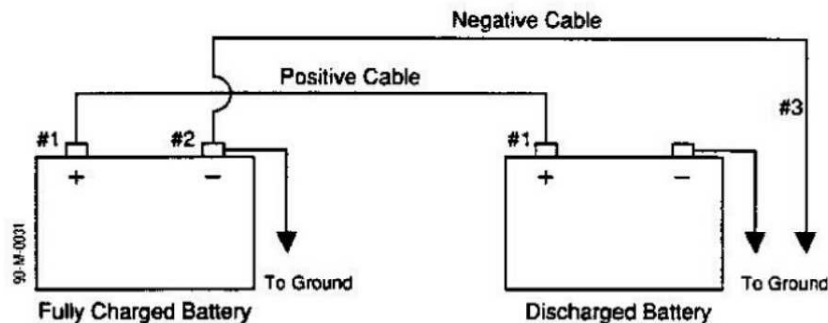
About this class.....	3
About safety.....	4
Section 1. The Battery.....	5
Troubleshooting the Standard Battery.....	6
Specific Gravity Test.....	7
Three Minute Charge Test.....	7
Battery Load Test.....	8
Jump Starting with Auxiliary Battery.....	8
Troubleshooting the Maintenance-Free Battery.....	9
Section 2. The Charging System.....	11
Charging Circuit System Components.....	11
Delco 10-SI Alternator.....	12
System Description and Maintenance.....	12
Delco 10-SI Parts Breakdown.....	13
Motorola 9DB Alternator.....	14
Motorol Parts Breakdown.....	16
Alternator Maintenance Precautions.....	17
Alternator Inspection.....	18
Alternator Drive (Fan) Belt.....	18
Fan Belt Tension Specification.....	18
Troubleshooting the Alternator.....	19
A. Abnormal Charge Indicator Lamp Operation.....	19
B. Abnormal Charging System Operation.....	20
Charging System Schematics.....	22
Troubleshooting Guide.....	22
Section 3. The Ignition System.....	23
Ignition Circuit Electronic Components.....	23
Ignition Circuit Point Components.....	23
Ignition Circuit Secondary System.....	23
The Standard Ignition System.....	23
The Distributor.....	24
Contact Points and Condensers.....	25
Distributor Caps.....	26
Distributor Rotor.....	26
Distributor Lubrication.....	26
The Ignition Coil.....	27
The Ignition Resistor	28
The Ignition Switch.....	28
The Spark Plugs.....	28
The Wiring.....	29
Standard Ignition Maintenance.....	30
The High Energy Ignition System.....	33
The Distributor.....	33
The Ignitor	34
Distributor Parts Breakdown.....	35

2. Lay a cloth over the open vent wells of each battery. Leave flame arrestor caps in place. These actions help reduce the explosion hazard always present in either battery when connecting "live" booster batteries to batteries.

3. Attach one end of one jumper cable to the positive terminal of the booster battery and the other end of the same cable to the positive terminal of the discharged battery.

WARNING DO NOT PERMIT the vehicles to touch each other as this could establish a negative connection and counteract the benefits of this procedure.

4. Attach one end of the remaining negative (-) cable to the negative terminal of the booster battery, and the other end to the engine or truck frame at least 12 inches from the battery filler caps of the vehicle being started.



1. Connect a jumper cable to the positive post of each battery.
2. Connect one end of the free jumper cable to the negative post of the charged battery.
3. Connect the other end of the free jumper cable to an engine ground on the disabled truck.

Use this exact sequence!

CAUTION Make sure cables are kept away from any engine parts-fans and belts-that will move when the engine is started.

WARNING Do Not Connect Directly To The Negative Post Of The Dead Battery.

WARNING Any procedure other than the above could result in:
Personal injury caused by electrolyte squirting out the battery vents,
Personal injury or property damage due to battery explosion,
Damage to the charging system of the booster vehicle or of the immobilized vehicle.

The Maintenance-Free Battery

It is never necessary to add water to the maintenance-free battery. The battery is completely sealed except for a small vent hole on the side, which allows the small amount of gas produced in the battery to escape.

Listed below is a description of two of the more common alternators used on Clark lift trucks.

Delco 10-SI Alternator

System Description and Maintenance

The Delco 10-SI is an integrated Delcotron, featuring an internally mounted electronic voltage regulator and simplified internal construction.

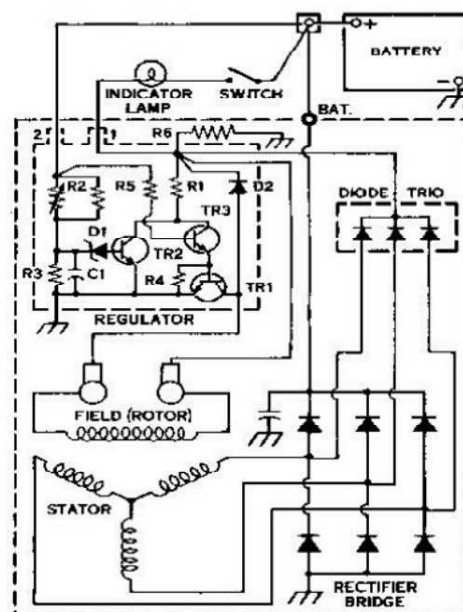
Periodic Alternator Servicing

The alternator rotor is supported by a ball bearing at the drive end and a roller bearing at the slip ring end. Each bearing has a grease supply which eliminates the need for periodic lubrication. However, after periods of extended operation or at overhaul time, check the bearings to see that they are in satisfactory condition. Hold the alternator pulley and note the side play and freeness of rotation to determine the condition of the bearings. If the bearings are rough, worn, or have excessive side play, remove the alternator for replacement or repair.

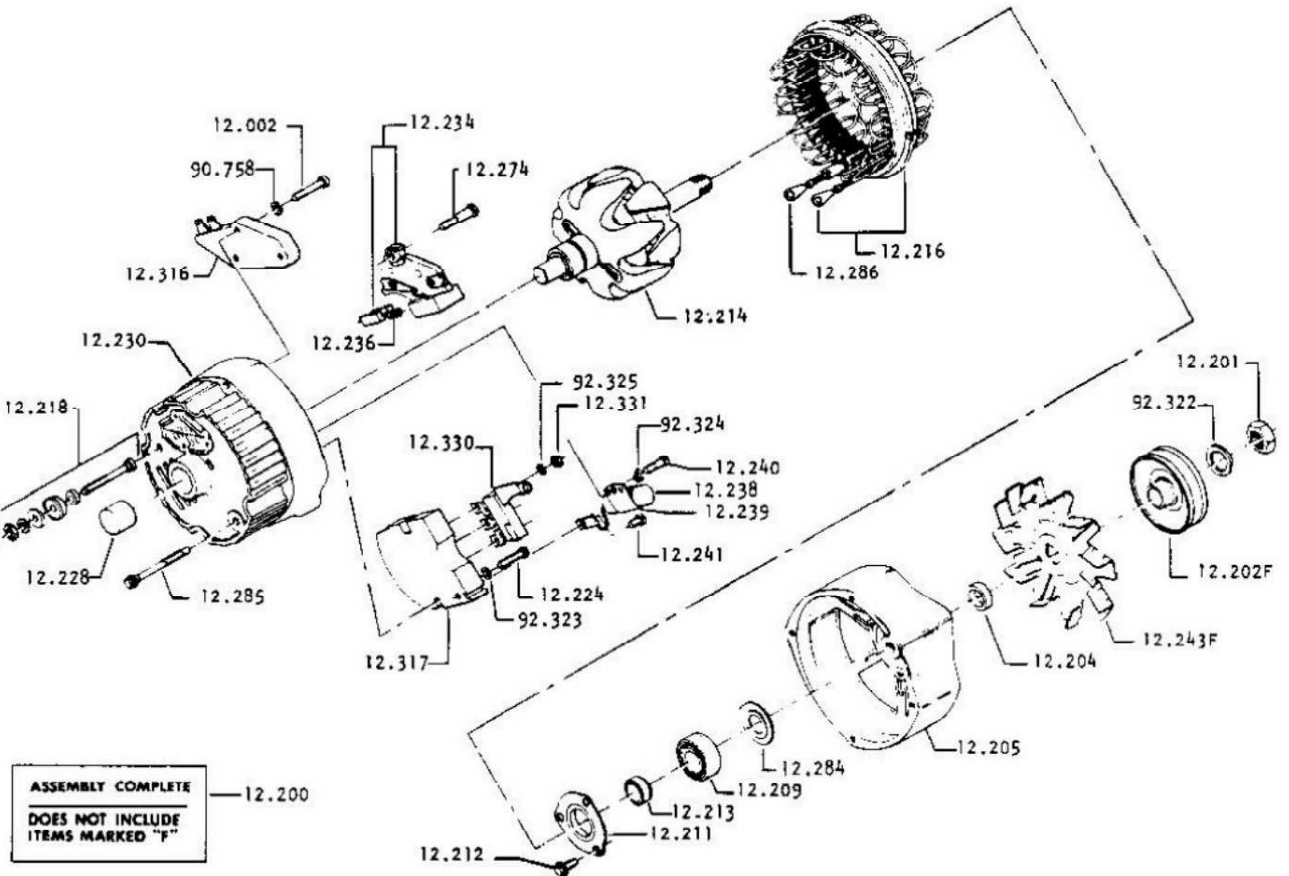
Periodically, examine the alternator drive belt for wear or glazing from slipping in the pulley. Replace the belt if necessary, since loose, slipping belts are often the cause of a run-down battery complaint.

The two alternator brushes carry current through the slip rings to the rotor-mounted field coil. They require no periodic servicing. However, check the brushes after extended operation or at engine overhaul time.

The electronic regulator is contained in a small plastic package mounted underneath the brush holder, inside the alternator. The voltage regulator setting cannot be adjusted and the unit should never need servicing.



Delco 10SI Alternator



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12.200	ALTERNATOR ASSEMBLY	12.238	CAPACITOR, ALTERNATOR
12.002	SCREW, VOLTAGE REGULATOR	12.239	BRACKET, ALTERNATOR CAPACITOR
12.201	NUT, ALTERNATOR PULLEY	12.240	SCREW, CAPACITOR BRACKET
12.202	PULLEY, ALTERNATOR	12.241	SCREW, ALTERNATOR CAPACITOR LEAD
12.204	COLLAR, ALTERNATOR DRIVE END	12.243	FAN, ALTERNATOR
12.205	FRAME, ALTERNATOR DRIVE END	12.274	SCREW, BRUSH HOLDER HOUSING
12.209	BEARING, ALTERNATOR DRIVE END	12.284	SLINGER, ALTERNATOR DRIVE END OIL
12.211	RETAINER, ALTERNATOR DRIVE END BEARING	12.285	SCREW, ALTERNATOR FRAME
12.212	SCREW, ALTERNATOR DRIVE END BRG RET PLATE	12.286	TERMINAL, ALTERNATOR STATOR LEAD
12.213	COLLAR, ALTERNATOR DRIVE END	12.316	REGULATOR, ALTERNATOR VOLTAGE OUTPUT
12.214	ROTOR ASSEMBLY, ALTERNATOR	12.317	RECTIFIER ASSEMBLY, ALTERNATOR
12.216	STATOR ASSEMBLY, ALTERNATOR	12.330	DIODE, ALTERNATOR FIELD CURRENT
12.218	TERMINAL PACKAGE, BATTERY	12.331	NUT, ALTERNATOR RECTIFIER TERMINAL
12.224	SCREW, ALTERNATOR HEAT SINK	90.758	LOCKWASHER, VOLTAGE REGULATOR FASTENER
12.228	BEARING, ALTERNATOR SLIP RING FRAME END	92.322	LOCKWASHER, ALTERNATOR PULLEY FASTENER
12.230	FRAME, SLIP RING END	92.323	LOCKWASHER, ALTERNATOR HEAT SINK FASTENER
12.234	BRUSH HOLDER, ALTERNATOR	92.324	LOCKWASHER, CAPACITOR BRACKET FASTENER
12.236	SPRING, ALTERNATOR BRUSH	92.325	LOCKWASHER, ALTERNATOR RECTIFIER TERMINAL

Motorola 9DB Alternator

The Motorola 9DB alternator is a three-phase, diode-rectified generator with a diecast aluminum housing to provide strength while keeping weight to a minimum. It is a drop-in replacement for the Delco 10-SI alternator and requires no changes in truck mounting hardware or electrical hook-up.

The field for the alternator is wound concentrically about the core of the rotor. The field structure contains twelve poles (six sets of pole pairs). The rotor is supported by a pair of sealed ball bearings.

Field current of approximately 2.5 amperes is supplied to the field through copper slip rings and a set of electrographite brushes.

The stator contains the current-generating windings (or armature) of the alternator. It is mounted in the unit by clamping between the front and back housings. It is aligned by means of four notches in the periphery of the laminations that engage the housing through-bolts. The stator laminations are insulated with an epoxy coating prior to installation of the three-phase windings. The assembly is then varnish-coated for added insulation and to prevent movement of the windings in use.

The stator is connected to a three-phase, full-wave bridge rectifier package which contains six diodes. The bridge converts the AC voltage generated in the stator to DC voltage output for battery charging and accessory operation.

Power to the field is provided by the field diode (or diode-trio) package contained in the alternator.

The alternator produces a rated output of 62 amps at 6000 alternator RPM and 75 degrees F. (23.8 degrees C.) ambient temperature. To ensure proper cooling of the rectifier bridge and internal components, the alternator must be used with the proper cooling fan.

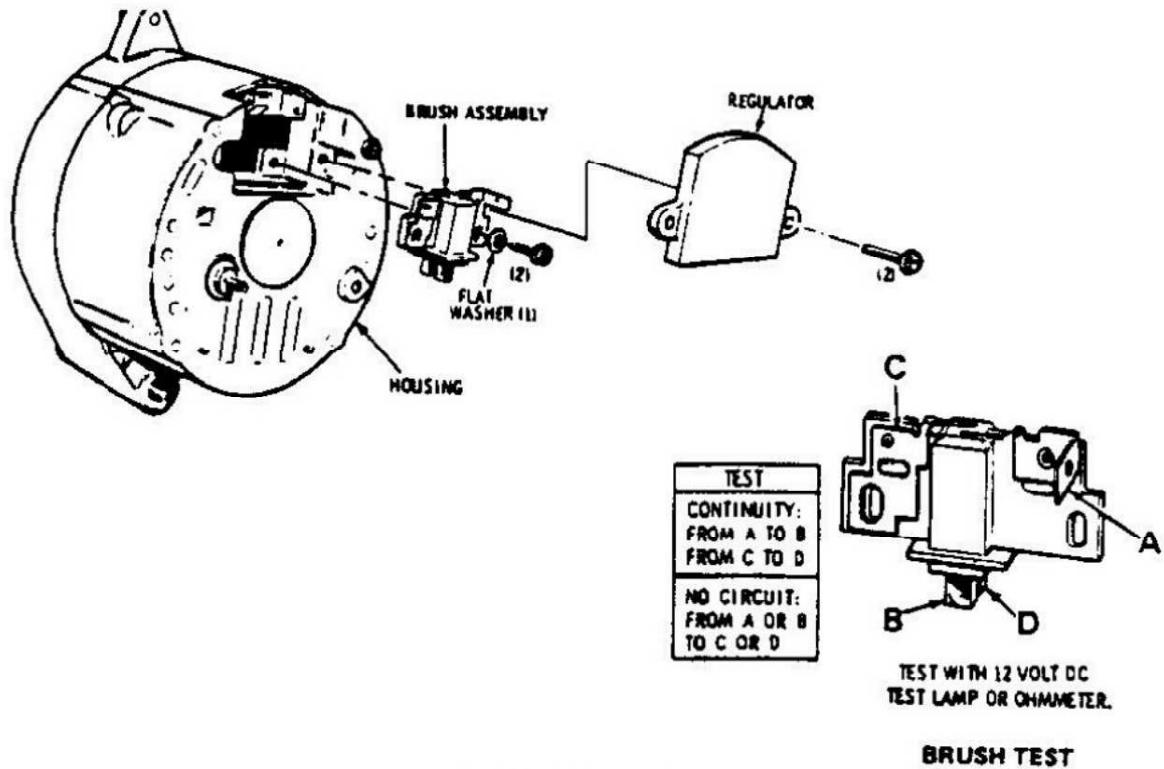
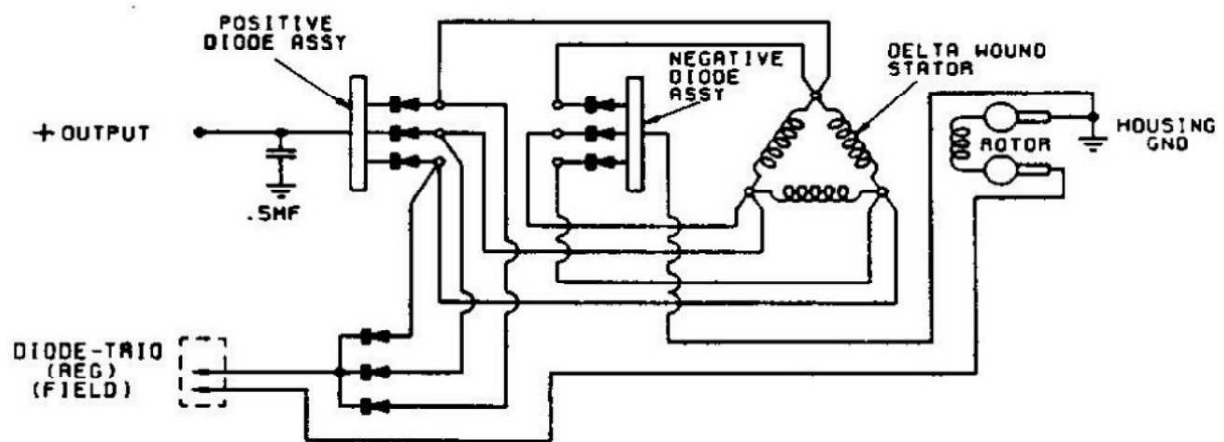
A feature of the Motorola alternator is its ease of serviceability. With the removal of only four machine screws both the integral voltage regulator (2 screws) and the brush and holder assembly (2 screws) can be removed for testing and/or replacement without removing the alternator from the truck.

Motorola Alternator Maintenance

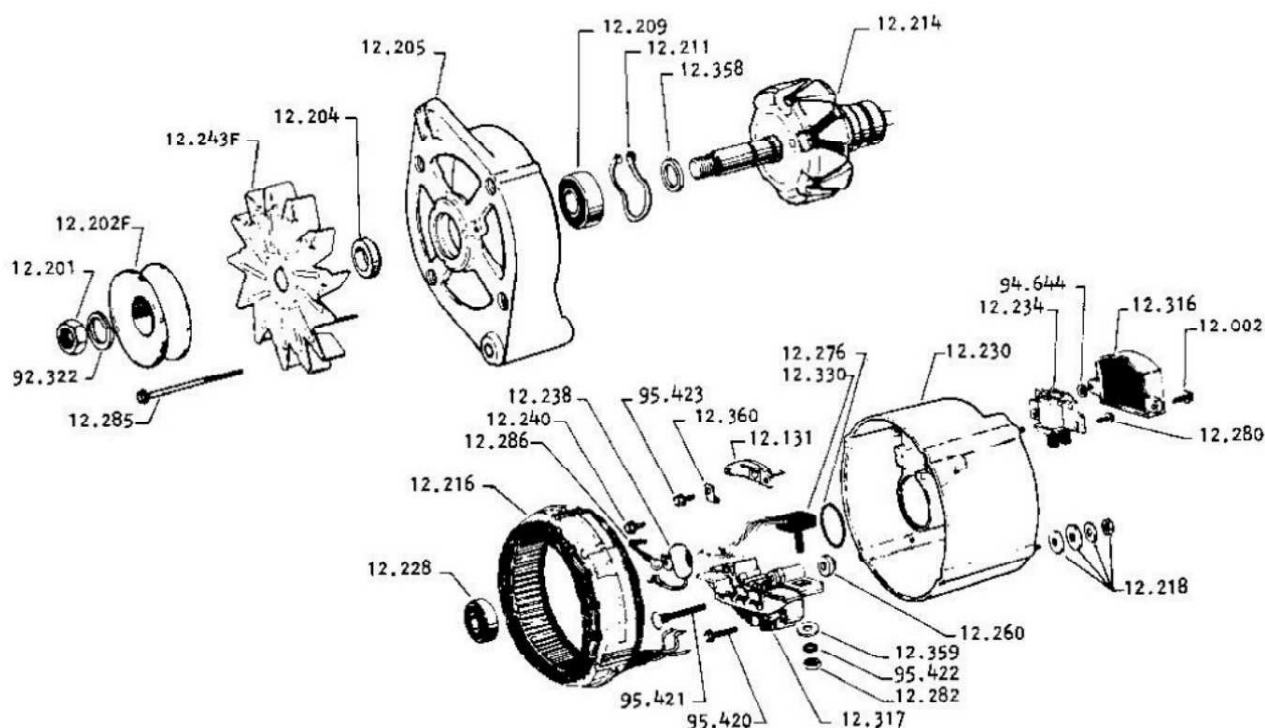
- The alternator assembly requires no periodic adjustments or maintenance of any kind.
- The alternator rotor bearings contain a supply of lubricant sufficient to eliminate the need for periodic lubrication.
- The regulator voltage setting never needs adjusting. Consequently, no provision for adjustment is provided.

Voltage Regulator and Brush Assembly Removal

1. Remove the two regulator mounting screws, then pull the regulator straight back to unplug unit. It may be necessary to insert a screwdriver between the regulator cover and rear housing to facilitate separation.
2. Remove the two brush assembly mounting screws and then the brush assembly. Note the use of a flat washer under the right side mounting screw.
3. Test brushes with a 12 volt DC test lamp or ohmmeter.



Motorola 9DB Alternator



ASSEMBLY COMPLETE
DOES NOT INCLUDE
ITEMS MARKED "F"

12.200

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12.200	ALTERNATOR ASSEMBLY	12.276	RETAINER, REAR BEARING
12.002	FASTENER, ALTERNATOR VOLTAGE REGULATOR	12.280	FASTENER, BRUSH HOLDER
12.131	TERMINAL ALTERNATOR REGULATOR	12.282	FASTENER, DIODE TRIO
12.201	FASTENER, ALTERNATOR PULLEY	12.285	FASTENER, ALTERNATOR THROUGH
12.202	PULLEY-ALTERNATOR	12.286	TERMINAL, STATOR LEAD
12.204	SPACER, FAN AND PULLEY	12.316	REGULATOR, ALTERNATOR VOLTAGE OUTPUT
12.205	FRAME, ALTERNATOR DRIVE END	12.317	RECTIFIER BRIDGE ASSEMBLY
12.209	BEARING, ALTERNATOR DRIVE END	12.330	DIODE TRIO
12.211	RETAINER, ALTERNATOR DRIVE END BEARING	12.358	SPACER, ALTERNATOR ROTOR
12.214	ROTOR ASSEMBLY, ALTERNATOR	12.359	INSULATOR, DIODE TRIO
12.216	STATOR ASSEMBLY, ALTERNATOR	12.360	CLIP, DIODE TRIO WIRE
12.218	TERMINAL PACKAGE, ALTERNATOR BATTERY	12.382	FASTENER, DIODE TRIO
12.228	BEARING, ALTERNATOR REAR FRAME	92.322	LOCKWASHER, ALTERNATOR PULLEY FASTENER
12.230	FRAME, ALTERNATOR REAR	94.644	FASTENER, ALTERNATOR BRUSH HOUSING
12.234	BRUSH AND BRUSH HOLDER ASSEMBLY	95.420	FASTENER, RECTIFIER
12.238	CAPACITOR, ALTERNATOR	95.421	FASTENER, RECTIFIER
12.240	FASTENER, CAPACITOR MOUNTING	95.422	LOCKWASHER, DIODE TRIO FASTENER
12.243	FAN, ALTERNATOR	95.423	FASTENER, ALTERNATOR REGULATOR TERMINAL
12.260	INSULATOR, RECTIFIER		

Alternator Maintenance Precautions

Precautions to be observed when testing or servicing the alternator system:

- Disconnect the battery before connecting or disconnecting test instruments (except voltmeter) or before removing or replacing any unit or wiring. Accidental grounding or shorting at the regulator, alternator, ammeter or accessories, will cause severe damage to the units and/or wiring.
- Always follow the manufacturer's instructions for the test instrument being used when making connections and tests on electrical circuits.
- To avoid damage to the regulator, do not at any time connect the battery to the regulator field terminal.
- Never ground the field circuit between the alternator and the regulator on this system, as this will damage the regulator.
- Never ground the alternator output terminal as this may damage the alternator and/or circuit and components.
- Do not attempt to polarize the alternator. Any attempt to do so may result in damage to the alternator, regulator, or circuits.
- Do not short across or ground any of the terminals on the alternator or in the charging circuit, except as specifically instructed in a troubleshooting procedure.
- Do not operate the alternator on open circuit with the rotor winding energized. Check all terminals for tight connections.
- Be sure the alternator and battery have the same polarity.
- Check battery polarity with a voltmeter before connecting the battery, as reversed battery connections may damage the rectifiers, wiring or other components of the charging system.
- When using a booster battery or a fast charger, be sure to correctly connect its polarity so as to prevent damage to the electrical system components. Connect positive to positive, negative to negative. Connect the negative cable connection last.

WARNING When connecting booster or charger cables to a battery, do not connect the negative cable connection to the battery, as this could cause an explosion. Connect the negative cable to the truck chassis, away from the battery.

Alternator Inspection

1. Inspect the terminals for corrosion and loose connections.
2. Inspect wiring for damaged or worn insulation.
3. Check mounting bolts for tightness.
4. Check the alternator drive belt for wear, correct alignment and correct tension.

Note When servicing the charging system, never remove a unit until tests have shown it to be defective.

Alternator Belt Inspection

1. Inspect fan belt and pulleys for damage.
2. Inspect fan belt for cracks.
3. Make sure the fan belt does not contact the bottom of pulley grooves.
4. Be sure there is no oil on the fan belt.
5. Clean or replace a fan belt that is worn, oily or damaged.
6. Adjust an improperly adjusted fan belt.

Note Pay particular attention to V-belt tension, as slipping belts cause many other problems in accessory drives as well as in the charging system. Low belt tension can induce slipping, causing excessive belt and pulley wear and overheating of the front alternator bearing.

A slipping belt will not drive the alternator to full output, eventually leading to battery discharge problems.

A belt which has been slipping will be glazed and cracked. Replace it. Excessive belt tension will create an overload condition in the alternator front bearing and in the water pump bearings.

Fan Belt Tension Specification

Adjust belt tension to the proper specifications.

1. Adjust the alternator in order to create proper fan belt tension.
2. Loosen the bolt at the alternator adjusting strap, tighten belt as required, and retighten bolt.

Note The belt should be adjusted so that the belt deflection on the long side is $\frac{1}{2}$ inch (13mm).