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ABOUT THIS MANUAL

This Component Technical Manual (CTM3) covers the recommended repair and adjustment procedures for the following engines:

- 3 and 4TN Series Diesel Engines used in John Deere Lawn and Grounds Care and small Industrial products.
- Series 220 Diesel Engines offered as OEM units. Three different configurations are available: Base industrial engine, industrial power unit or a generator drive unit.

Before beginning repair of an engine, clean the engine and mount on a repair stand.

This manual contains SI Metric units of measure, followed immediately by the U.S. customary units of measure.

Direction of engine crankshaft rotation in this manual is referenced facing the flywheel looking toward the water pump. Front of engine is water pump end.

Some components of this engine may be serviced without removing the engine from the machine. Refer to the specific machine technical manuals for information on components that can be serviced without removing the engine from the machine and for engine removal and installation procedures.

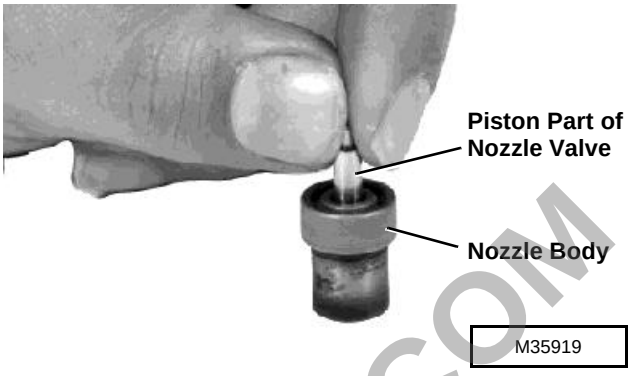
Read each story completely before performing service to check engine model differences in procedure or specifications.

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7. Further inspect the nozzle assembly by performing a slide test. Use the following procedure:
   - Dip the nozzle valve in clean diesel fuel. Insert valve in nozzle body.
   - Hold nozzle vertical, and pull valve out about 1/3 of its engaged length.
   - Release valve. Valve should slide down to its seat by its own weight.

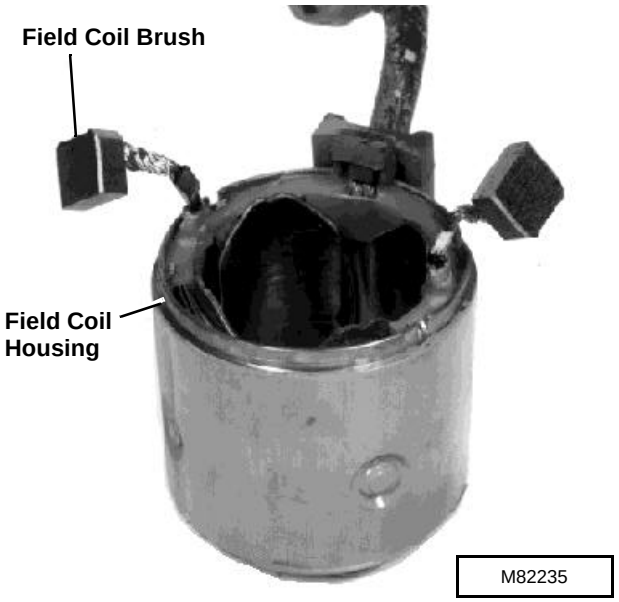
Replace nozzle assembly if the valve does not slide freely to its seat.



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3

IMPORTANT: Do not clean armature with solvent. Solvent can damage insulation on windings. Use only mineral spirits and a brush.

6. Inspect armature. Look for signs of dragging against pole shoes.

7. Inspect commutator. Look for roughness, burned bars, or any material which might cause short circuits between bars. If necessary, clean and touch up with 400 sandpaper. NEVER use emery cloth. Clean all dust from armature when finished.

NOTE: Test armature windings using an ohmmeter or test light.

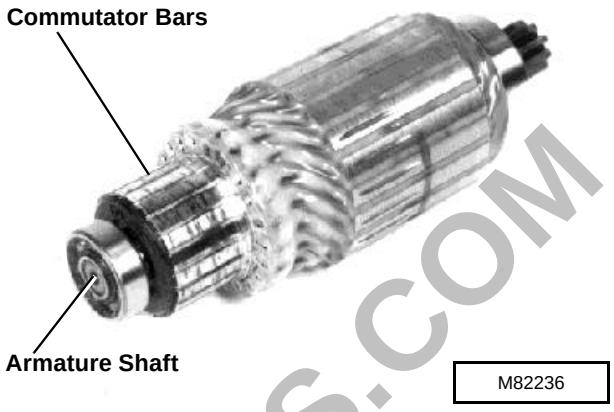
8. Test for grounded windings:

Touch probes on one commutator bar and armature shaft. Armature windings are connected in series, so only one commutator bar needs to be checked.

If test shows continuity, a winding is grounded and the armature must be replaced.

9. Test for open circuited windings:

Touch probes on two different commutator bars. If test shows no continuity, there is an open circuit and the armature must be replaced.

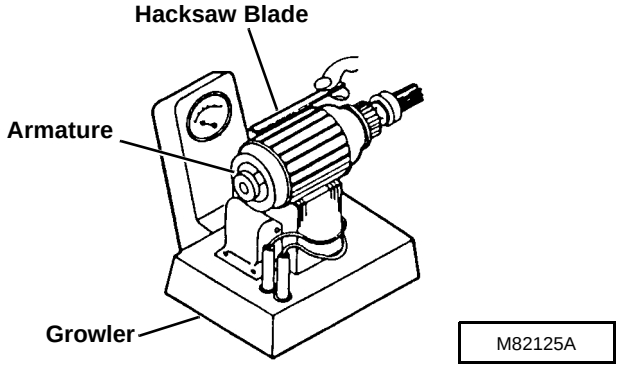


10. Test for short circuited windings using a growler. Put armature in a growler and hold a hacksaw blade above each slot while slowly rotating armature.

If coil is shorted, the blade will vibrate on the slot.

NOTE: A short circuit most often occurs because of copper dust or filings between two commutator segments.

11. If test indicates short circuited windings, clean the commutator of dust and filings. Check the armature again. If the test still indicates a short circuit, replace the armature.



12. Inspect armature cover and housing bearings for wear or damage. Replace if necessary.

To replace bearings:

Bearings are press fit. Remove bearings using a knife-edge puller set.

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PISTON AND CONNECTING ROD

Removal

1. Remove oil pan and strainer tube. (See *Lubrication System* in this section.)
2. Remove cylinder head. (See *Cylinder Head, Valves and Manifolds* in this section.)
3. Check cylinder bore for ridges. These ridges can cause damage to piston if ridge is not removed.
4. If necessary, remove ridge from top of cylinder bore using a ridge reamer.
5. Measure connecting rod side play. (See *Checks, Tests and Adjustments* in this section.)
6. Measure connecting rod bearing clearance. (See *Checks, Tests and Adjustments* in this section.)

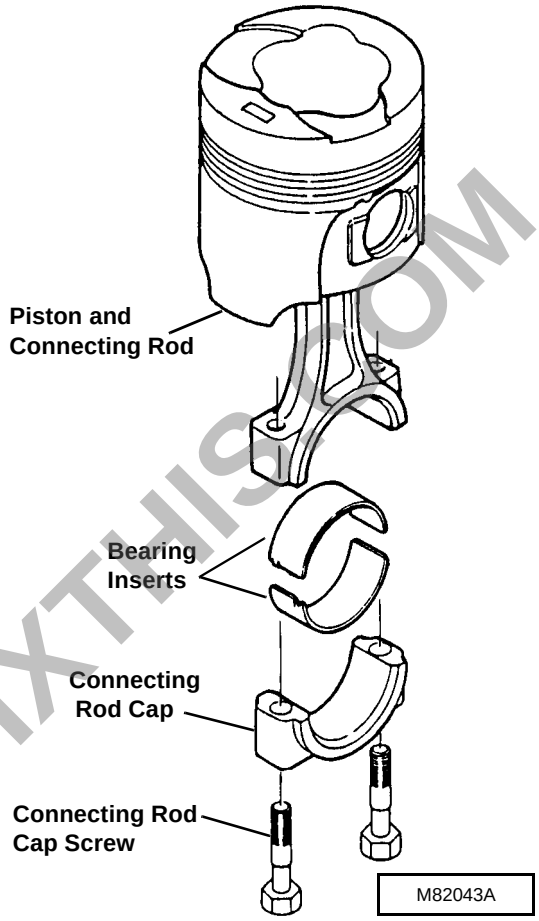
IMPORTANT: Keep connecting rods and caps together. Rods and caps are a matched set. Note alignment marks on each part.

4

7. Remove two cap screws, connecting rod cap and bearing inserts.

IMPORTANT: Pistons and cylinders are matched. Pistons must be installed in the cylinders from which they are removed.

8. Note connecting rod alignment mark in relation to the cylinders. Starting at flywheel end with cylinder number one, then two, etc.
9. Push piston and connecting rod out of cylinder bore using a wooden dowl.
10. Disassemble and inspect all parts for wear or damage. (See *Disassembly* and *Inspection/ Replacement* procedures.)



Installation

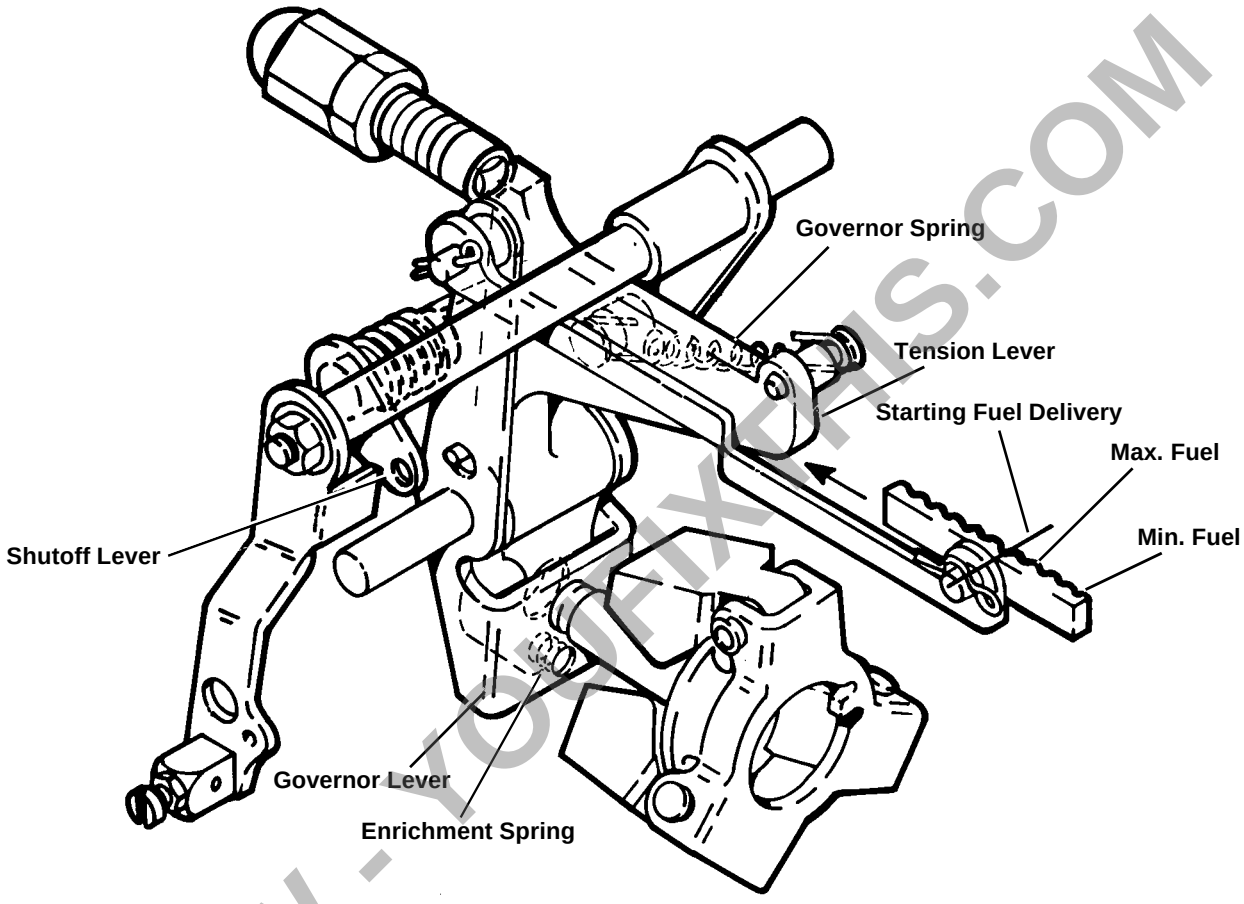
- Apply clean engine oil on all parts during installation.
- Never reuse connecting rod cap screws, Replace with new.

IMPORTANT: Pistons must be installed in cylinders from which they were removed and in the same direction. Be careful not to damage crankshaft rod journal while installing piston.

1. If new piston rings were installed, deglaze cylinder bore. (See procedure in this group.)
2. Install piston and connecting rod into the cylinder from which it was removed, with piston size mark on top of piston toward camshaft.

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GOVERNOR OPERATION - STARTING

M48495

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Assembly

1. Install bearing shaft into pump housing, long end down, using a piece of pipe or deep socket and a press. Press shaft into pump housing until bearing surface is flush with pump housing surface.
2. Install new shaft seal over impeller side of bearing shaft, rubber seal side away from pump housing. Push shaft seal into pump housing, until it stops, using a 25 mm or 1 in. socket and a press.

IMPORTANT: Support pump housing on bearing shaft only. DO NOT support on housing or damage to housing will occur.

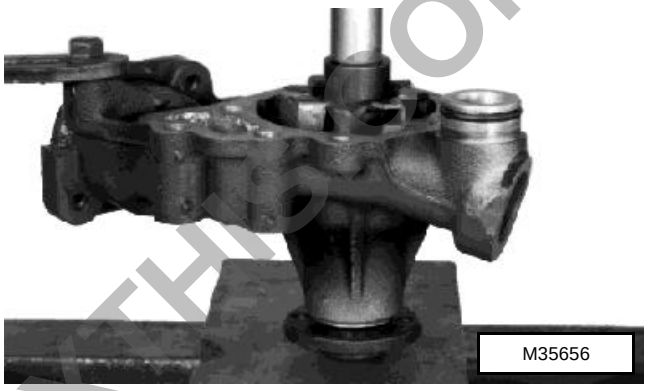
3. Place water pump housing on a press table. Support housing on bearing shaft using a driver disk. Install pulley flange onto shaft with straight hub facing away from housing.

   Press pulley flange onto bearing shaft until flange is flush with end of shaft.

IMPORTANT: DO NOT touch lapped sealing surface of ceramic seal with bare hands. It must be clean and dry.

4. Install seal cup and ceramic seal in impeller.
5. Install a knife-edge puller around bearing shaft, between pulley flange and pump housing. Place pump housing, with knife-edge puller down, on a press table. Install impeller with ceramic seal toward shaft seal.

   Press impeller on bearing shaft until top of impeller is even with end of shaft.



6. Install new gasket, plate and six screws. Tighten to specifications.
7. Install coolant temperature sensor. (See procedure in this group.)
8. Install thermostat. (See procedure in this group.)

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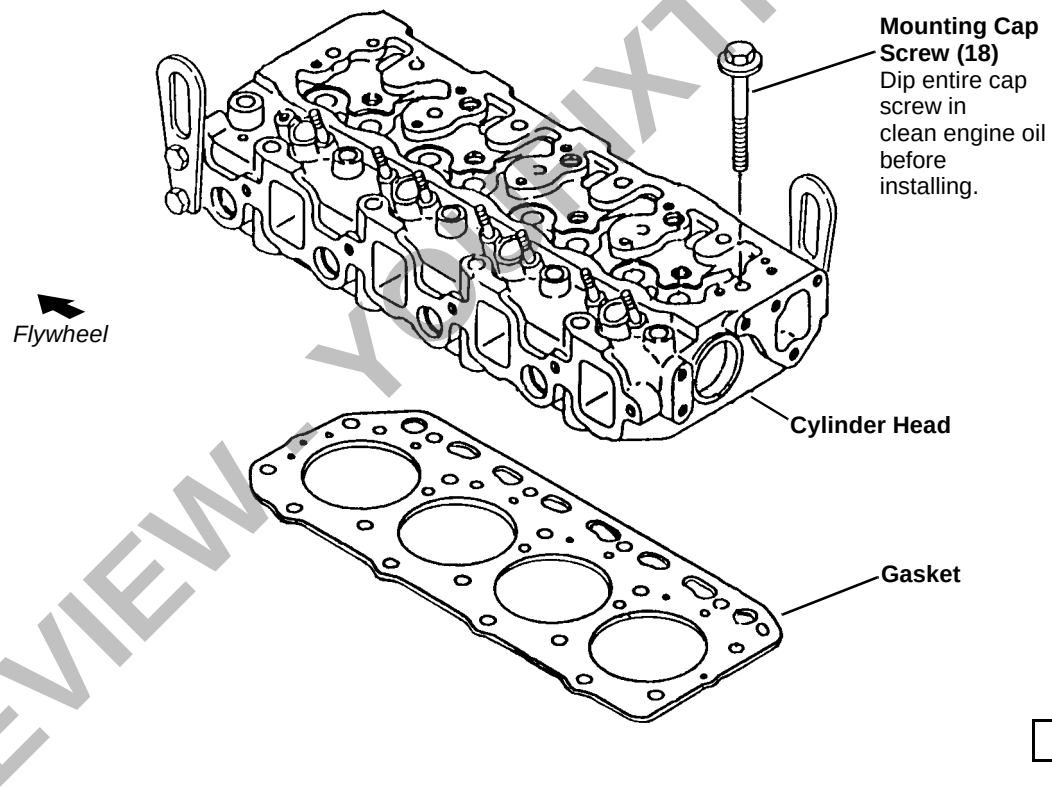
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CYLINDER HEAD AND VALVES

Removal/Installation

1. Remove rocker arm assembly, push rods and valve caps. (See procedure in this group.)
2. Remove exhaust and intake manifolds. (See procedures in this group.)
3. Remove water pump. (See *Cooling System* in this section.)
4. Remove fuel injection nozzles. (See *Fuel System* in this section.)
5. Disassemble and inspect cylinder head and valves. (See *Disassembly/ Assembly and Inspection/Replacement* procedures.)

IMPORTANT: Oil passage in gasket must be located over oil passage in cylinder block.



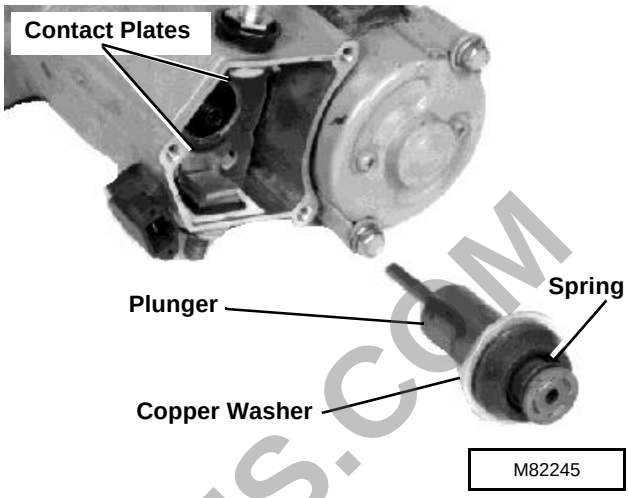
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Assembly

Assembly is done in the reverse order of disassembly.

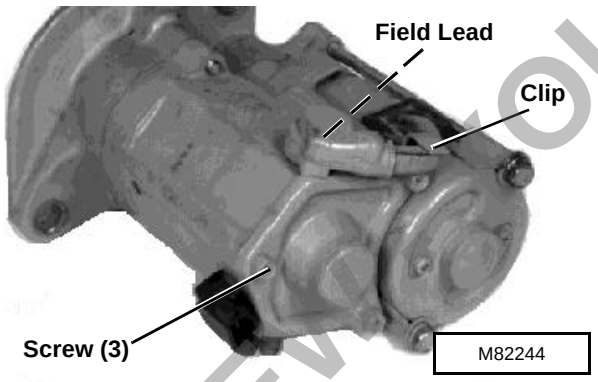
- Apply multipurpose grease to bearings, clutch shaft, springs, pinion gears, retainer, rollers and steel ball.
- Install large washer with flat side toward clutch assembly.
- Install retainer with cupped side away from clutch assembly.



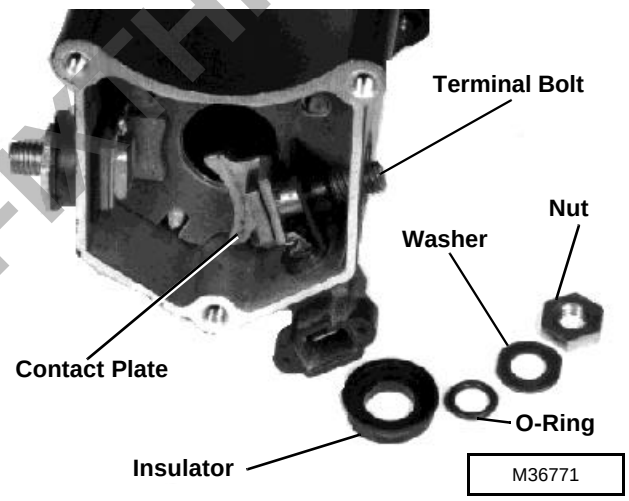
STARTER SOLENOID - NIPPONDENSO 1.0 kW

Disassembly/Inspection

1. Disconnect field lead.
2. Remove three screws and clip.
3. Remove cover and gasket.



4. Remove plunger.
5. Disassemble terminals. Remove parts from each terminal in order shown.
6. Inspect copper washer and contact plates for excessive burning or pitting. Clean burnt areas to improve electrical contact. Replace contacts or plunger if necessary. The solenoid is not serviceable. If defective, replace solenoid housing assembly.



Assembly

Assembly is done in the reverse order of disassembly.

NOTE: The assembly sequence of the left and right terminals is similar. Be sure solenoid terminal lead is installed between terminal bolt and contact plate. Also, be sure smaller contact plate is on the left side.

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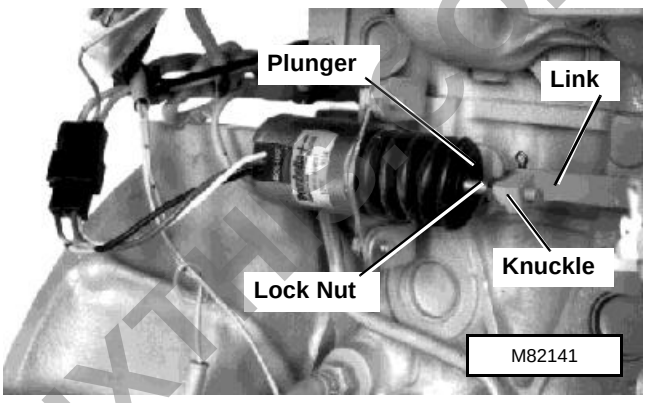
FUEL SHUTOFF SOLENOID ADJUSTMENT

Reason:

To ensure that fuel shutoff solenoid retracts fully, moving the injection pump shutoff control lever far enough to allow full rack travel.

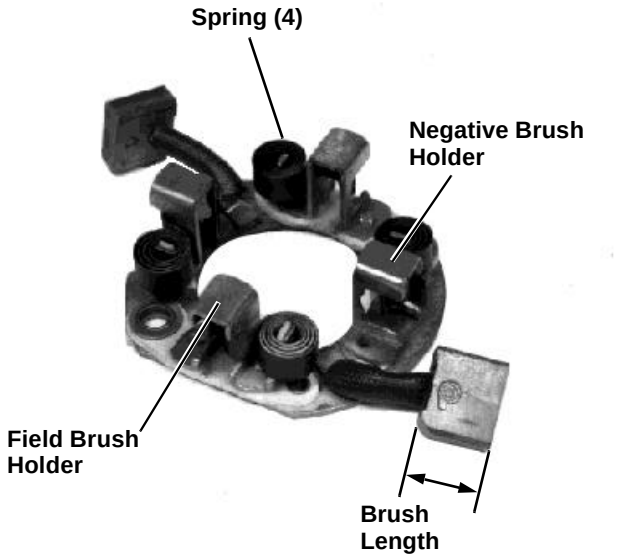
Procedure:

1. Loosen lock nut.
2. Disconnect link from solenoid.
3. Hold solenoid plunger bottomed in solenoid body.
4. Move link toward solenoid until it stops
5. Turn plunger rod in or out of knuckle until knuckle and link holes line up. Turn out two additional turns. The additional turns insure that the solenoid bottoms out before the linkage.
6. Assemble and check for free movement when key switch is turned ON. Also check that linkage returns completely to the STOP position when key switch is turned OFF.



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NOTE: Test field coil using an ohmmeter or test light.

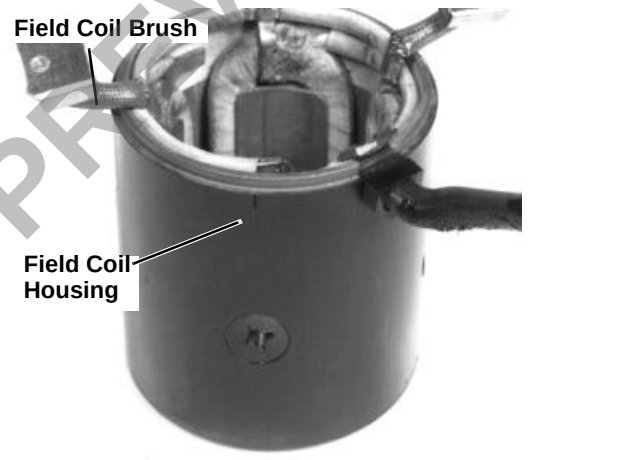
4. Inspect springs for wear or damage. Replace if necessary.

5. Test for grounded field winding:

Touch one probe of tester to field coil brush and other probe to field coil housing. Be sure the brush lead is not touching the frame. If there is continuity, the coil is grounded and the field coil housing assembly must be replaced.

6. Test for open field coil:

Touch one probe of tester to each field coil brush. If there is no continuity, the field coil is open and the field coil housing assembly must be replaced.



IMPORTANT: Do not clean armature with solvent. Solvent can damage insulation on windings. Use only mineral spirits and a brush.

7. Inspect armature. Look for signs of dragging against pole shoes.

8. Inspect commutator. Look for roughness, burned bars, or any material which might cause short circuits between bars. If necessary, clean and touch up with 400 sandpaper. NEVER use emery cloth. Clean all dust from armature when finished.

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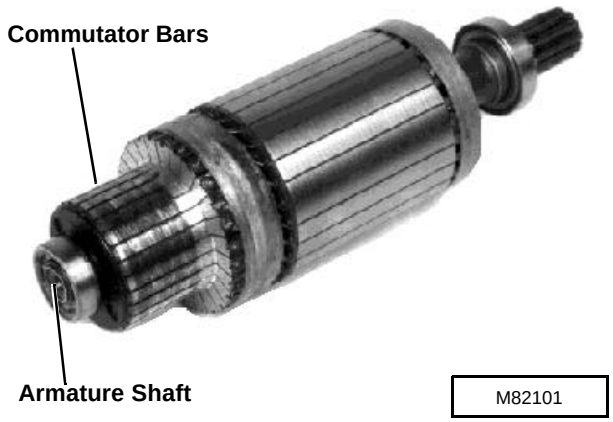
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If test shows continuity, a winding is grounded and the armature must be replaced.

10. Test for open circuited windings:

Touch probes on two different commutator bars. If test shows no continuity, there is an open circuit and the armature must be replaced.

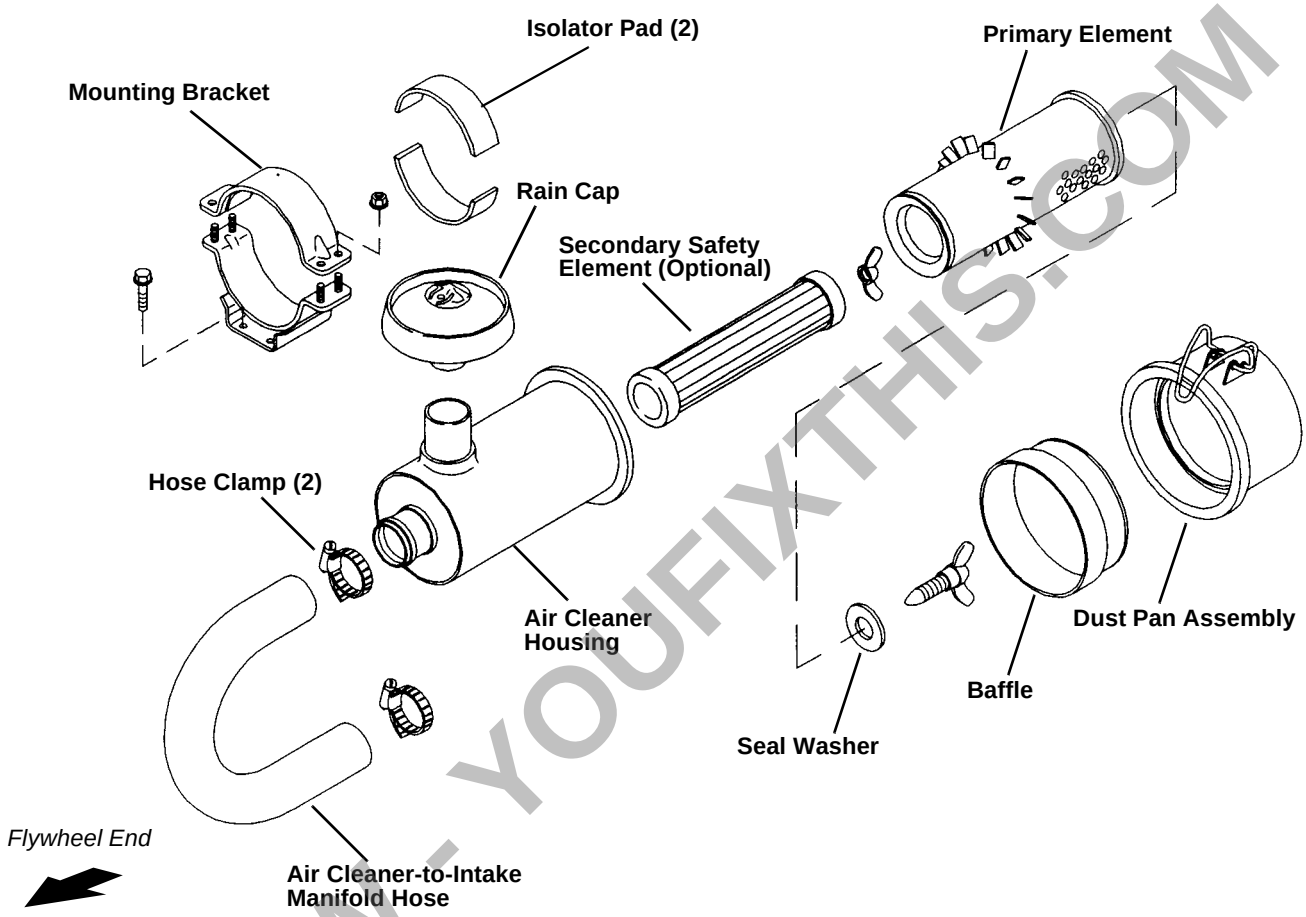


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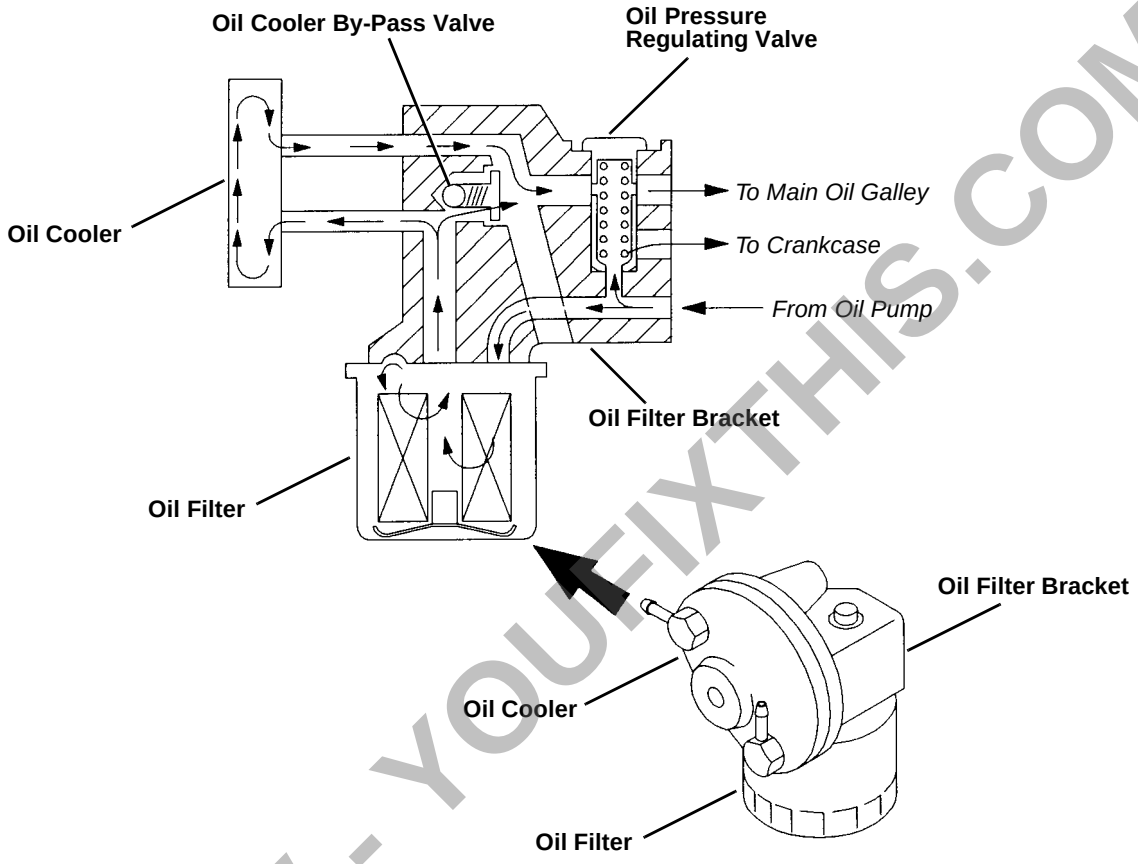
AIR CLEANER - 3011(3TNC78), 3014 (3TN84) AND 4019D (4TN84)

Inspection



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OIL COOLER OPERATION - 3TN84UJ, 4TN78T, 4TN84T (4019T) AND 4TN100

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