

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

Stanadyne (Roosa-Master) 9.5 millimeter Injection Nozzle Specifications (20505-AR68364)

GENERAL INFORMATION

Number of orifices 4

Orifice size 0.012 in.
(0.30 mm)

NOZZLE SETTINGS

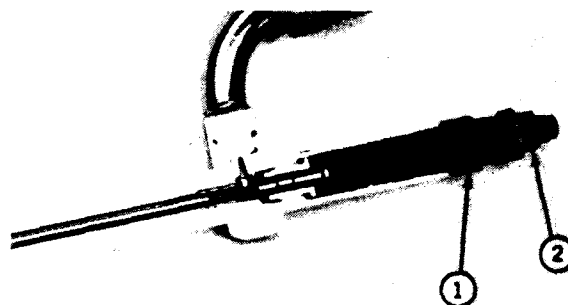
Nozzle opening
pressure (new) 3150 to 3250 psi
(217 to 224 bar) (221 to 228 kg/cm²)

Nozzle opening
pressure (used) 2950 to 3050 psi
(203 to 210 bar) (207 to 214 kg/cm²)

Return oil leakage 3 to 10 drops per 30
seconds at 1500 psi
(103 bar) (105 kg/cm²)
from first drop (service only)

Nozzle valve lift $1/2 \pm 1/8$ turn from bottom
(0.009 in. [0.23 mm]
nominal)

- 1 - Pressure adjusting screw-to-nozzle body lock nut
torque 70 to 80 lb-in
(7.9 to 9.0 Nm) (0.81 to 0.92 kg-m)
- 2 - Lift adjusting screw
lock nut torque 35 to 45 lb-in
(4.0 to 5.1 Nm) (0.40 to 0.52 kg-m)



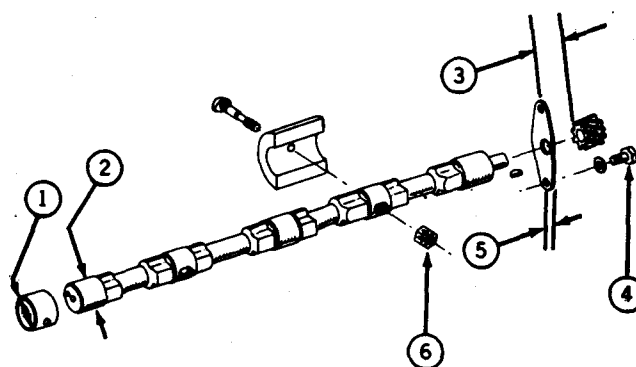
T53899NY

Fig. 77-Injection Nozzle Torque

ENGINE BALANCER (0415)

SPECIFICATIONS AND TORQUE VALUES

- 4
- 1 - Bushing inside diameter (new) 1.502 to 1.504 inch (38.15 to 38.20 mm)
 - 2 - Shaft journals outside diameter (new) 1.500 to 1.501 inch (38.10 to 38.13 mm)
 - 3 - Clearance between thrust plate and gear (new) 0.002 to 0.010 inch (0.05 to 0.25 mm)
 - 4 - Thrust plate to engine front plate cap screw torque 35 lb-ft (47 Nm) (5 kg-m)
 - 5 - Thrust plate thickness (new) 0.117 to 0.119 inch (2.97 to 3.02 mm)
 - 6 - Weight lock nut torque 43 lb-ft (58 Nm) (6 kg-m)



T53951N

Fig. 78-Engine Balancer Specifications

TURBOCHARGER (0416)

SPECIFICATIONS AND TORQUE VALUES

- 1 - Radial bearing movement 0.003 to 0.006 in
(0.08 to 0.15 mm)
 - 2 - Rotating assembly axial
movement 0.001 to 0.004 in.
(0.03 to 0.10 mm)
 - 3 - Impeller nut torque 18 to 20 lb-in
(2.0 to 2.3 Nm) (0.21 to 0.23 kg/m)
 - 4 - Lock plate bolts torque 40 to 60 lb-in
(4.5 to 6.8 Nm) (0.46 to 0.69 kg/m)
 - 5 - Turbine housing to center
housing nut torque 100 to 130 lb-in
(11.3 to 14.7 Nm) (1.15 to 1.50 kg/m)
- Exhaust adapter
end play 0.03 inch
(0.8 mm)

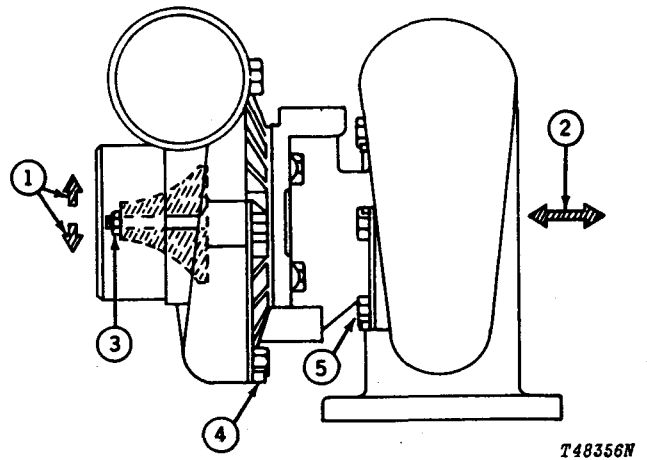


Fig. 80-Turbocharger Specifications

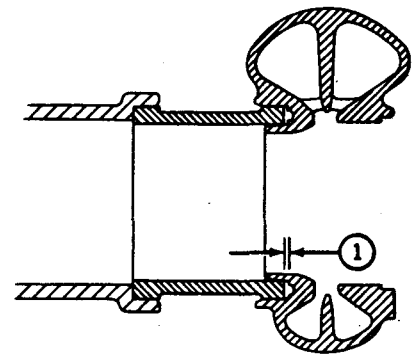


Fig. 81-Exhaust Adapter End Play

WATER PUMP (0417)

SPECIFICATIONS AND TORQUE VALUES

Rear Cover Cap
Screw Torque (1, Fig. 82)

35 lb-ft
(47 Nm) (5 kg-m)

Impeller position:

4 Engine	Pump Code	Distance
3-164D and 4-219D	2001 (3) (Fig. 82)	0.000 to 0.010 inch (0.00 to 0.25 mm)
	2002 (3)	0.000 to 0.010 inch (0.00 to 0.25 mm)
	2004 (3)	0.000 to 0.010 inch (0.00 to 0.25 mm)
	2005 (3)	0.000 to 0.010 inch (0.00 to 0.25 mm)
4-276D	2001 (3)	0.000 to 0.010 inch (0.00 to 0.25 mm)
4-276T	2001 (2)	0.015 to 0.035 inch (0.38 to 0.89 mm)
6-329D	2001 (3)	0.000 to 0.010 inch (0.00 to 0.25 mm)
	2004	
6-414D and 6-414T	2001 (2)	0.015 to 0.035 inch (0.38 to 0.89 mm)

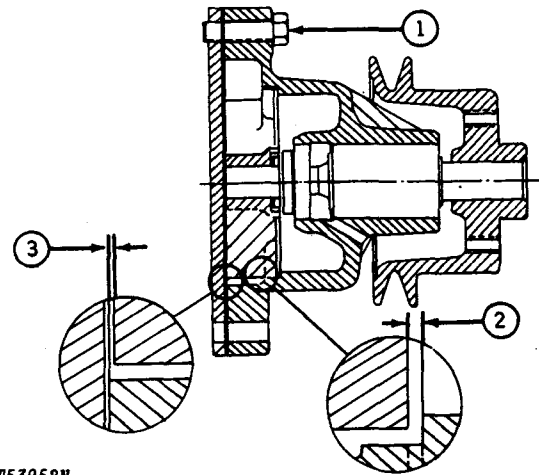


Fig. 82-Water Pump Specifications

WATER PUMP (0417)

SPECIFICATIONS AND TORQUE VALUES—Continued

Water Pump Pulley Position:

Engine	Pump Code	Distance
3-164D and 4-219D	2001 (2)	
	2002	
	2004 (1)	5.47 inch (138.9 mm)
	2005	
4-276D	2001	
4-276T	2001 (1)	6.38 inch (162.1 mm)
6-329D	2001	
	2004	
6-414D and 6-414T	2001 (1)	6.38 inch (162.1 mm)

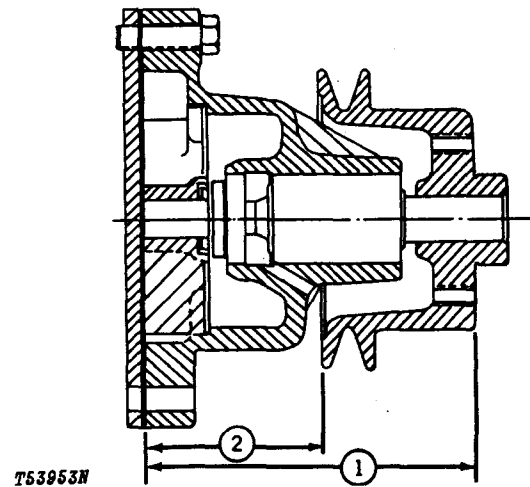


Fig. 83-Water Pump Specifications

THERMOSTATS, HOUSINGS AND WATER PIPING (0418)**SPECIFICATIONS AND TORQUE VALUES**

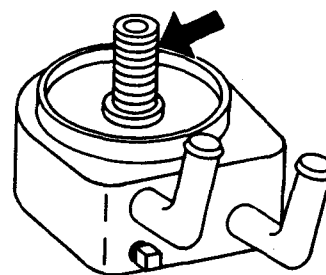
Thermostat test temperature:

Engine	Code	Full Open Temperature	Opening Temperature
4 3-164 and 4-219	2201	183°F (84°C)	156 to 163°F (69 to 73°C)
	2202	212°F (100°C)	189 to 197°F (87 to 92°C)
	2203	213°F (101°C)	201 to 207°F (94 to 97°C)
	2204	203°F (95°C)	176 to 183°F (80 to 84°C)
4-276	2204	203°F (95°C)	176 to 182°F (80 to 83°C)
6-329		200°F (93°C)	180 to 195°F (82 to 91°C)
6-414	2204	203°F (95°C)	176 to 182°F (80 to 83°C)

OIL COOLER (0419)

SPECIFICATIONS AND TORQUE VALUES

Oil cooler nipple
torque 20 to 25 lb-ft
(27 to 34 Nm) (3 to 3.5 kg-m)

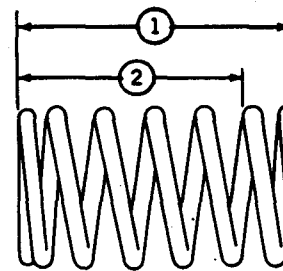


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Fig. 84-Oil Cooler Nipple Torque

Oil cooler-bypass
valve spring
Free length (approx.) 2.60 in.
(66.04 mm)
Test length 1.91 in.
(48.5 mm)
when compressed with 29.5 to 36.5 lb.
(131 to 162 N) (13 to 17 kg)



T50940N.

Fig. 85-Oil Cooler By-pass Valve Spring Length

STARTING MOTOR AND FASTENINGS (0422)

SPECIFICATIONS AND TORQUE VALUES

John Deere Starting Motor

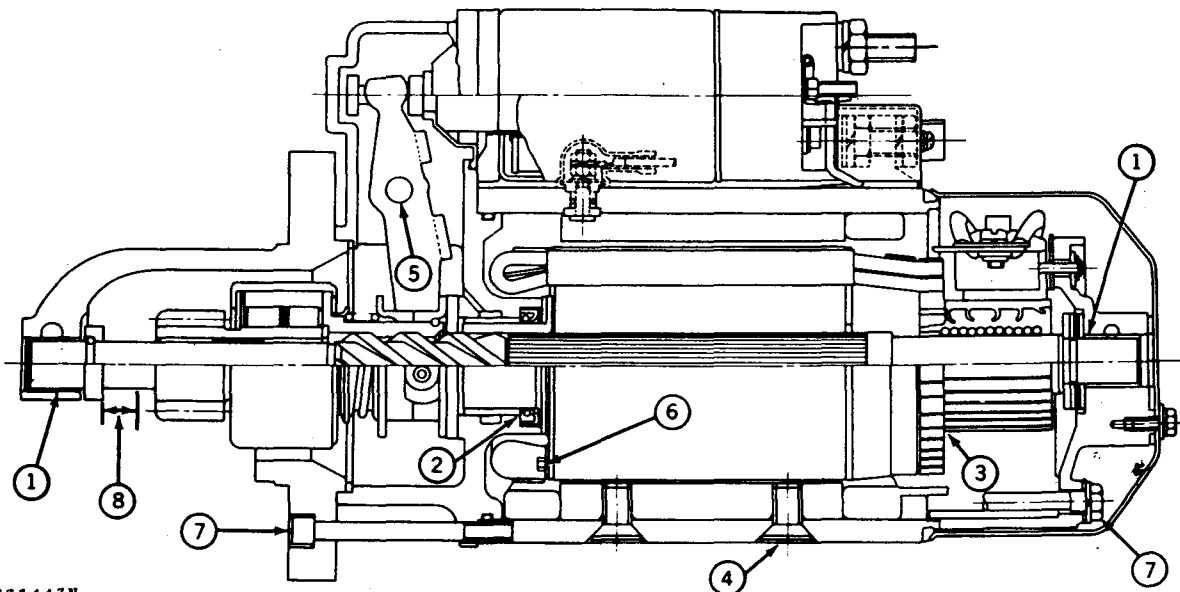
No Load Test (Before Disassembly)

Current draw 70 to 110 amp at 9.0 volts
Armature speed 2500 to 4500 rpm

Solenoid Pull-In Test 8 volts or less
Solenoid Return Test 12 volts

No Load Test (After Assembly)

Battery 12-volt-reserve capacity 290 minutes
Speed 3100 rpm min.
Voltage 11.7 volts
Current Draw 110 amps max.



T31443N

Fig. 86-Starting Motor

Starting Motor

- 1 - Commutator and drive housing bushing I.D. 0.6693 to 0.6704 in.
(17.000 to 17.028 mm)
Wear tolerance (maximum) 0.6740 in.
(17.120 mm)
Oil clearance 0.0036 to 0.0070 in.
(0.091 to 0.178 mm)
Wear tolerance (additional) 0.016 in.
(0.41 mm)
Depth 0.008 to 0.022 in..
(0.20 to 0.56 mm)

STARTING MOTOR AND FASTENINGS (0422)**SPECIFICATIONS AND TORQUE VALUES—Continued**

- 2 - Center housing bushing
(Fig. 86) I.D. 1.182 to 1.184 in.
(30.02 to 30.07 mm)
Wear tolerance (maximum) 1.189 in.
(30.20 mm)
Oil clearance wear
tolerance 0.0236 in.
(0.600 mm)
Depth 0.017 to 0.037 in.
(0.43 to 0.94 mm)
- 3 - Armature (Fig. 86)
Armature runout 0.006 in.
(0.15 mm)
Commutator runout 0.016 in.
(0.41 mm)
Commutator minimum undercut 0.008 in.
(0.20 mm)
Commutator O.D. 1.77 in.
(44.9 mm)
- 4 - Torque—pole shoe screws
(Fig. 86) 30 lb-ft
(41 Nm) (4 kg-m)
- 5 - Torque—shift lever pivot
screw (Fig. 86) 30 lb-ft
(41 Nm) (4 kg-m)
- 6 - Torque—center bearing
housing to field frame
(Fig. 86) 6 lb-ft
(8 Nm) (0.8 kg-m)
- 7 - Torque—commutator frame and
drive housing (Fig. 86) 10 lb-ft
(14 Nm) (1 kg-m)
- 8 - Clearance between pinion
and pinion stop (Fig. 86) 0.012 to 0.185 in.
(0.30 to 4.70 mm)

STARTING MOTOR AND FASTENINGS (0422)**SPECIFICATIONS AND SPECIAL TOOLS—Continued**

1 - Brush minimum length 5/8 in.
(15.88 mm)

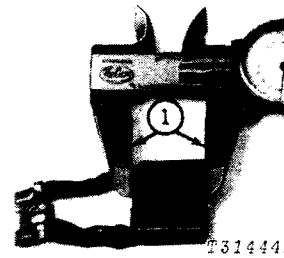


Fig. 87-Brush Length

Brush spring minimum
tension 40 oz.
(11 N) (1.1 kg)

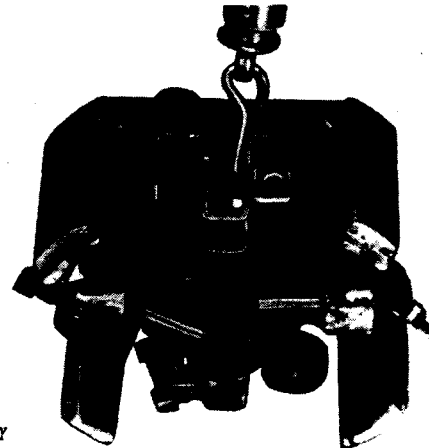


Fig. 88-Brush Spring Tension

Delco Remy Starting Motor No Load Test

Motor No.	Test Volts	Min. Amps	Max. Amps	Min. rpm	Max. rpm
1109251	9	20*	120*	9000	14000
1107871	9	40*	140*	8000	13000
1114381	9	124*	185*	4700	7600

*Includes Solenoid

STARTING MOTOR AND FASTENINGS (0422)

SPECIFICATIONS AND TORQUE VALUES—Continued

- 1 - Brush spring minimum tension 35 oz.
(10 N) (1.0 kg)



Fig. 89-Brush Spring Tension

- 1 - Brush minimum length beyond holder . 5/16 in.
(7.938 mm)

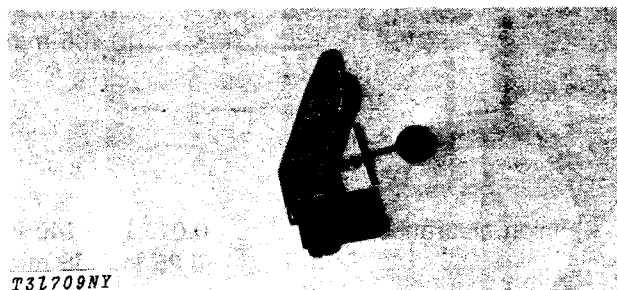


Fig. 90-Brush Length

- 1 - Drive housing bushing
I.D. 0.4990 to 0.5010 in.
(12.675 to 12.725 mm)
Wear tolerance 0.511 in.
(12.98 mm)
Oil clearance 0.0020 to 0.0050 in.
(0.051 to 0.127 mm)
Wear tolerance 0.0170 in.
(0.432 mm)
- 2 - Overrunning clutch housing
I.D. 0.5620 to 0.5630 in.
(14.275 to 14.300 mm)
Wear tolerance 0.5740 in.
(14.580 mm)

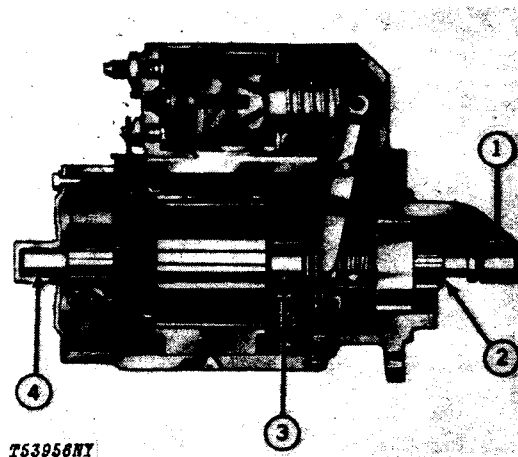


Fig. 91-Starting Motor

STARTING MOTOR AND FASTENINGS (0422)

SPECIFICATIONS AND TORQUE VALUES—Continued

3 - Center bearing bushing

I.D. 0.7600 to 0.7620 in.
(19.304 to 19.355 mm)

Wear tolerance 0.7720 in.
(19.609 mm)

Oil clearance 0.0100 to 0.0150 in.
(0.254 to 0.381 mm)

Wear tolerance 0.0250 in.
(0.635 mm)

4 - Commutator end frame bushing

I.D. 0.5625 to 0.5635 in.
(14.288 to 14.313 mm)

Wear tolerance 0.5730 in.
(14.554 mm)

Oil clearance 0.0020 to 0.0050 in.
(0.051 to 0.127 mm)

Wear tolerance 0.0160 in.
(0.406 mm)

1 - Pinion clearance 0.010 to 0.140 in.
(0.25 to 3.56 mm)

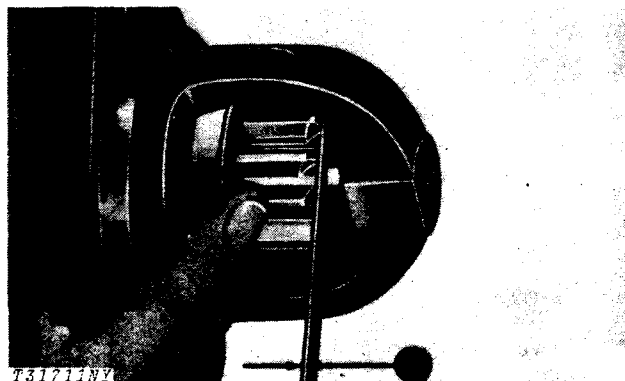


Fig. 92-Pinion Clearance

FAN DRIVE (0429)

SPECIFICATIONS AND TORQUE VALUES

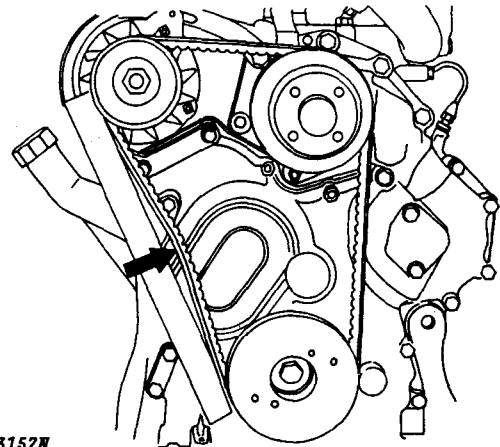
Fan drive belt tension:

With gauge (initial) 100 to 110 lb.
(445 to 490 N) (45 to 50 kg)

With gauge
(after 3 minutes operation) 80 lb.
(356 N) (36 kg)

without gauge 20 lb.
(89 N) (9 kg)

with belt flexed 0.75 inch
(19 mm)



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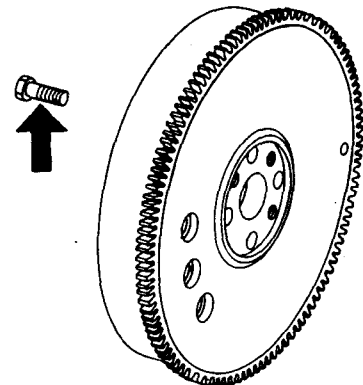
Fig. 93-Fan Drive Belt Tension

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FLYWHEEL, HOUSING AND FASTENINGS (0433)

SPECIFICATIONS AND TORQUE VALUES

Flywheel attaching
cap screw torque 120 lb-ft
(163 Nm) (17 kg-m)



T53958N

Fig. 94-Flywheel Attaching Cap Screws

ENGINE REMOVAL AND INSTALLATION (0400)

SPECIAL TOOLS

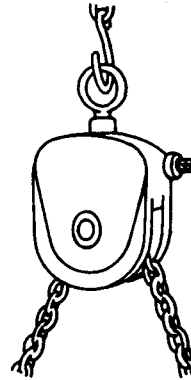
Convenience Tools

Tool Number

Use

D01043AA

Load Positioning Sling—To remove and install engine in unit. Comes with one set of JDG-19 Lifting Bracket.



T47209N

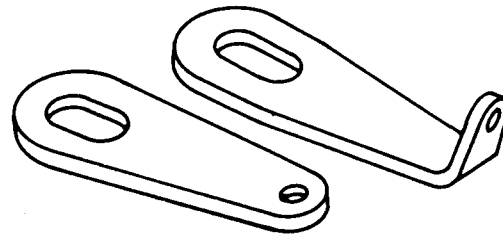
Fig. 95-Load Positioning Sling

JDG-19

Lifting Bracket—Used with D01043AA load positioning sling for engine removal and installation (1, Fig. 96).

JD-244

Lifting Eyes—Used with D01043AA load positioning sling for engine removal (engine may be equipped with these (Fig. 96).

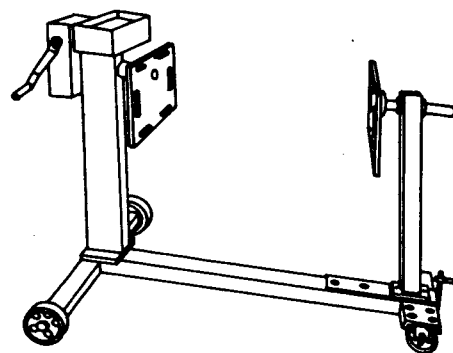


T31364N

Fig. 96-Lifting Brackets and Lifting Eyes

D01003AA

Engine Stand and Adapter Plates—Used to hold engine after removal from unit.



T47199N

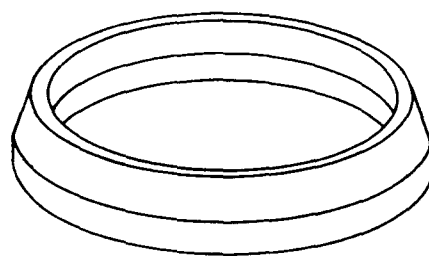
Fig. 97-Engine Stand

CRANKSHAFT AND MAIN BEARINGS (0401)

SPECIAL TOOLS

Convenience Tools

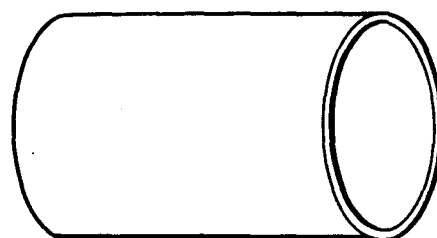
Tool Number	Use
JD-251-4	Seal Protector—Used to install fly-wheel housing.



T48357N

Fig. 98-Seal Protector

JDH-7	Rockshaft Seal Driver—Used to install oil seals and crankshaft gears.
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T27605N

Fig. 99-Seal Driver

JD-297-1	Seal and Wear Sleeve Installer—Used on all 300 Series Engines.
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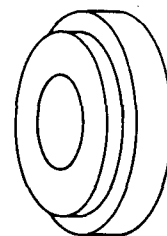
T46643N

Fig. 100-Seal and Wear Sleeve Installer

CRANKSHAFT AND MAIN BEARINGS (0401)**SPECIAL TOOLS—Continued****Essential Tools****Tool Number****Use**

JD-250

Front Crankshaft Oil Seal Driver—
To install front crankshaft oil seal in
timing gear cover.



T31581N

Fig. 101-Oil Seal Driver

CRANKSHAFT AND MAIN BEARINGS (0401)

SPECIAL TOOLS—Continued

Convenience Tools

Tool Number	Use
JD-251-2	Pilot Plate - To install crankshaft wear ring.



T48358N

Fig. 102-Pilot Plate

10012	Socket Head Cap Screw.
27489	Handle - Attach to JD-297-1 Driver to install crankshaft wear ring.



T486

Fig. 103-Handle and Screw

CAMSHAFT AND VALVE ACTUATING MEANS (0402)

SPECIAL TOOLS—Continued

Essential Tools

Tool Number**Use**

JD-254

Gear Timing Tool—Use to time camshafts.

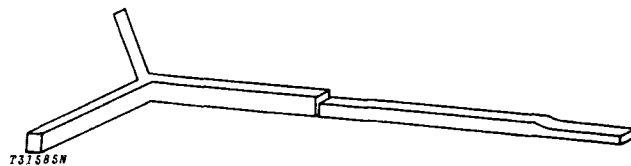
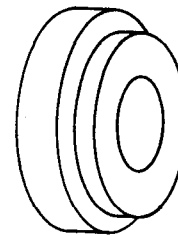


Fig. 104-Gear Timing Tool

JD-252

Idler Gear Bushing Driver—Used to install idler bushings.



T31584N

Fig. 105-Idler Gear Bushing Driver

Convenience Tools

Tool Number**Use**

JDE-81-1

Flywheel Turning Tool—Used to rotate flywheel when timing engine.



T34737N

Fig. 106-Flywheel Turning Tool

CONNECTING RODS AND PISTONS (0403)

SPECIAL TOOLS

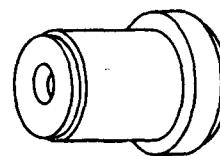
Essential Tools

Tool Number

Use

JDE-88

Bushing Installation and Removal Tool—Used for removing and installing the piston pin bushings in the connecting rods.



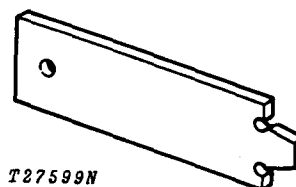
T32805NY

Fig. 107-Bushing Installation and Removal Tool

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JDE-62

Ring Groove Wear Gauge—To measure keystone ring groove wear.



T27599N

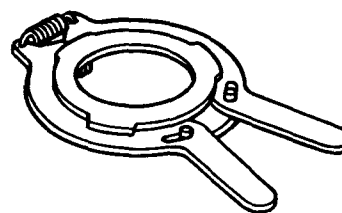
Fig. 108-Ring Groove Wear Gauge

JD-45

Piston Ring Expander—Used on 3-164, 4-2A and 6-329 engines to remove and install piston rings.

JD-285

Piston Ring Expander—Used to remove and install piston rings on 4-276 and 6-414 engines.



T27603N

Fig. 109-Piston Ring Expander

CONNECTING RODS AND PISTONS (0403)**SPECIAL TOOLS—Continued****Essential Tools****Tool Number****Use**

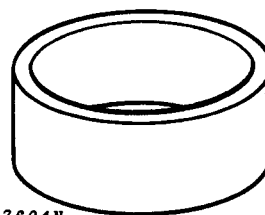
JD-84

Piston Ring Compressor—Used to install pistons in 4-276 and 6-414 engines.

4

JD-271

Piston Ring Compressor—Used to install pistons in 3-164, 4219, and 6-329 engines.



T27604N

Fig. 110-Piston Ring Compressor

CYLINDER BLOCK (0404)

SPECIAL TOOLS

Essential Tools

Tool Number	Use
D17004BR	Cylinder Brush—To deglaze cylinder liners.



Fig. 111-Cylinder Brush

Convenience Tools

Tool Number	Use
D01062AA or D01063AA	Cylinder Liner Puller—To remove cylinder liners.

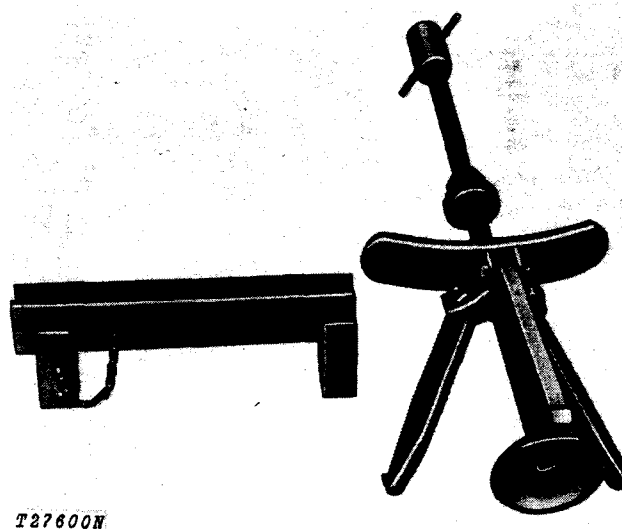


Fig. 112-Cylinder Liner Puller

OILING SYSTEM (0407)

SPECIAL TOOLS

Essential Tools

Tool Number**Use**

JD-248

Driver - To install oil pressure control valve bushing.

T31580N

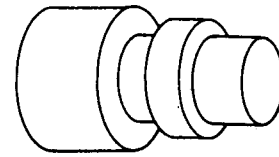


Fig. 113-Driver

CYLINDER HEAD AND VALVES (0409)

SPECIAL TOOLS

Essential Tools

Tool Number**Use**

D2000Z WI

Knurling Tool - To knurl engine valve guides.

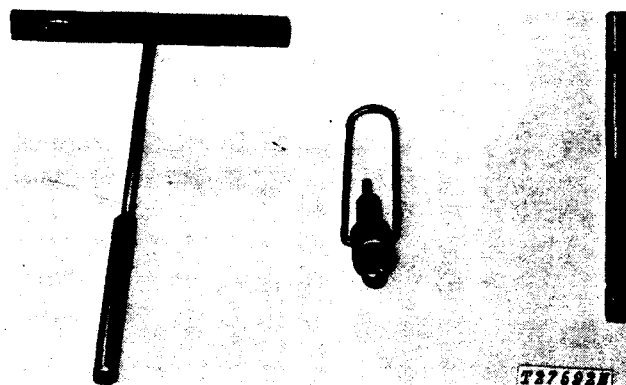


Fig. 114-Knurling Tool

JDE-41296

Valve Seat Puller - Removes intake and exhaust valve seat of engines having replaceable seats.

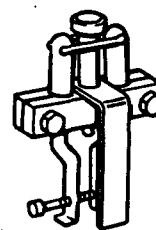


Fig. 115-Valve Seat Puller

JDE-7

Valve Guide Pilot Driver - Used for removing and installing valve guides with JDE-9.



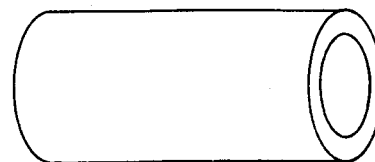
T27596N

Fig. 116-Torque Wrench Adapter

CYLINDER HEAD AND VALVES (0409)**SPECIAL TOOLS—Continued****Essential Tools****Tool Number****Use**

JDE-9

Valve Guide Driver—To correctly position valve guides when installing them.



T31591N

Fig. 117-Valve Guide Driver

Convenience Tools**Tool Number****Use**

JD-307

Torque Wrench Adapter—Allows mechanic to torque head bolts without removing rocker arm assembly.



T51077N

Fig. 118-Torque Wrench Adapter

FUEL INJECTION SYSTEM (0413)

SPECIAL TOOLS

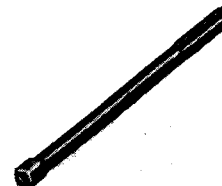
Essential Tools

Tool Number

Use

JDE-39

Nozzle Bore Cleaning Tool - Used to clean carbon and other foreign matter from the nozzle bore.

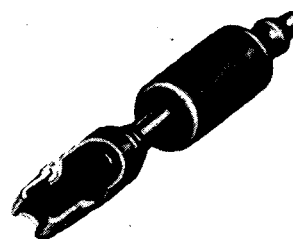


T32810N

Fig. 119-Nozzle Bore Cleaner

JDE-3

Injection Nozzle Puller - Permits fast removal of fuel injection nozzles from cylinder head.

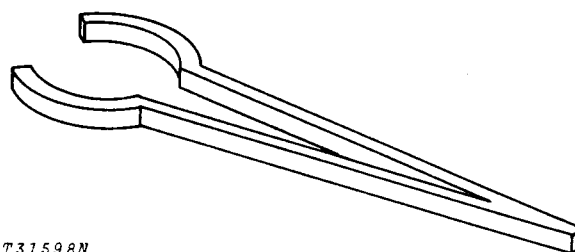


T32808N

Fig. 120-Injection Nozzle Puller

JD-256

Injection Pump Drive Shaft Seal Installing Tool - For servicing Roosa Master Injection pumps.



T31598N

Fig. 121-Injection Pump Drive Shaft Seal Installing Tool

FUEL INJECTION SYSTEM (0413)**SPECIAL TOOLS—Continued****Essential Tool****Tool Number****Use**

JD-258

Carbon Stop Seal Installing Tool -
Used to properly install the carbon
stop seal or "pencil type" fuel in-
jection nozzles used in John Deere
engines.

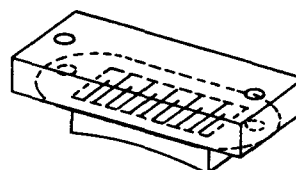


T32809N

Fig. 122-Carbon Stop Seal Installing Tool

JD-259

Timing Window - For servicing
"Roosa Master" injection pumps.



T31920N

Fig. 123-Timing Window

WATER PUMP (0417)

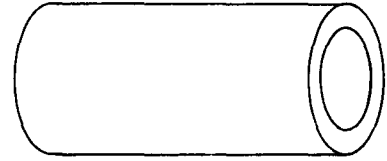
SPECIAL TOOLS

Essential Tools

Tool Number**Use**

JD-262-A

Water Pump Bearing Installing Tool—Used to install water pump bearing on 300 Series engine.

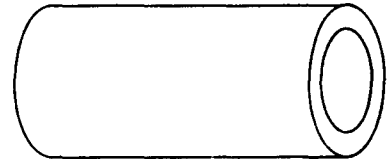


T31591N

Fig. 124-Water Pump Bearing Installing Tool

JDE-74

Water Pump Shaft and Bearing Driver—For servicing the new and larger water pump bearings found in turbocharged engines.



T31591N

Fig. 125-Water Pump Shaft and Bearing Tool

STARTING MOTOR AND FASTENINGS (0422)

SPECIAL TOOLS

Essential Tools (For JOHN DEERE STARTER)

Tool Number Use

Commutator and Drive End Bushing Tools

4

- | | |
|---------------------|---|
| 1 - 27487 | Handle - For removing and installing commutator and drive end bushings. |
| 2 - 27494 | Disk - For removing commutator and drive end bushing. |
| 27495 | Disk - For installing commutator and drive end bushing. |
| 3 - 27491 and 27492 | Disk Spacer - For removing and installing commutator and drive end bushing. |
| 4 - 27493 | Disk Pilot - For removing and installing commutator and drive end bushing. |

Tool Number Use

Center Bushing and Oil Seal Tools

- | | |
|-----------|--|
| 1 - 27487 | Handle - For installing center bushing and oil seal. |
| 2 - 27505 | Disk - For installing center bushing. |
| 3 - 27512 | Disk - For installing center oil seal. |
| 4 - 27501 | Disk Pilot - For installing center bushing and oil seal. |

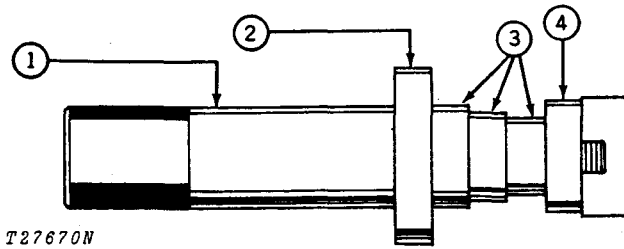


Fig. 126-End Drive Bushing Removal and Installation Tool

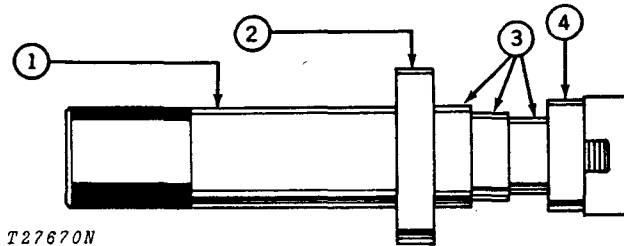


Fig. 127-Center Bushing and Oil Seal Tools

STARTING MOTOR AND FASTENINGS (0422)

SPECIAL TOOLS—Continued

Essential Tools

Tool

Commutator and Drive End Bushing Tool

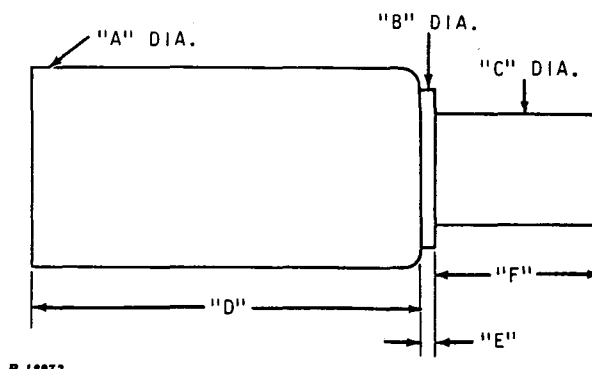
Dimension	Removal	Installation
A	1 in. (25 mm)	1 in. (25 mm)
B	0.732 to 0.736 in. (18.59 to 18.69 mm)	0.732 to 0.736 in. (18.59 to 18.69 mm)
C	0.661 to 0.665 in. (16.79 to 16.89 mm)	0.661 to 0.665 in. (16.79 to 16.89 mm)
D	2 in. (51 mm)	3.94 in. (100.08 mm)
E	0.901 to 0.909 in. (22.89 to 23.09 mm)	0.018 to 0.022 in. (0.46 to 0.56 mm)
F	0.783 to 0.791 in. (19.89 to 20.09 mm)	0.783 to 0.791 in. (19.89 to 20.09 mm)

Center Bearing Bushing Tool

Dimension	Removal	Installation
A	1.57 in. (39.9 mm)	1.57 in. (39.9 mm)
B	1.36 to 1.37 in. (34.5 to 34.8 mm)	1.36 to 1.37 in. (34.5 to 34.8 mm)
C	1.17 to 1.18 in. (29.7 to 30.0 mm)	1.17 to 1.18 in. (29.7 to 30.0 mm)
D	2 in. (50.8 mm)	2 in. (50.8 mm)
E	0.95 to 1.02 in. (24.1 to 25.9 mm)	0.018 to 0.02 in. (0.46 to 0.51 mm)
F	0.866 to 0.945 in. (22.0 to 24.0 mm)	0.966 to 1.000 in. (25.54 to 25.40 mm)

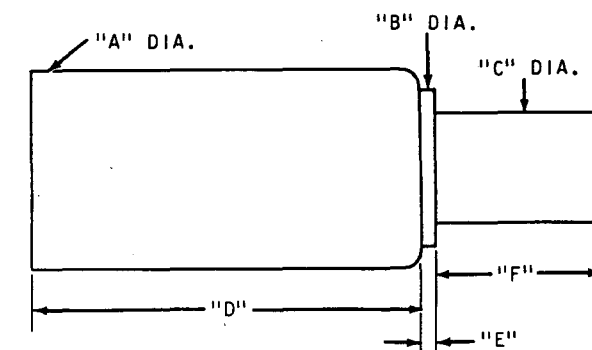
JDE-80

Starter Wrench - To remove and install rear mounting nut on starting motor.



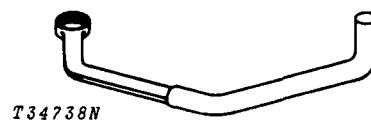
R 18972

Fig. 128-Dimension for Shop-made Bushing Driver



R 18972

Fig. 129-Center Bearing Bushing Tool



T34738N

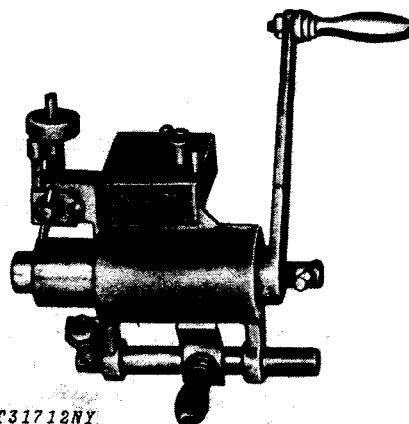
Fig. 130-Starter Wrench

STARTING MOTOR AND FASTENINGS (0422)

SPECIAL TOOLS—Continued

Convenience Tools (For a Delco-Remy Starter)

..... Armature Commutator Turning and Undercut Tool—Used to undercut armature and commutator.



T31712NY

Fig. 131-Armature Commutator Turning and Undercut Tool

..... Pre-Lubricated Bushing Arbor—To install prelubricated bushings.

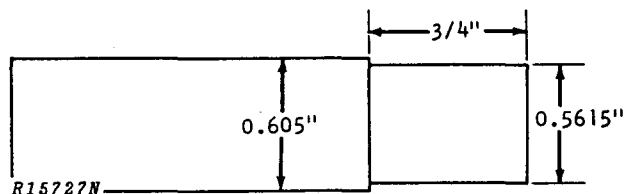


Fig. 132-Pre-Lubricated Bushing Arbor

..... Spring Tension Gauge—To check brush spring tension.



Fig. 133-Spring Tension Gauge

Section 5

ENGINE AUXILIARY SYSTEMS

CONTENTS OF THIS SECTION

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GROUP 0510 - ENGINE COOLING SYSTEM		GROUP 0520 - INTAKE SYSTEM	
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Repair	0515-1	Cooling System	0599-1
Installation	0515-1		

Group 0510

ENGINE COOLING SYSTEM

GENERAL INFORMATION

The power unit cooling system consists of a radiator, fan and fan shroud.

The radiator (Fig. 2) and the fan are located at the front of the power unit.

REMOVAL

Disconnect battery negative cable.

Remove side shields by lifting and pulling out.

Remove top hood.

Remove screws that attach the front shroud.

Remove front shroud.

Drain cooling system.

Disconnect radiator braces (1, Fig. 1).

Remove radiator mounting screws (2, Fig. 1).

Remove radiator.

To remove the fan shroud, remove screws on the sides of the radiator.

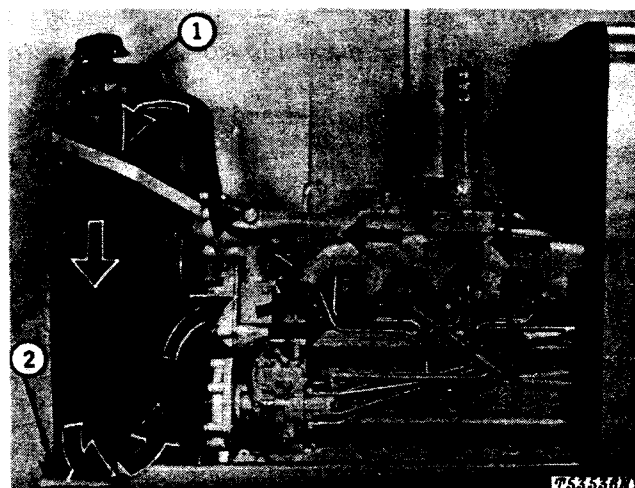


Fig. 1-Cooling System

To remove fan remove fan cap screws.

REPAIR

Inspect radiator for cracks and leaks. Repair or replace as necessary.

Clean foreign matter out of radiator.

Inspect fan shroud for cracks and holes. Replace as necessary.

Inspect fan for bent or broken blades. The fan is not a repairable part. Replace if defective.

5

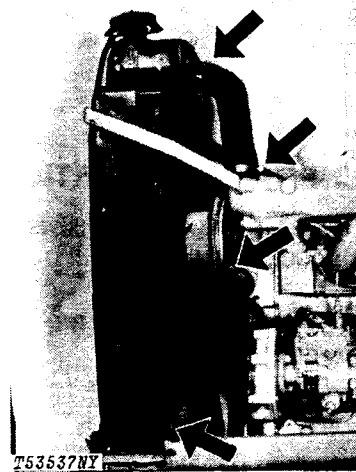


Fig. 2-Connecting Radiator Hoses

INSTALLATION

Install fan and cap screws. Tighten cap screws to 35 lb-ft (47 Nm) (5 kg-m).

Replace fan shroud on radiator.

Install radiator.

Install radiator screws.

Connect radiator hoses (Fig. 2).

Connect radiator braces (Fig. 3).

Replace front shroud (Fig. 4).

Replace top panel.

Replace side shields.

Connect battery negative cable.

Fill cooling system with the proper coolant to the proper level.

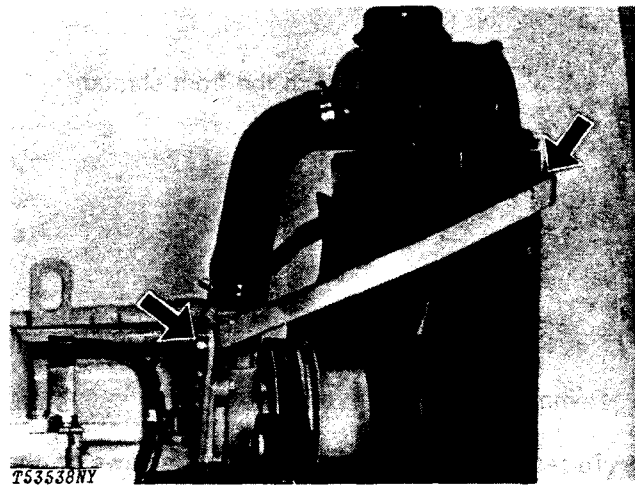


Fig. 3-Connecting Radiator Braces

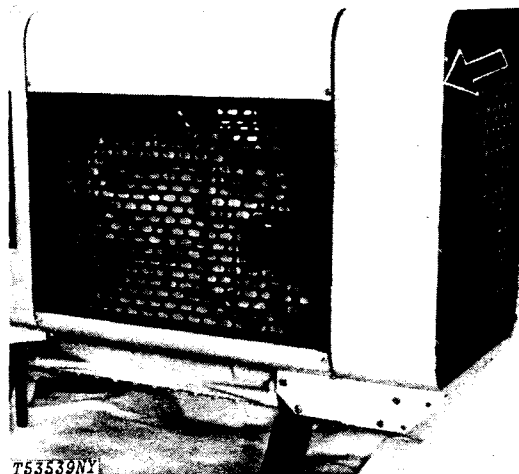


Fig. 4-Replacing Front Shroud

Group 0515 SPEED CONTROLS

GENERAL INFORMATION

The speed control consists of a cable control (Fig. 1) that runs from the injection pump to the handle on the panel of the power unit.

REMOVAL

Shut off engine.

Disconnect battery negative (–) cable.

Disconnect shut-off wire from injection pump.

Disconnect cable from the injection pump.

Disconnect cable from the cylinder block connect point (Fig. 1).

Remove handle mounting nuts.

Slowly pull cable out from power unit.

REPAIR

Inspect cable (Fig. 2) for any defects. Replace as necessary.

INSTALLATION

Slide cable through hole at the control panel.

Route cable to the injection pump.

Connect the cable to the injection pump.

Connect the cable to the connect point on the cylinder block.

For cable adjustment, refer to Group 9010.

Connect battery negative (–) cable.

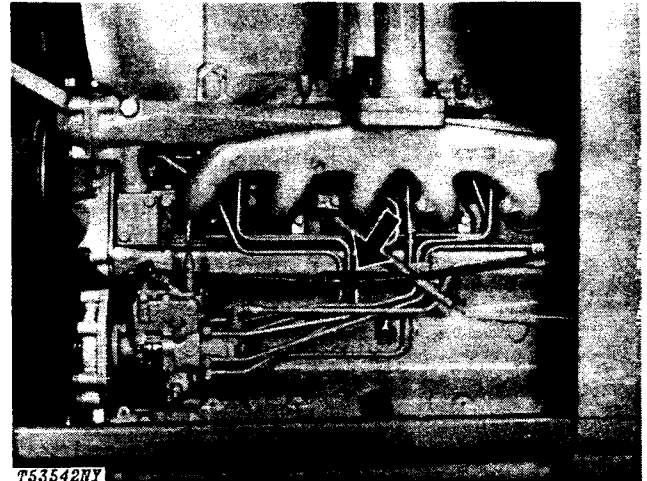


Fig. 1-Left Side

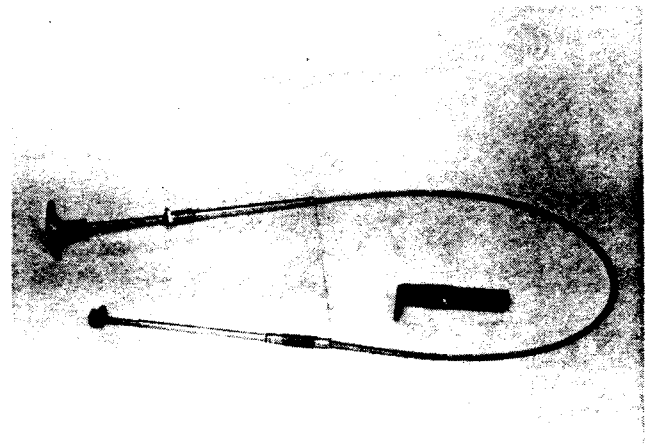


Fig. 2-Cable Assembly

Group 0520 INTAKE SYSTEM

GENERAL INFORMATION

If the power unit is equipped with an air cleaner system it is located at the rear of the engine (Fig. 1).

REMOVAL

Remove precleaner (1, Fig. 1).

Remove intake hose (2).

Remove bolts that hold air cleaner unit to the power unit housing (3).

Remove air cleaner cover.

Remove the wing nuts (5, Fig. 2) that hold the air cleaner elements (2, Fig. 2).

Remove elements.

REPAIR

Check filter elements for holes, tears and cracks. Replace if necessary.

Check the housing for holes. Replace if necessary.

Refer to the owner's manual for service of the filter elements.

INSTALLATION

Install both filter elements securely attach both wing nuts.

Empty dust bowl (1, Fig. 2).

Replace rubber skirt baffle (6).

Replace dust bowl.

Secure band (3, Fig. 1).

Replace air cleaner assembly on the power unit.

Replace the precleaner (3, Fig. 2).

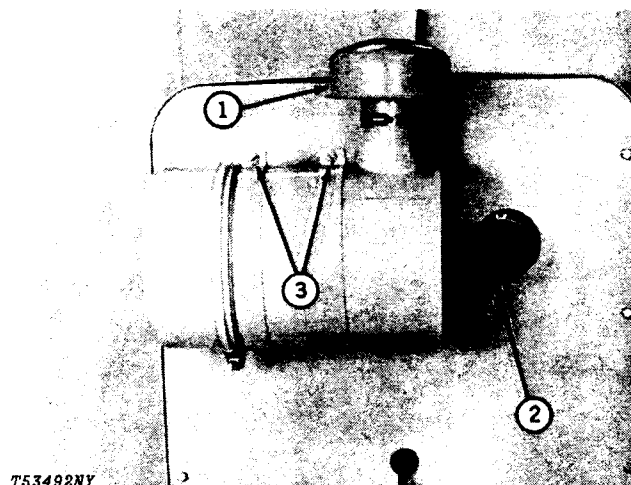


Fig. 1-Air Cleaner

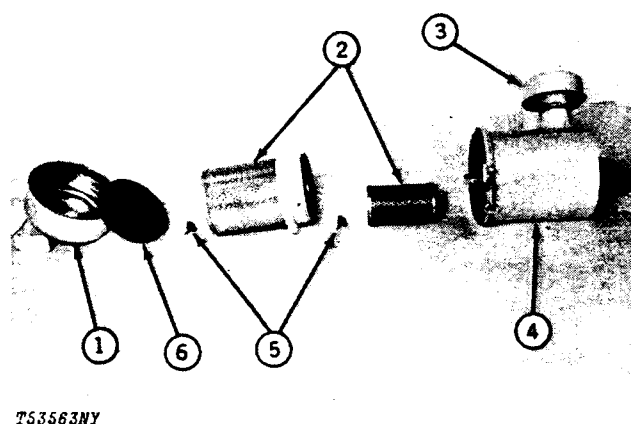


Fig. 2-Air Cleaner Assembly

5

Group 0599

SPECIFICATIONS AND SPECIAL TOOLS

COOLING SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Fan cap screw
torque 35 lb-ft
(47 Nm) (5 kg-m)

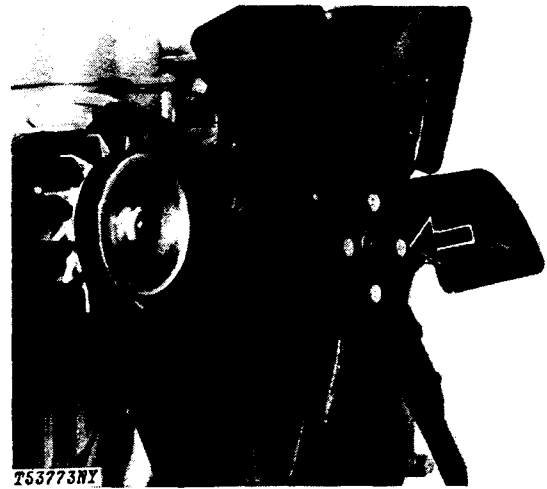


Fig. 1-Fan Cap Screw Torque

Section 16 ELECTRICAL SYSTEMS

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Group 1672

ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING

REMOVAL

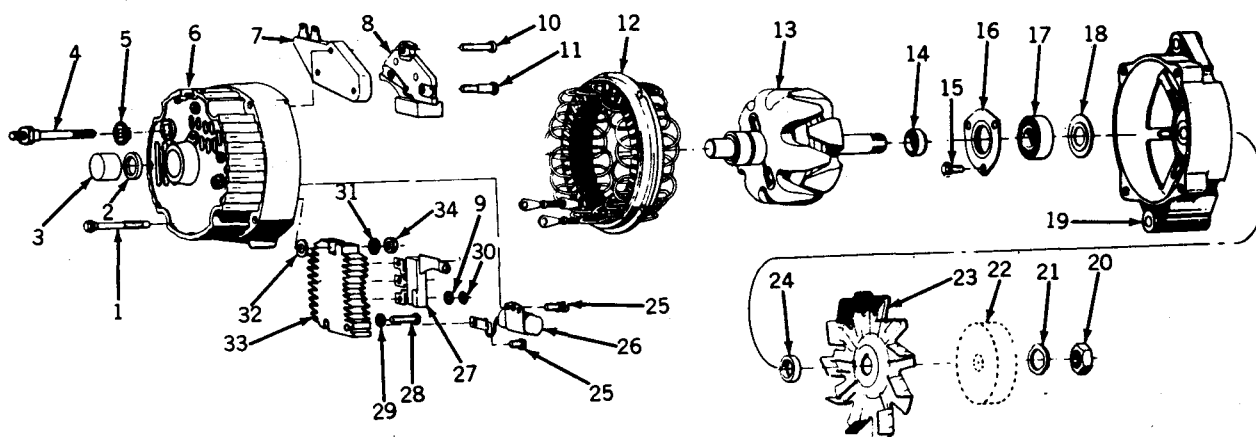
IMPORTANT: Disconnect battery negative (-) cable at the battery.

Disconnect battery wires from terminals and field wire connector.

Loosen bolts attaching alternator to mounting brackets and remove drive belt.

Remove attaching bolts and alternator.

DELCO-REMY



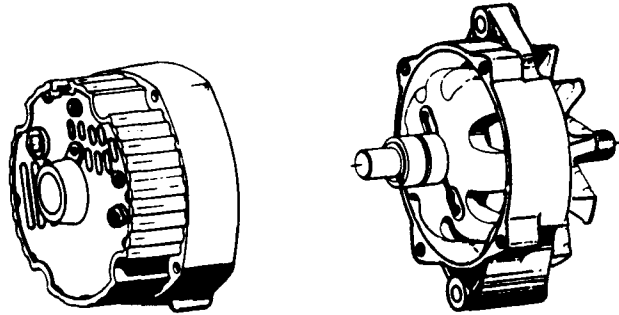
T32815N

- | | | | |
|-------------------------|-----------------------------|--------------------|---------------------------|
| 1—Through Bolt (4 used) | 10—Regulator Ground Screw | 18—Slinger Washer | 26—Capacitor |
| 2—Oil Seal | 11—Insulated Screw (2 used) | 19—Drive End Frame | 27—Diode Trio |
| 3—Slip Ring End Bearing | 12—Stator | 20—Pulley Nut | 28—Rectifier Ground Screw |
| 4—Output Terminal | 13—Rotor | 21—Lock Washer | 29—Lock Washer |
| 5—Insulating Washer | 14—Inner Collar | 22—Pulley | 30—Nut (4 used) |
| 6—Slip Ring End Frame | 15—Screw (3 used) | 23—Fan | 31—Washer |
| 7—Regulator | 16—Bearing Retainer | 24—Outer Collar | 32—Insulating Washer |
| 8—Brush Assembly | 17—Drive End Bearing | 25—Screw (2 used) | 33—Rectifier Bridge |
| 9—Lock Washer (3 used) | | | 34—Nut |

Fig. 1-Delco-Remy Alternator

REPAIR

Remove through bolts. Pry stator and slip ring end frame assembly from the rotor and drive end frame assembly. After disassembly, place a piece of pressure-sensitive tape over the slip ring end bearing to prevent entry of dirt or foreign material.



T53791N

Fig. 2-Separate Frames

Drive End Frame Bearing

Remove pulley, fan, and collar. Then separate the drive end frame from the rotor shaft. Remove the retainer plate and press bearing from the end frame (Fig. 3). The bearing may be reused if it is in satisfactory condition. Clean the bearing and fill it 1/4 full with Delco-Remy Lubricant No. 1948791 before assembly. Overfilling bearing may cause bearing to overheat.

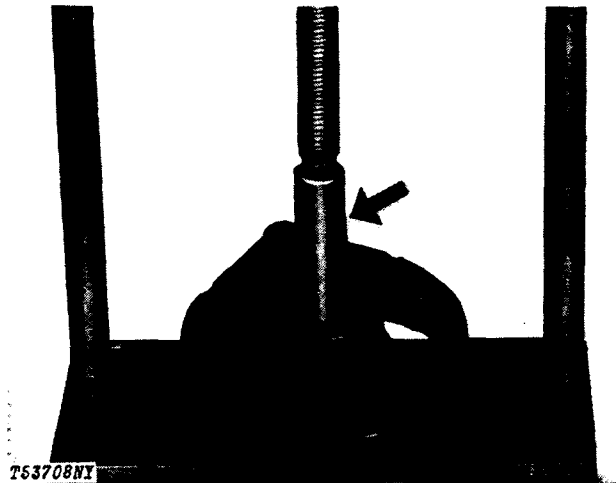


Fig. 3-A-209 Tool

Install bearing (Fig. 4). Install new retainer plate if felt seal is hard or excessively worn. Fill cavity between retainer plate and the bearing with 1948791 Lubricant. Install rotor, collars, fan and pulley. Tighten nut to 40 to 60 lb-ft (54 to 81 Nm) (6 to 8 kg-m) torque.

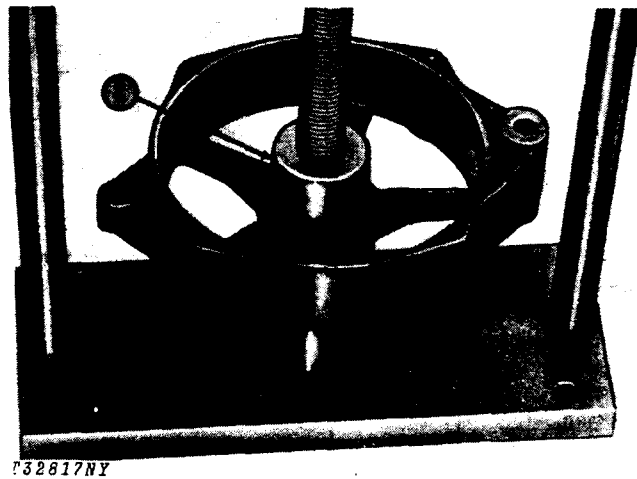


Fig. 4-A-203 and A-207 Tool

Slip Ring End Bearing

Replace the slip ring end bearing if its grease supply is exhausted or if the bearing is defective. Do not attempt to relubricate bearing. Press bearing from outside to inside of frame (Fig. 5).

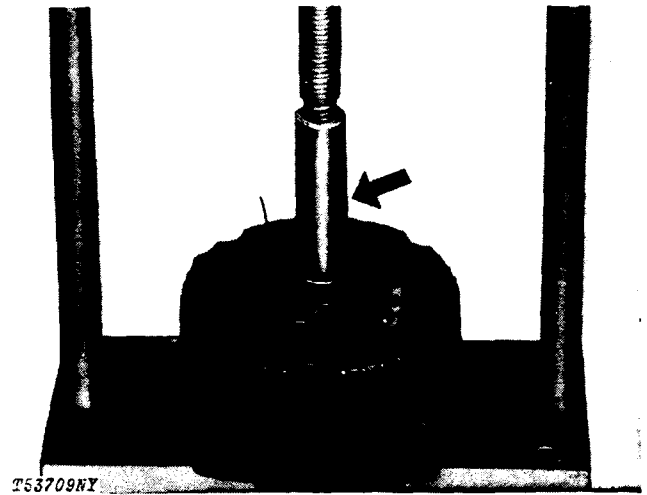


Fig. 5-A-209 Tool

16

To install a new bearing, place a flat plate over the bearing and press it in from the outside towards the inside of the frame until the bearing is flush with the outside of the end frame (Fig. 6). Support the inside of the frame with a cylinder to prevent breakage of the end frame.

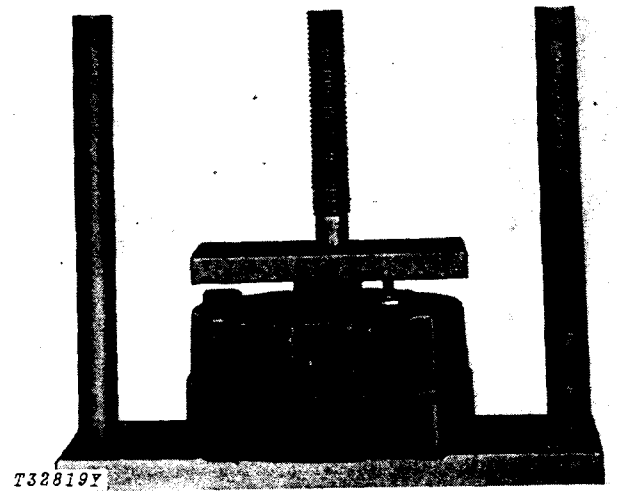


Fig. 6-Install Slip Ring End Bearing

Stator and Slip Ring End Frame

Before removing brushes or diode trio, check for grounds between points A to C and B to C (Fig. 7) with an ohmmeter, using the lowest range scale. Then reverse the lead connections.

If both A to C readings or both B to C readings are the same, the brushes may be grounded because of a defective insulating washer and sleeve at the two screws. If the screw assembly is not damaged, the regulator or diode trio is defective.

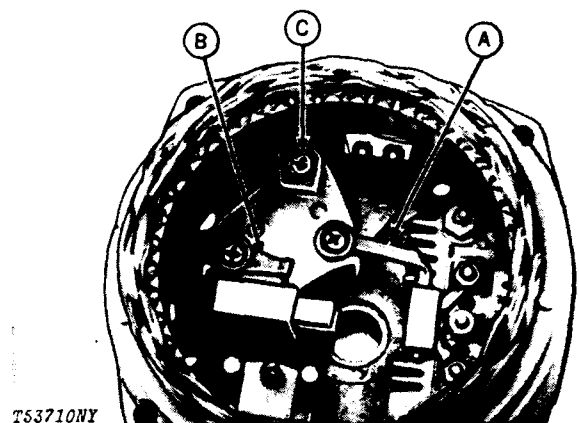


Fig. 7-Stator Ground Check

Diode Trio

To check the diode trio, first remove the stator. Then remove the diode trio, noting the insulator positions. With an ohmmeter, check between points A (Fig. 8) and D and then reverse the ohmmeter lead connections. A good diode trio will give one high and one low reading. If both readings are the same, the diode trio is defective. Repeat this test at points B and D and at points C and D.

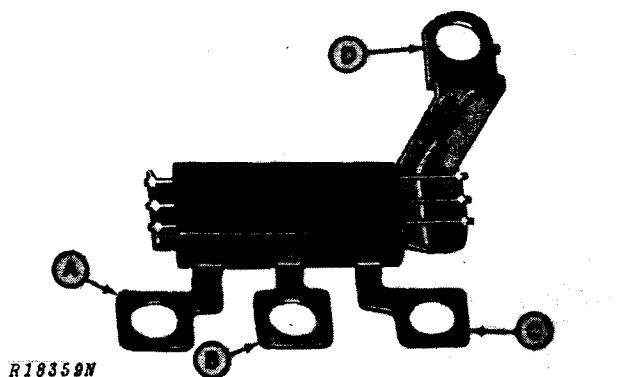


Fig. 8-Diode Trio

16

Rectifier Bridge

The rectifier bridge has a grounded heat sink (1, Fig. 9) and an insulated heat sink (2) that is connected to the output terminal. Connect ohmmeter to the grounded heat sink (A) and to the flat metal strip (B, Fig. 9). Then reverse the ohmmeter lead connections. If both readings are the same, the rectifier bridge is defective. Repeat this test between points A to C, A to D, B to E, C to E and D to E.

The ohmmeter check of the rectifier bridge, and of the diode trio as previously covered, is a valid and accurate test. Do not replace either unit unless at least one pair of readings is the same.

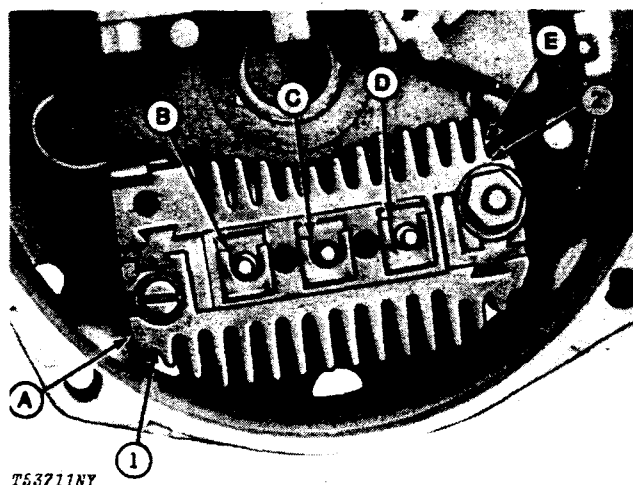


Fig. 9-Rectifier Bridge

Brush Assembly and Regulator

Check brushes for continuity between points A to B and C to D (Fig. 10). Wiggle the brush to locate poor connections.

After removing stator and diode trio, the brush assembly and the regulator may be removed. The screws at points B and C must have insulating washers and sleeves. A ground at these points will cause no output or uncontrolled output.

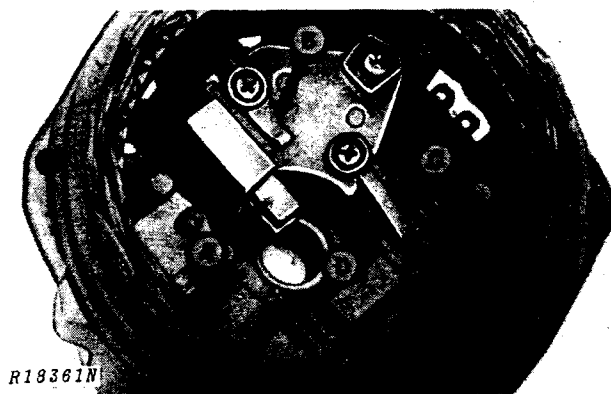


Fig. 10-Rectifier Bridge

Rotor

Test A—Short Circuit or High Resistance

Connect voltmeter (1, Fig. 11), ammeter (3), and battery (4) to rotor (2).

This test checks for short circuits or excessive resistance. The rotor winding current draws should be 4 to 4.5 amps at 12 volts.

An ammeter reading above this specified value indicates shorted windings, a reading below the specified value indicates excessive resistance.

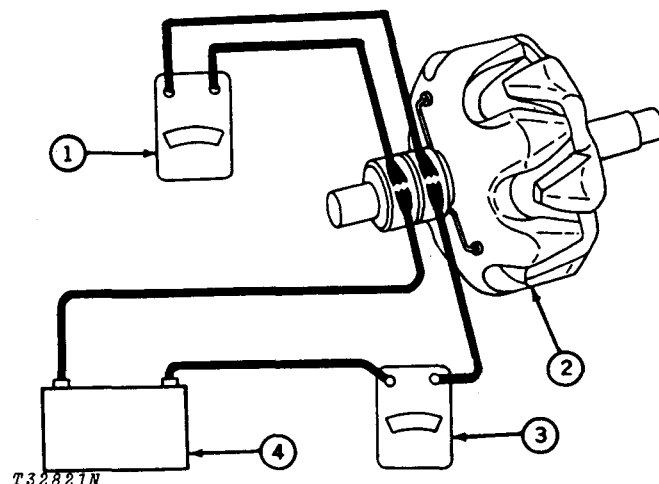


Fig. 11-Rotor Current Draw Test

Test B: Checking Field Coil for Opens

To check for opens connect the test lamp or ohmmeter to each slip ring (B, Fig. 12). If the test lamp fails to light, or if the ohmmeter reading is high (infinite), the winding is open.

Test C: Checking Field Coil for Grounds

Connect ohmmeter to either slip ring and to the shaft (C, Fig. 12). Test lamp should not light or ohmmeter reading should show a high resistance. If test lamp lights or ohmmeter resistance is low, the field windings are grounded.

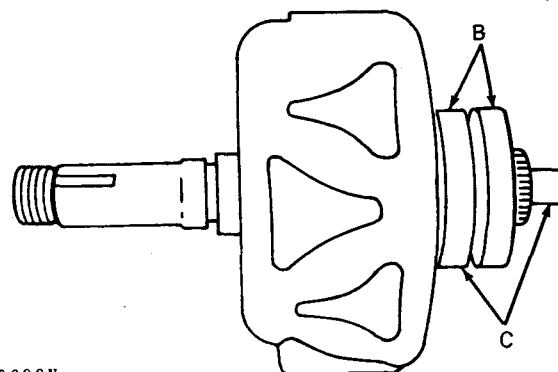


Fig. 12-Test B and C Test Points

Polish slip rings with 400-grit silicon carbide paper.

Examine stator for insulation failure or defects. The alternator is "Y" connected (1, Fig. 13).

Check for ground between any terminal and the stator frame. If the meter reading is low the windings are grounded. Check for an open circuit by connecting an ohmmeter from point A to B and from B to C (Fig. 13). If the meter readings are high the windings are open.

Shorted stator leads are usually discolored and have a burned odor.

Replace stator only after other electrical components have been checked and are satisfactory.

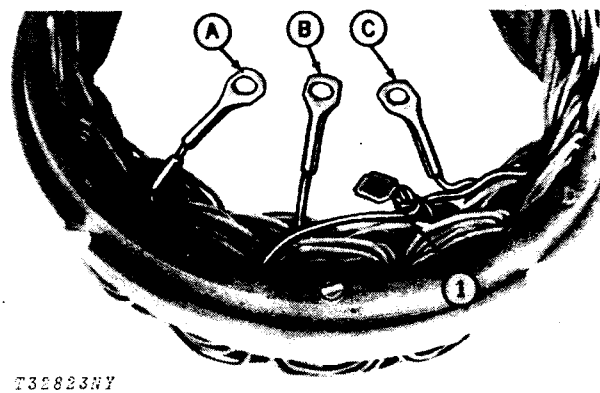
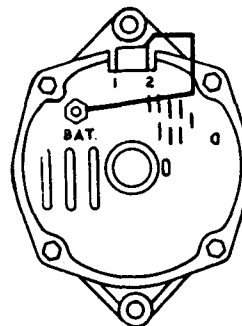


Fig. 13-Stator

ASSEMBLY

Alternator assembly is the reverse of the disassembly procedures. Be sure insulated screws for the regulator and brush holder and the insulating washer for the rectifier bridge are assembled correctly (Figs. 1 and 7).

To connect the slip ring end frame assembly to the rotor and drive end frame assembly, insert a pin through the hole (Fig. 14) to hold the brushes up. Remove the tape over the slip ring end bearing and make sure the shaft is perfectly clean. Carefully install the shaft in the slip ring end frame assembly to avoid seal damage. After tightening through bolts, remove the brush retaining pin.



T53731N

Fig. 14-Brush Pin Hole

16 Mount alternator on electrical servicer. Make connections shown in Fig. 15 using an AR55283 Delcotron harness. Connect jumper wire to terminal with resistor, not to terminal with orange wire.

- | | |
|------------------------|-----------------------------|
| 1—Carbon Pile Resistor | 5—AR55283 Delcotron Harness |
| 2—Ammeter | 6—Test Hole |
| 3—Jumper Wire | 7—Voltmeter |
| 4—Resistor | 8—12-Volt Battery |

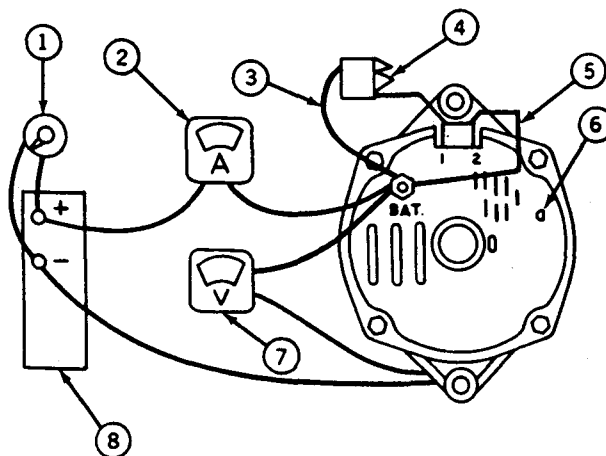
Fig. 15-Legend

Run alternator at approximately 5000 rpm.

Use the following temperature/voltage chart to check the alternator:

Regulator Case Temperature	Voltage
85°F (29°C)	14.5—15.0 volts
105°F (41°C)	14.3—14.8 volts
125°F (52°C)	14.1—14.7 volts
145°F (63°C)	13.9—14.5 volts

If voltage rises above the specified voltage, check for a grounded brush lead clip.



T53732N

Fig. 15-Alternator Test Connections

If voltage falls below the specified voltage, adjust the carbon pile to obtain maximum amperage output.

If amperage output is 60% or more of the rated amperage, the alternator is good.

If amperage output is low, ground field windings at tab in test hole (6, Fig. 15). If output is now correct, replace regulator and check field winding. If output is not correct, check diode trio, rectifier bridge, and stator.

Open carbon pile resistor and after voltage stabilizes, regulated voltage should be as listed in the following chart. If battery is partially discharged, it may be necessary to connect a 1/4-ohm resistor in series with the ammeter.

Regulator Case

Temperature	Voltage
85°F (29°C)	14.5—15.0 volts
105°F (41°C)	14.3—14.8 volts
125°F (52°C)	14.1—14.7 volts
145°F (63°C)	13.9—14.5 volts

MOTOROLA

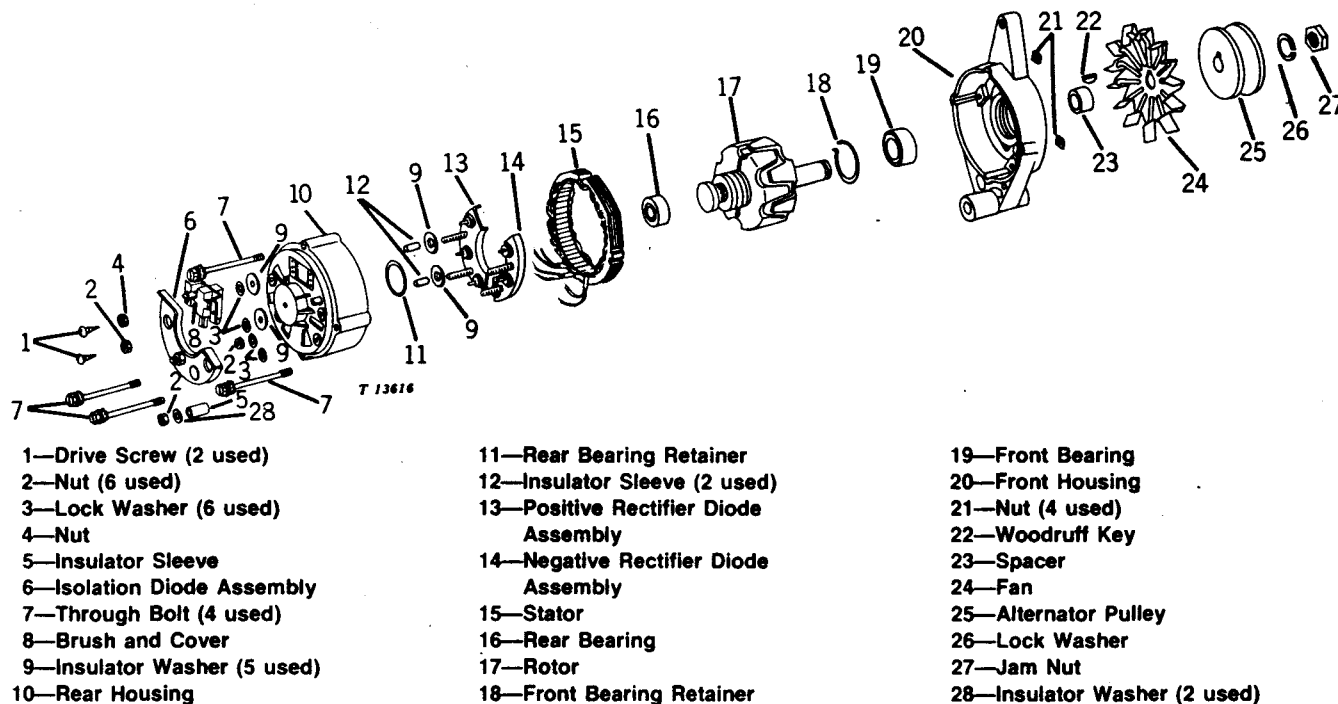
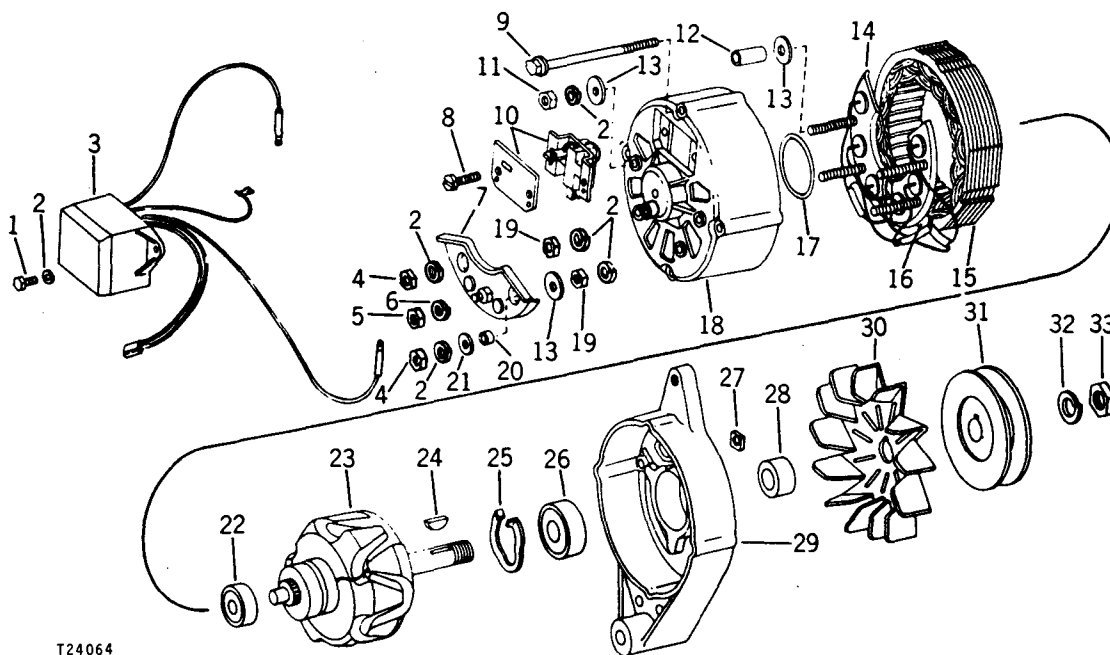


Fig. 16-35 Amp Alternator Assembly



T24064

- 1—Self Tapping Screw (3 used)
- 2—Lock Washer (9 used)
- 3—Regulator
- 4—Nut (2 used)
- 5—Nut
- 6—Lock Washer
- 7—Dual Diode Insulator
- 8—Drive Screw (2 used)
- 9—Through Bolt (4 used)
- 10—Brush and Cover
- 11—Nut (2 used)

- 12—Insulator Sleeve (2 used)
- 13—Insulator Washer (5 used)
- 14—Positive Rectifying Diode
- 15—Stator
- 16—Negative Rectifying Diode
- 17—Rear Bearing Retainer
- 18—Rear Housing
- 19—Nut (2 used)
- 20—Insulator Sleeve
- 21—Insulator Washer
- 22—Rear Bearing

- 23—Rotor
- 24—Woodruff Key
- 25—Front Bearing Retainer
- 26—Front Ball Bearing
- 27—Square Nut (4 used)
- 28—Fan and Pulley Spacer
- 29—Front Housing
- 30—Fan
- 31—Pulley
- 32—Lock Washer
- 33—Jam Nut

Fig. 17-55 Amp Alternator Assembly

REPAIR

The pulley is a slip fit on the shaft with a Woodruff key. To remove the nut and lock washer, clamp pulley in vise as shown in Fig. 18. Belt protects pulley from damage. While supporting alternator, strike end of shaft with a wooden mallet or plastic hammer.

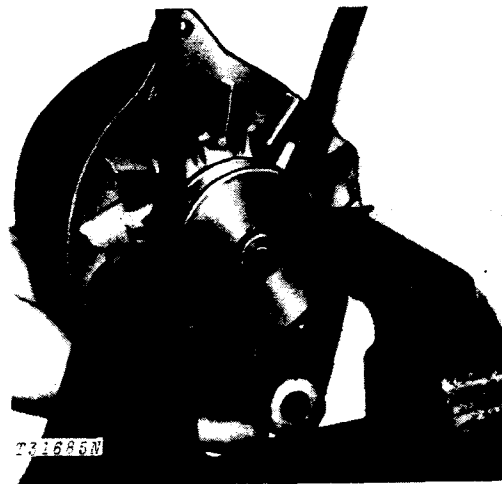


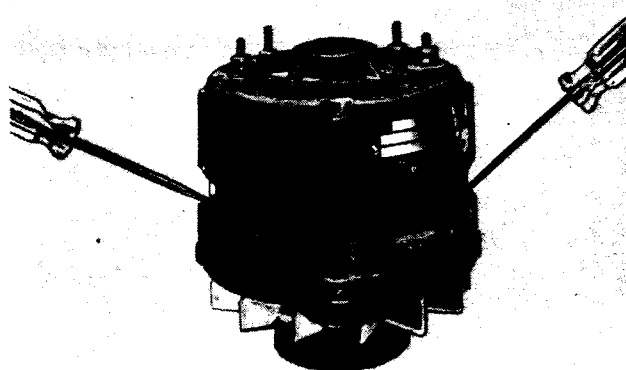
Fig. 18-Pulley Removal

Removing Rear Housing

IMPORTANT: Do not insert screwdriver blade deeper than 1/16 inch (1.6 mm).

Remove brush assembly, then remove isolation diode assembly (see Fig. 16 and 17). Remove the four through bolts and nuts. Insert a small-bladed screwdriver in the stator slots between stator and front housing (Fig. 19).

Apply prying pressure at several points around the stator to extract rotor and front housing as an assembly. Do not burr the stator core.



T12664N

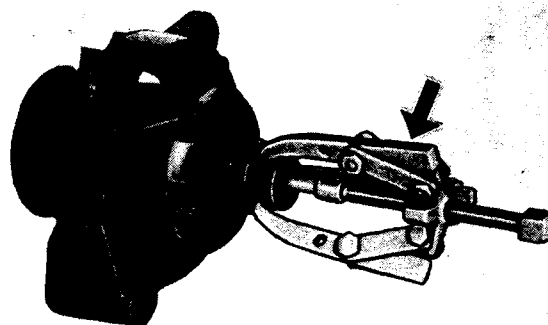
Fig. 19-Remove Rear Housing

16

Rear Bearing

Using A-216 Puller (Fig. 20), remove rear bearing.

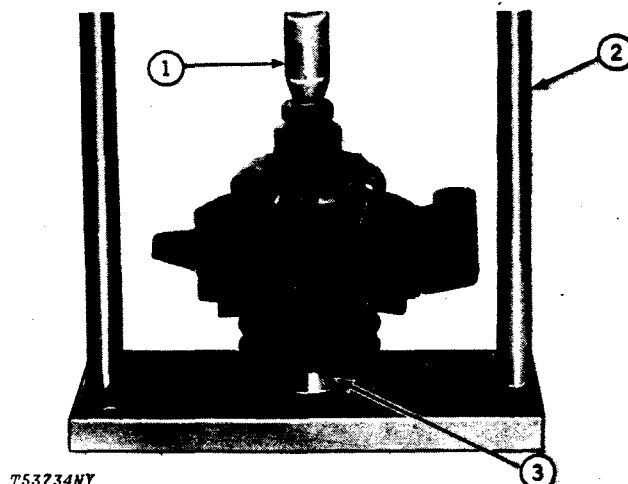
Replace rear bearing retainer (17, Fig. 17 or 11, Fig. 16).



T53733NY

Fig. 20-A-216-Puller

Using A-206 (1, Fig. 21), A-201 (2), and A-208 Tools, install rear bearing.



T53734NY

Fig. 21-Installing Rear Bearing

Front Bearing

Remove Woodruff Key (1, Fig. 22) from rotor shaft.

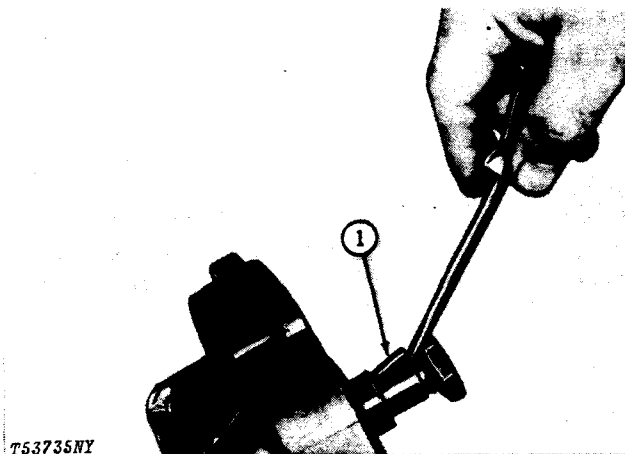


Fig. 22-Remove Woodruff Key

Compress bearing retainer (Fig.23) and remove rotor and bearing from front housing.

Press bearing from rotor shaft or use A-216 Puller to pull bearing from shaft.



Fig. 23-Compress Bearing Retainer

Using A-203 (1, Fig. 24) and A-207 (2) Tools, press bearing into housing.

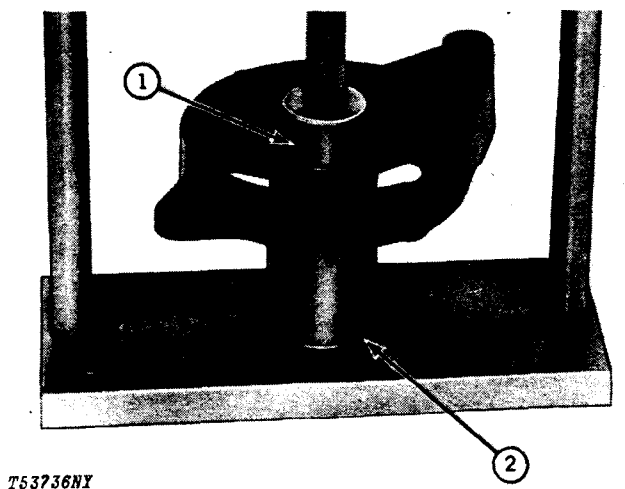
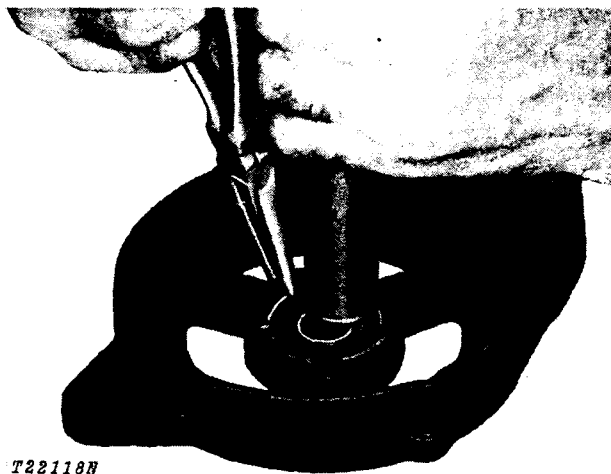


Fig. 24-Install Front Bearing

Install bearing retainer in front housing. Compress the waves of the bearing retainer to seat it in its groove (Fig. 25). Do not use a screwdriver or other small object that might slip off and damage the bearing seal.



T22118N

Fig. 25-Install Bearing Retainer

Using A-209 (1, Fig. 26), A-208 (2), and A-203 (3) Tools, press housing and bearing onto shaft.

A-209 Tool presses against inner bearing race.

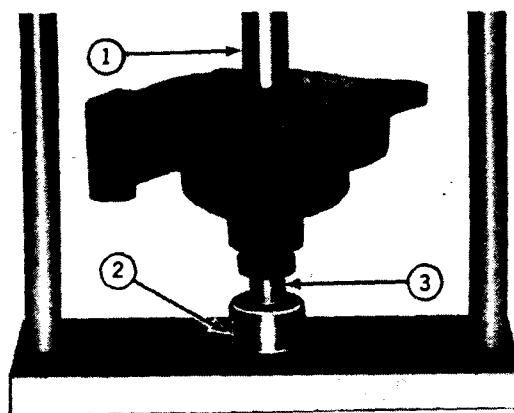
Removing Stator and Diodes

Remove stator and diode assembly from the rear housing. Carefully note locations of insulators and washers for proper reassembly. Do not unsolder stator-to-diode wire junctions. Avoid bending stator wires at junction.

When soldering and unsoldering leads from diodes, grasp the diode lead with pliers between the diode and the stator lead to be removed (Fig. 2). This gives better heat dissipation and protects the diode. Do not exert excessive stress on diode lead.

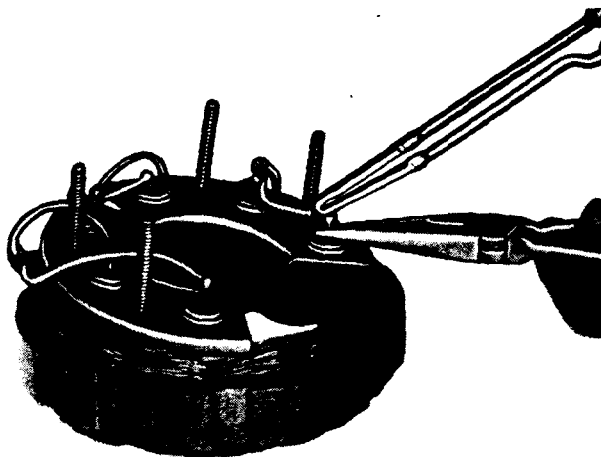
Note diode assembly to stator connections. Be sure replacement diode assembly connections are the same. The positive diode assembly has red printing and the negative has black printing—DO NOT INTERCHANGE.

IMPORTANT: Do not use an acid-core solder when soldering diode leads. Use rosin-core solder.



T53737NY

Fig. 26-Install Front Housing



T53738NY

Fig. 27-Unsoldering Diode Leads

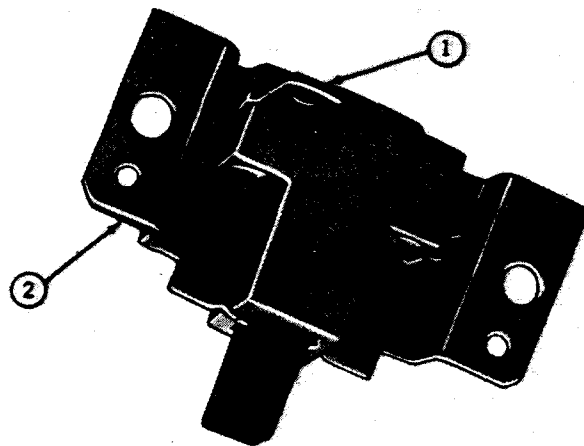
ALTERNATOR COMPONENT TESTS

Brush Assembly Insulation and Continuity Tests

Insulation Test

Connect ohmmeter or test lamp (12 to 120 volt) to field terminal (1, Fig. 28) and bracket (2).

Resistance should be high (infinite) or test lamp should not light. If resistance is low or test lamp lights, brush assembly is shorted and must be replaced.



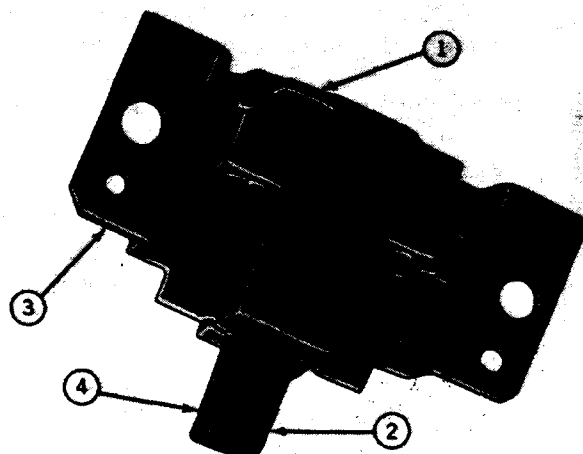
T53739RY

Fig. 28-Brush Insulation Test Points

Continuity Test

Connect an ohmmeter to field terminal (1, Fig. 29) and brush (2). Use an alligator clip to assure good contact to brush. Resistance reading should be zero. Move brush and brush lead wire to make certain that the brush lead wire connections are not intermittent. Resistance reading should not vary when brush and lead wire is being moved around.

Connect ohmmeter to bracket (3) and grounded brush (4). Resistance reading should be zero. Repeat same test on brush lead wire as described in above paragraph.

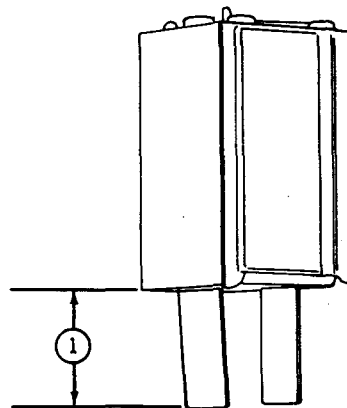


T53740NY

Fig. 29-Brush Continuity Test Points

Measure brush exposed length.

Brush exposed length (minimum) 0.25 inch
(6.5 mm)



T53714N

Fig. 30-Brush Exposed Length

Isolation Diode Test

If a commercial diode tester is used, follow tester manufacturer's testing instructions. If a commercial tester is not available, use a DC test lamp.

IMPORTANT: Do not use a 120-volt test lamp, use a 12-volt DC test lamp only, otherwise diodes will be damaged.

Connect the test lamp to output terminal and regulator terminal (2). Then reverse test probes. The test lamp should light in one direction, but should not light in the other direction.

Repeat test after isolation diode has been removed to ascertain findings.

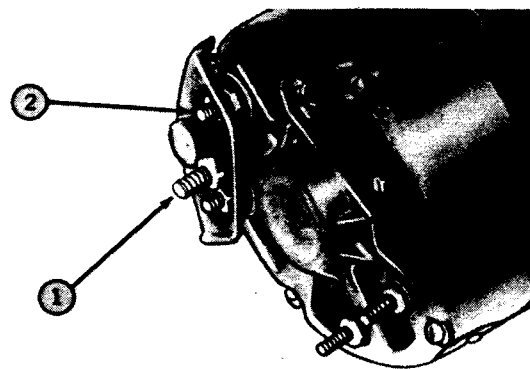
In-Circuit Rectifier Diode Test With Diode Tester

Any commercial in-circuit diode tester will be adequate to make this check. Follow tester manufacturer's recommended testing procedure.

If the in-circuit tester indicates that diodes are faulty, recheck diodes individually after the diode assemblies have been disconnected from stator assembly.

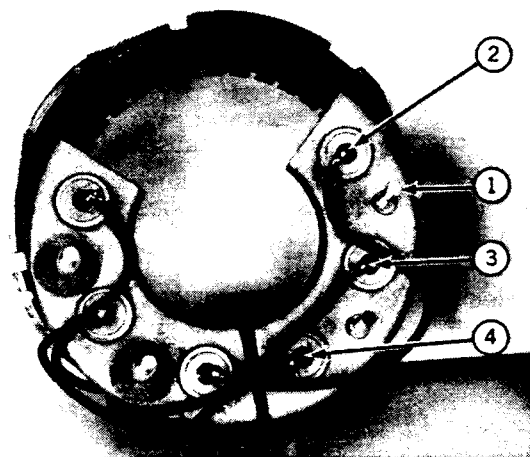
Shorted stator coil or shorted insulating washers or sleeves on positive diode assembly would make diodes appear to be shorted.

To check negative diode assembly, connect tester to diode plate stud (1, Fig. 32) and to diode lead (2). Check remaining diodes (3 and 4) by the same method.



T22230N

Fig. 31-Isolation Diode Test Points



T53741NY

Fig. 32-In-Circuit Negative Rectifier Diode Test Points

To check positive diode assembly, connect tester to output terminal (1, Fig. 33) and to diode lead (2). Check remaining diodes (3 and 4) by the same method.

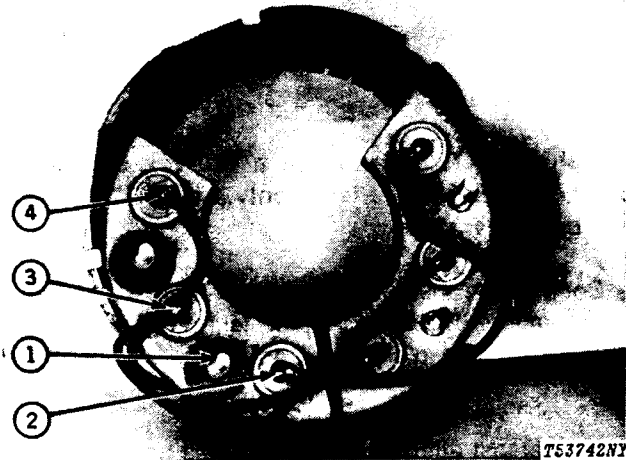


Fig. 33-In-Circuit Positive Rectifier Diode Test Points

In-Circuit Rectifier Diode Test With Test Light

IMPORTANT: Do not use a 120-volt test lamp. Use a 12-volt DC test lamp only; otherwise diodes will be damaged.

To check negative diode assembly, connect test lamp probes to diode plate stud (1, Fig. 34) and to diode lead (2). Reverse test lamp probes. Test lamp should light in one direction only.

Recheck diodes individually after disassembly to determine which diode is shorted if test lamp lights in both directions.

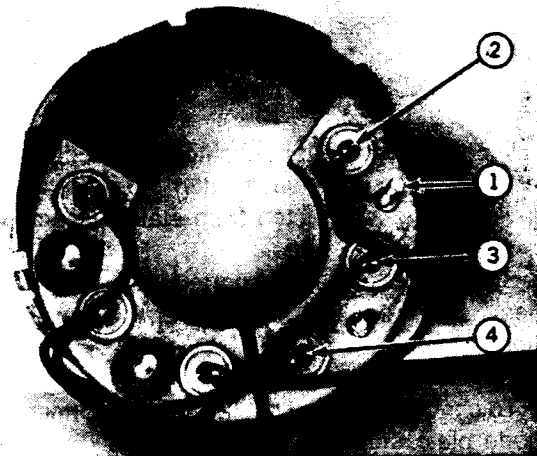


Fig. 34-In-Circuit Negative Rectifier Diode Test Points

To check positive diode assembly, connect test lamp probes to output terminal (1, Fig. 35) and to diode lead (2). Reverse test lamp probes. Test lamp should light in one direction only.

Recheck diodes individually after disassembly to determine which diode is shorted if test lamp lights in both directions.

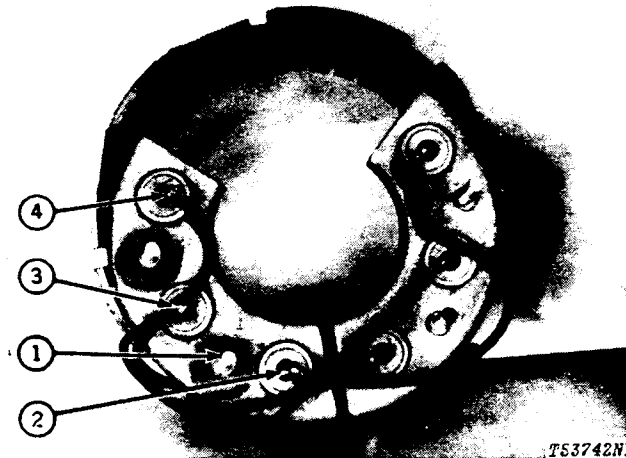


Fig. 35-In-Circuit Positive Rectified Diode Test Points

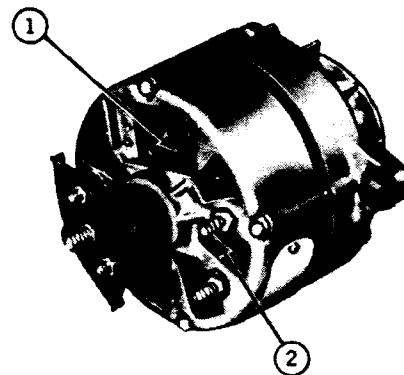
Field Leakage (Short) Test

Remove the regulator and brush assembly.

Connect ohmmeter or test lamp (12 volt or 120 volt may be used) test probes to one of the slip rings (1, Fig. 36) and to the ground terminal (2).

Ohmmeter resistance should be infinite (test lamp should not light).

Repeat test after rotor has been removed to ascertain leakage or short. Connect test probes to one of the slip rings and to rotor shaft.



T53743NY

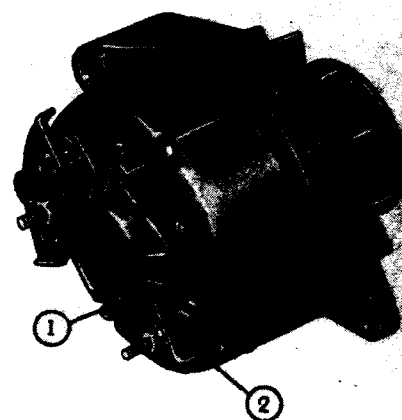
Fig. 36-Field Leakage Test Points

In-Circuit Stator Leakage (Short) Test

IMPORTANT: Do not use a 120-volt test lamp. Use a 12-volt DC test lamp only, otherwise diodes will be damaged.

To check stator leakage, connect test lamp probes to diode plate (1, Fig. 37) and to diode lead 2. Reverse test lamp probes. Test lamp should light in one direction only.

Repeat test after stator has been removed if test light lights in both directions.



T16231N

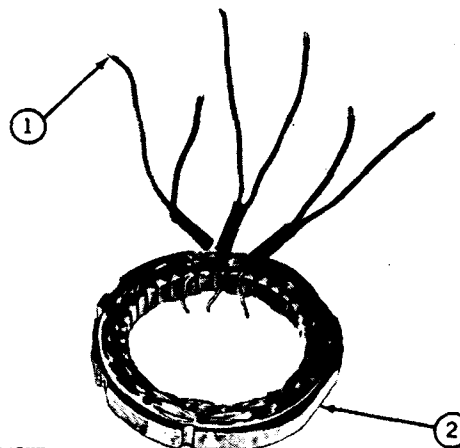
Fig. 37-In-Circuit Stator Leakage Test Points

Out-of-Circuit Stator Leakage (Short) Test

Remove rectifier diode plates and stator as an assembly.

Connect ohmmeter or test lamp (12 volt only) probes to a diode lead (1, Fig. 38) and to the stator (2).

Resistance reading should be infinite (test lamp should not light).



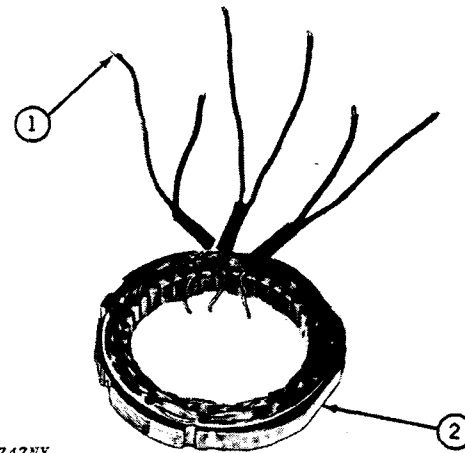
T53747NY

Fig. 38-Out-of-Circuit Stator Leakage Test Points

Stator

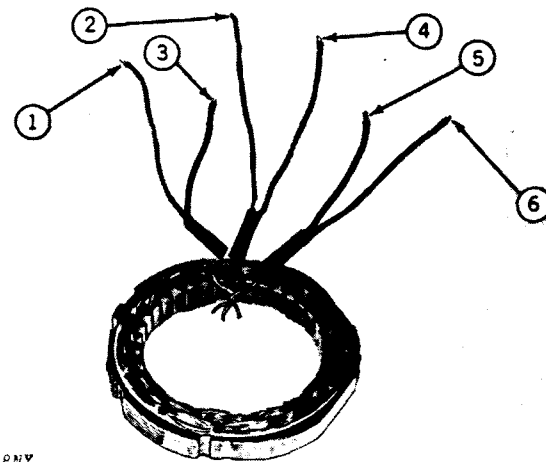
Disconnect the stator leads from the diode leads.

Check for a grounded winding by connecting ohmmeter probes to one stator lead (1, Fig. 39) and to the stator frame (2). The ohmmeter reading should be infinite.



T53747NY

Fig. 39-Grounded Stator Winding Test Points



T53748NY

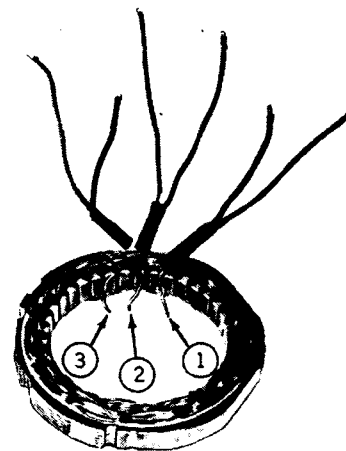
Fig. 40-Shorted Stator Winding Test Points

If a sensitive ohmmeter is not available, disconnect stator leads (1, 2, and 3, Fig. 41).

IMPORTANT: Stator leads may be brittle if they have been overheated or if they are old.



Refer to FOS Manual 20 - Electrical Systems to test stator.



T53749NY

Fig. 41-Stator Leads

Out-of-Circuit Rectifier Diode Test

If a commercial "Alternator Rectifier Diode Tester" is used, follow the tester manufacturer's recommended testing procedure.

IMPORTANT: Do not use a 120-volt test lamp. Use a 12-volt DC test lamp only, otherwise diodes will be damaged.

If a commercial tester or ohmmeter is not readily available, check diodes with a test lamp.

When unsoldering the stator wires from the rectifier diode assembly, provide a heat sink to the diode terminal with long-nosed pliers (Fig. 41).

Connect the test lamp probes to diode terminal (1, Fig. 43) and diode plate stud (2) then reverse test lamp probes. The test lamp should light in one direction but not in the other.

Repeat test on remaining diodes. If test lamp fails to light or lights in both directions on any diode, replace rectifier diode assembly.

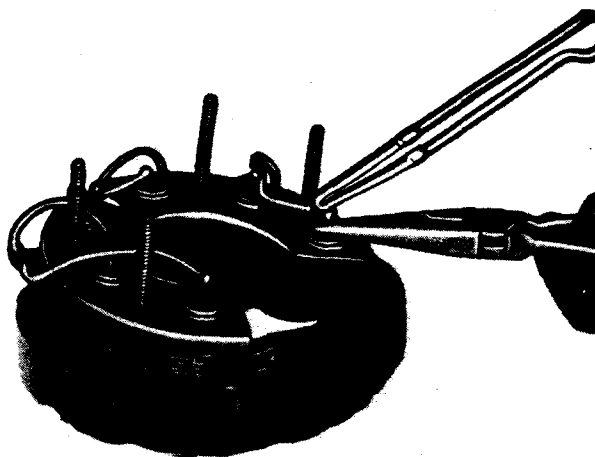
When testing with an ohmmeter, if a needle deflection is observed with the positive lead to the diode stem and negative lead to the case, the diode is positive. The reverse is true for a negative diode.

Positive diodes have red printing and negative diodes have black printing. DO NOT INTERCHANGE THEM.

ASSEMBLY

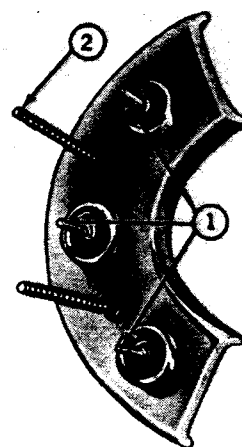
Rear Housing to Front Housing

Assemble stator to rear housing making sure insulating washers (1, Fig. 44) and sleeves (2) are positioned as shown in Fig. 43.



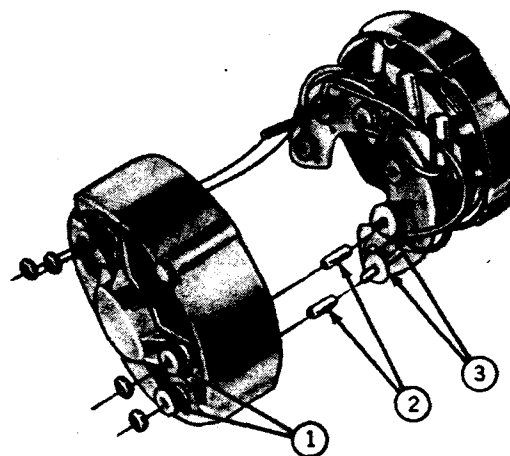
T53738NY

Fig. 42-Unsoldering Diodes



T53750NY

Fig. 43-Rectifier Diode Test Points

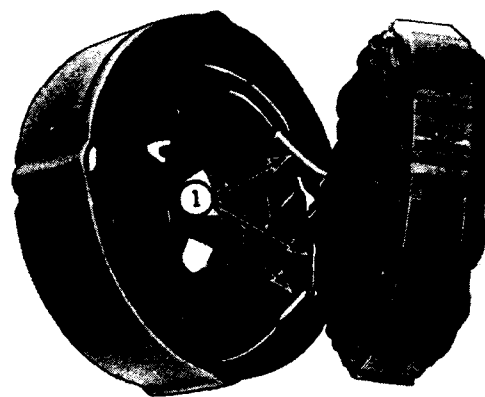


T53751NY

Fig. 44-Stator and Rear Housing Assembly

Position stator leads (1, Fig. 45) to prevent interference with rotor. Assemble stator and rear housing to the rotor and front housing. Tighten through bolts to 50 to 60 lb-in. (5.6 to 6.8 Nm) (0.58 to 0.69 kg-m). Install brush assembly and tighten screws to 20 to 30 lb-in. (2.3 to 3.4 Nm) (0.23 to 0.35 kg-m).

Seal small hole at center of bearing boss in rear housing.

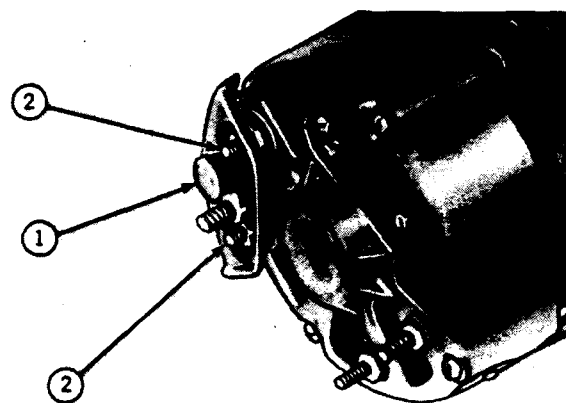


T53754NY

Fig. 45-Stator and Slip Ring End Frame

Before mounting isolation diode, make certain that the positive rectifier diode plate has been properly insulated from housing (Fig. 44).

The isolation diode (1, Fig. 46) is mounted to the positive (+) rectifier diode studs (2).



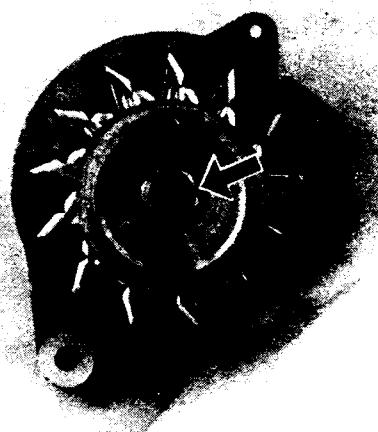
T53756NY

Fig. 46-Isolation Diode Assembly

Pulley

To facilitate tightening pulley retainer lock washer and nut, position Woodruff key, fan and pulley on shaft and grasp in vise with a belt protecting the pulley as shown in Fig. 47 40 to 50 lb-ft (54 to 68 Nm) (6 to 7 kg-m).

Alternator pulley nut torque 40 to 50 lb-ft
 (54 to 68 Nm) (6 to 7 kg-m)



T53778NY

Fig. 47-Alternator Pulley Nut Torque

TESTING

See Group 9015 for charging system testing.

INSTALLATION

Position alternator in mounting brackets and install bolts.

Position alternator drive belt on pulley and tighten drive belt (Group 9010).

Delco-Remy

IMPORTANT: DO NOT ATTEMPT TO POLARIZE THE ALTERNATOR after connecting the battery. No polarization is needed.

Connect red wire to alternator output terminal (1, Fig. 48).

Join plastic connector (2).

Connect battery negative (–) cable to battery negative (–) terminal.

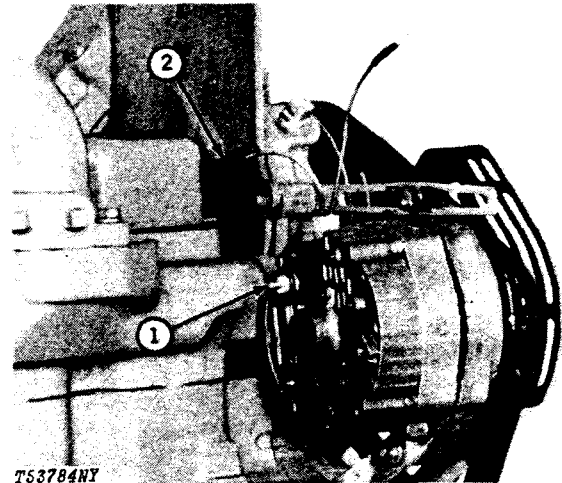


Fig. 48-Delco-Remy Wire Connection

Motorola

IMPORTANT: DO NOT ATTEMPT TO POLARIZE THE ALTERNATOR after connecting the battery. No polarization is needed.

Connect red wire to alternator output terminal (1, Fig. 49).

Join purple wires at plastic connector (2).

Connect battery negative (–) cable to battery negative (–) terminal

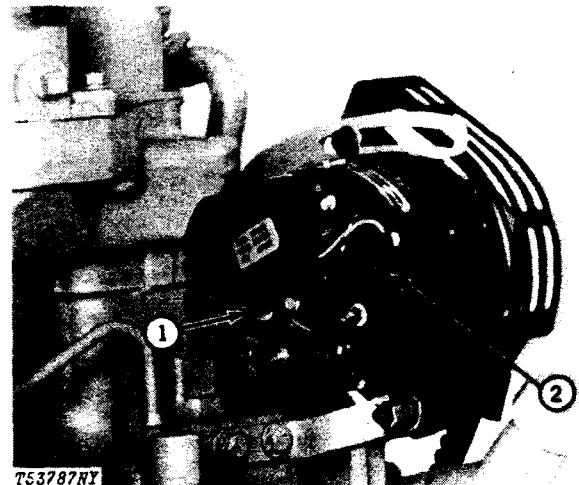


Fig. 49-Motorola Wire Connection

Group 1674

WIRING HARNESS AND SWITCHES

GENERAL INFORMATION

The wiring harness for the power units is shown in Figures 1 and 2. The wiring diagram is on the following page.

REMOVAL

Disconnect the battery negative (–) cable.

Disconnect and mark wires at the alternator (Fig. 1).

Disconnect and mark wires at the wires at the starter (Fig. 1).

Disconnect and mark all wires at the rear panel (Fig. 2).

Disconnect and mark wire at the injection pump.

REPAIR

Test wires with an ohmmeter as necessary.

All wires should have no resistance to current.

Replace all cracked or burned wires.

IMPORTANT: When replacing wires use the correct wire gauge and proper connectors.

INSTALLATION

Route wiring harness through the engine connect wires as needed, use wiring diagram (Fig. 3).

Connect battery negative (–) cable.

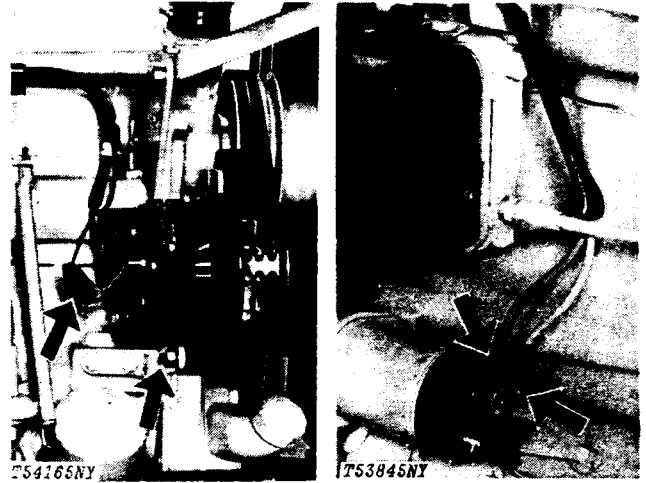


Fig. 1-Alternator and Generator Wiring

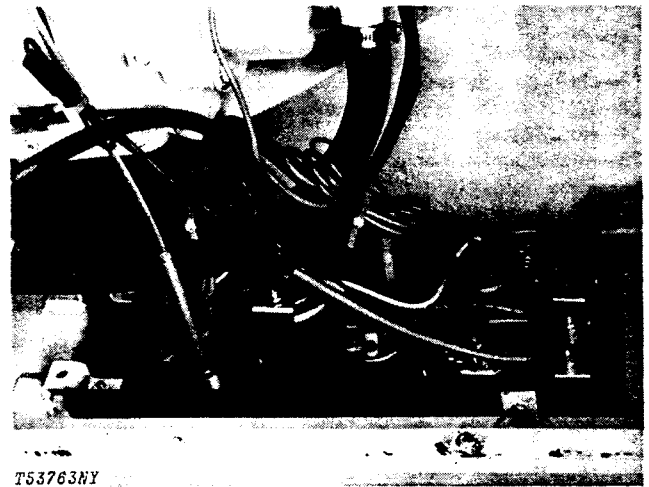
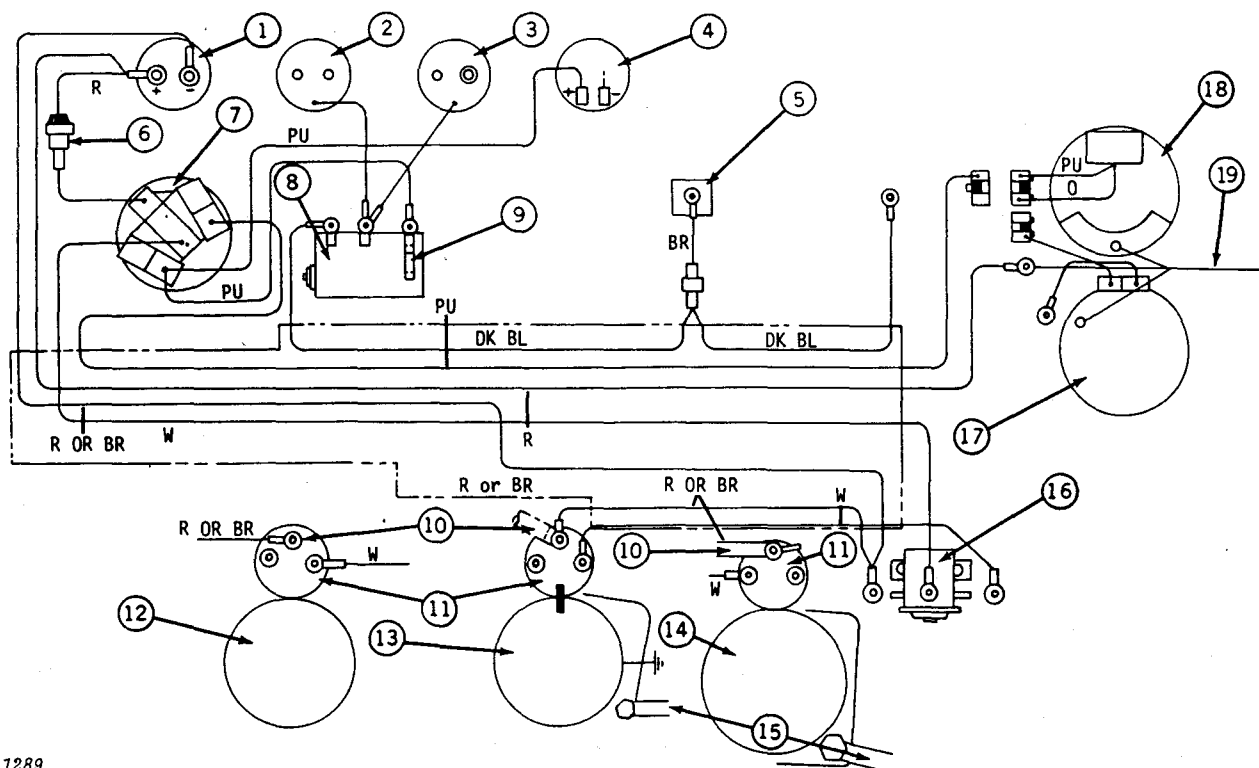


Fig. 2-Instrument Panel



T51289

- 1—Ammeter
- 2—Oil Pressure Gauge
- 3—Water Temperature Gauge
- 4—Hour Meter
- 5—Fuel Injection Pump
- 6—Fuse Holder (25 amp fuse)
- 7—Key Switch
- 8—Safety Switch
- 9—Fuse, 14 amp

- 10—Positive Battery Cable
- 11—Solenoid
- 12—Starting Motor (Delco Remy, R.H. side)
- 13—Starting Motor (Delco Remy, L.H. side)
- 14—Starting Motor (John Deere)
- 15—Negative Battery Cable
- 16—Starting Circuit Relay
- 17—Alternator (Delco Remy)
- 18—Motorola
- 19—Output to Battery

- R—Red
- O—Orange
- BL—Blue
- BR—Brown
- W—White
- PU—Purple
- DK—Dark

Fig. 3-Wiring Diagram

Group 1676

INSTRUMENTS AND INDICATORS

GENERAL INFORMATION

The power unit is equipped with both mechanical and electrical instruments and indicators as shown in Fig. 1.

TACHOMETER (FIG. 1)

The tachometer is mechanically driven by a cable that is routed to the flywheel housing (Fig. 2).

Removal

Remove engine side shields.

Disconnect battery negative (-) cable.

Disconnect tachometer cable from the flywheel housing (Fig. 2).

Disconnect tachometer cable from the tachometer gauge (Fig. 2).

Remove tachometer gauge mounting screws.

Remove tachometer.

Repair

Inspect cable for defects; replace as necessary.

If tachometer is defective, replace it.

Installation

Install the tachometer and replace the mounting fasteners with lock washers.

Run cable through hole in back panel and fasten to tachometer drive.

Fasten cable to the tachometer.

Replace engine side.

Connect battery negative (-) cable.

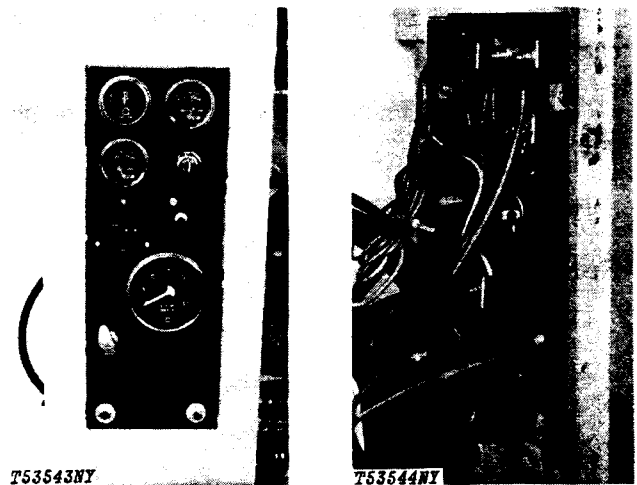


Fig. 1-Instrument Panel Front and Rear

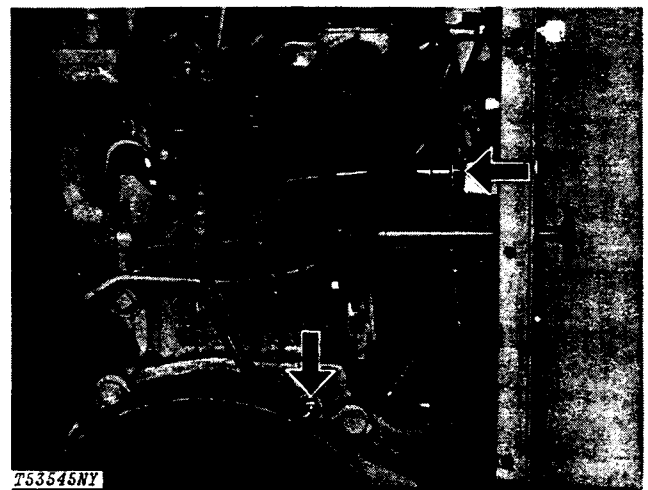


Fig. 2-Tachometer Drive

AMMETER

Removal

Disconnect battery negative (-) cable.

Remove fasteners that attach ammeter wires to the charging system.

Remove fasteners that attach ammeter to mounting bracket.

Remove ammeter.

Repair

Clean contacts if necessary.

If ammeter is defective replace it.

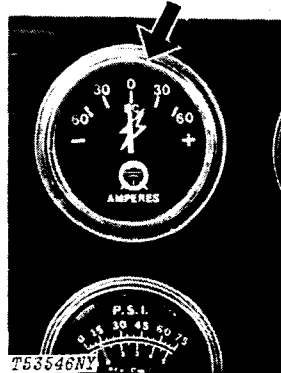


Fig. 3-Front and Rear of Ammeter

16

Installation

Install ammeter.

Install ammeter fasteners.

Install ammeter wires and fasteners.

Connect battery negative (-) cable.

ENGINE HOUR METER

The hour meter is electric and records time as the ignition switch is turned on.

Removal

Disconnect battery negative (-) cable.

Disconnect wires behind the hour meter and mark their position with tape (Fig. 4).

Remove front screws of the hour meter (Fig. 4).

Remove the hour meter.

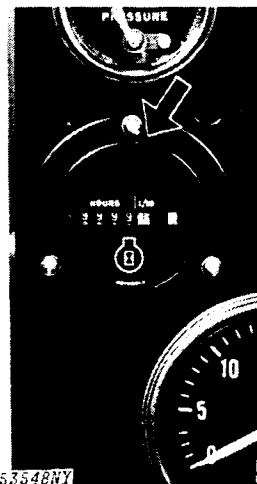


Fig. 4-Front and Rear of Hour Meter

Repair

Clean contact behind hour meter.

Replace hour meter if necessary.

Installation

Place and fasten hour meter on the panel.

Connect wires, remove the tape and connect battery negative (-) ground cable.

6. If reading at No. 1 terminal is under 2 volts, there is an open energizing circuit. Check alternator fuse. Check between batteries to key switch "BAT" terminal, between key switch "BAT" and "IGN" terminals and between key switch "IGN" terminal and alternator No. 1 terminal.

7. If reading at No. 1 terminal is 2 to 9 volts, connect ammeter between alternator "BAT" terminal and the starter solenoid "BAT" terminal. Connect carbon pile across battery. Operate engine at 1800 rpm. Adjust carbon pile to obtain maximum output.

IMPORTANT: Disconnect battery ground straps when making connections if not using tong-type ammeter.

If output reading is 45 amps, alternator is not defective, recheck steps 1 through 5.

If output is below 45 amps, ground field by inserting screwdriver into test hole (9, Fig. 9).

IMPORTANT: Tab is within 3/4 inch (19.05 mm) of casting surface. Never force screwdriver deeper.

Operate engine at same speed as before. Adjust carbon pile to obtain maximum output.

Now if the output goes above 45 amps, replace regulator and check field winding.

If output is still low, check field windings, brushes, diode trio, rectifier bridge and stator. See Group 1672.

8. If reading at alternator No. 1 terminal (Fig. 8) is above 9 volts, insert screwdriver into test hole (Fig. 9) to ground field winding.

Now if reading goes below 9 volts, replace regulator and check field windings.

If reading stays above 9 volts, check brushes, slip rings, and field windings for open circuit. See Group 1672.

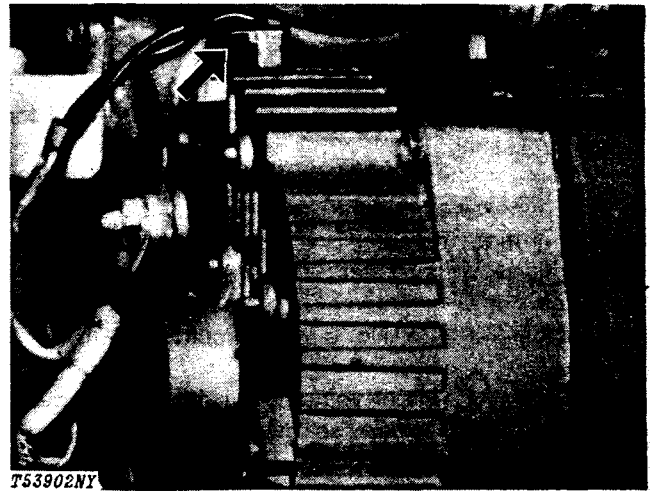


Fig. 8-Alternator Test

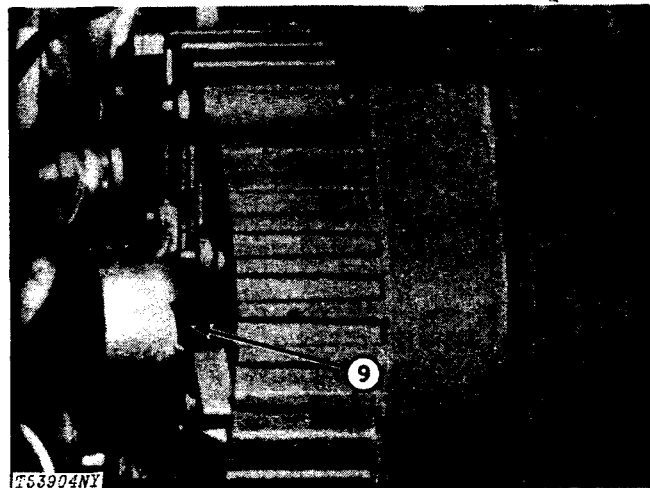


Fig. 9-Alternator Test

The following is a test and check procedure for an overcharged battery condition.

1. First check battery condition. See Group 1671 for "Battery Testing."

2. Connect voltmeter to alternator No. 2 terminal and to ground. Turn key switch on. Voltmeter should read 9 to 12 volts (battery voltage) (Fig. 14).

If reading is zero, No. 2 lead circuit is open.

If reading is battery voltage, but an obvious overcharge condition exists as evidenced by excessive battery water usage, proceed as follows:

a. Separate end frame as covered in Group 1672. Check field winding for shorts (see Group 1671). If shorted, replace rotor and regulator.

b. Connect ohmmeter using lowest range scale from brush lead clip to end frame (Fig. 11), then reverse lead connections.

If both readings are zero, either the brush lead clip is grounded or regulator is defective.

A grounded brush lead clip can result from omission of insulating washers (1, Fig. 11) or sleeve at screw. Remove screw to inspect sleeve. If satisfactory, replace regulator.

Testing Alternator Output on Unit

Disconnect wire from alternator output (BAT) terminal and connect ammeter between disconnected wire and output terminal (Fig. 13). Connect a carbon pile resistor (turned off) to the battery. Run engine at 1800 rpm and adjust carbon pile to obtain maximum output of 50 amps or more.

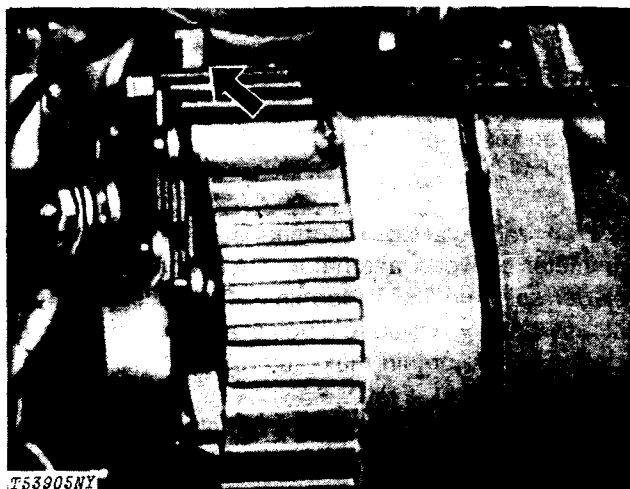


Fig. 10-Alternator Test

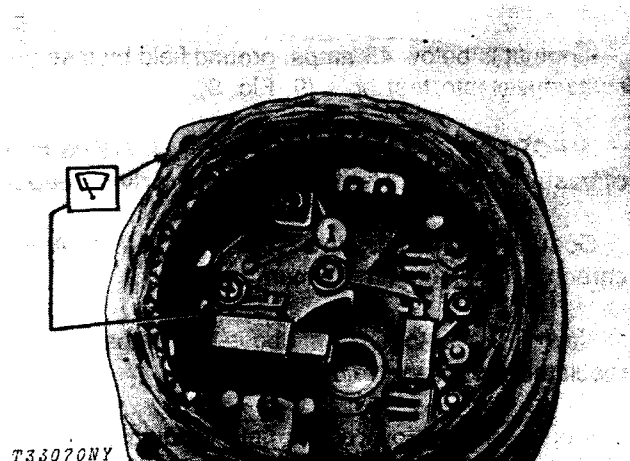


Fig. 11-Ohmmeter Connected to Brush Lead Clip and to End Frame

Testing Regulator

The regulator must be checked with an alternator that is in good condition. Connect voltmeter (with ± 0.1 volt accuracy) to the alternator output terminal (BAT) and a good ground (Fig. 11). With charged batteries and the regulator brought to operating temperatures, the voltage should be as shown for the temperatures in the chart.

Measure the temperature about 1 inch (25 mm) from the slip ring end frame of the alternator.

Temperature	Voltage
85°F (29°C)	14.5-15.0 volts
105°F (41°C)	14.3-14.8 volts
125°F (52°C)	14.1-14.7 volts
145°F (63°C)	13.9-14.5 volts

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Group 9035

SPECIFICATIONS AND SPECIAL TOOLS

ENGINE

SPECIFICATIONS AND TORQUE VALUES

Basic Engine

Combustion chamber
compression pressure
at 200 rpm engine
warm (minimum) 350 psi
(24 bar) (25 kg/cm²)

Combustion chamber
compression pressure
difference (maximum) 50 psi
(3 bar) (4 kg/cm²)

Engine Lubrication System

Oil pressure at 2500 rpm with engine oil at
normal operating temperature 45 to 65 psi
(3 to 4 bar) (3 to 4 kg/cm²)

Engine Cooling System

Radiator leakage test
pressure (maximum) 9 psi
(0.6 bar) (0.6 kg/cm²)

Radiator pressure cap
valve opening pressure 6.25 to 7.50 psi
(0.4 to 0.5 bar) (0.4 to 0.5 kg/cm²)

Fan belt deflection
(no gauge) 0.75 in. at 25 lb.
(19 mm at 111 N) (19 mm at 11 kg)

Fan belt deflection
(with gauge) (new
belt) 100 to 110 lb.
(445 to 490 N) (45 to 50 kg)

Fan belt deflection
(with gauge) (old
belt) 80 to 110 lb.
(356 to 490 N) (36 to 50 kg)

ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

Fuel System

Fuel supply pump
pressure 2 to 2.5 psi
(0.1 to 0.2 bar) (0.1 to 0.2 kg/cm²)

Injection pump cam advance:

Pump Numbers
JDB435MD2793 (AR70530)

1. At 1900 rpm (full load) set at 6° (check 6° ± 1°).
2. Advance must finish 7-1/2° minimum movement by 2500 rpm full load.
3. No load advance 4° movement at 1100 rpm.

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JDB331MD2406 (AR49904)

1. At 1900 rpm (full load) set 6° (check 6° ± 1°).
2. Advance must finish 7-1/2° minimum movement by 2200 rpm full load.
3. No load advance is 4° movement at 1300 rpm.

JDB635AL2446 (AR51568)

1. At 1500 rpm (full load) set 4° (check 4° ± 1°).
2. Advance must finish 5-1/2° minimum movement by 2300 rpm full load.
3. No load advance is 4° movement 1200 rpm.

JDB435AL2442 (AR51747)

1. At 1900 rpm (full load) set 5° (check 5° ± 1°).
2. Advance must finish 6-1/2° minimum movement by 2500 rpm full load.
3. No load advance is 4° movement at 1100 rpm.

ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

Speed Control Linkage

Speed control rod
excess travel
(fast idle) 1/8 to 1/4 in.
(3 to 6 mm)

Speed control rod
excess travel
(slow idle) 1/8 to 1/4 in.
(3 to 6 mm)

ENGINE SPECIAL TOOLS

Essential Tools

Tool Number	Use
D14550-BA	Compression Gauge Adapter - to check engine compression.

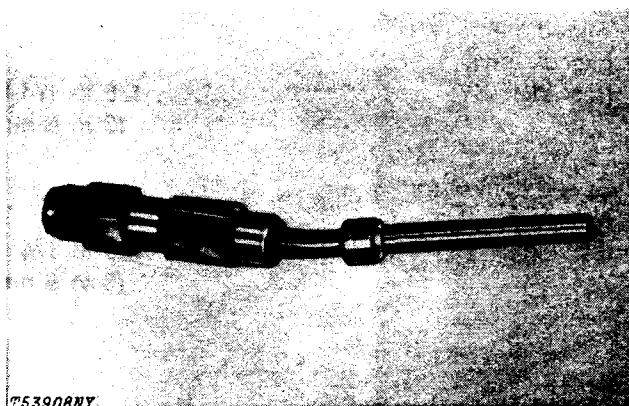


Fig. 1-Compression Gauge Adapter

D14547-BA	Compression Gauge - to check diesel engine compression.
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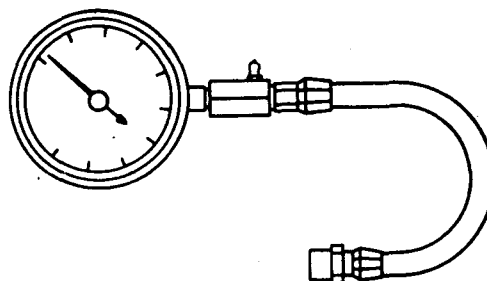


Fig. 2-Compression Gauge

Pressure Gauge - to check oil and fuel pressures.

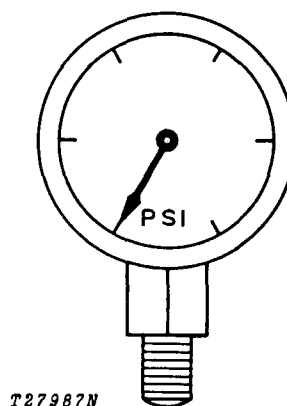


Fig. 3-Pressure Gauge

ENGINE SPECIAL TOOLS

Essential Tools—Continued

Tool Number	Use
19918	Used for timing engines with Roosa Master DM fuel injection pumps.
13366	Used for timing engines with Roosa-Master JDB fuel injection pumps.

T31920N

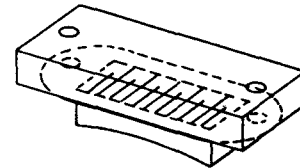


Fig. 4-Timing Window

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Starting Circuit Test Values

Test No. 1	9-12 Volts
Test No. 2	9-12 Volts
Test No. 3	9-12 Volts
Test No. 4	Zero Volts

Charging Circuit Test Values

Motorola Alternator

Test No. 1 - Isolation Diode Check
(Key Switch Off) 0 volts

Test No. 2 - Field Circuit Check
(Key Switch On, Engine
Not Running) 1.5 - 2.5 volts

90 Test No. 3 - Isolation Diode Check
(Key Switch On, Engine Running)
Regulator terminal 15.4 volts
Output terminal 14.4 volts

Test No. 4 - Field Draw Test (Key
Switch Off) 2 to 2.5 amps

Test No. 5 - Checking Alternator and Regulator
With Regulator Disconnected (Key
Switch On, Engine
Running) 15 to 16 volts

Test No 6 - 35 Amp Alternator Output
25 Amps 13 to 15 volts

55 Amp Alternator Output
43 Amps 13 to 15 volts

Test No. 7 - Testing Regulator (after
fifteen minutes of operation
at 1500 rpm) See Chart

Temperature*	Voltage
40° F (4° C)	14.4 - 14.9 volts
60° F (16° C)	14.3 - 14.7 volts
80° F (27° C)	14.2 - 14.6 volts
100° F (38° C)	14.0 - 14.4 volts
120° F (49° C)	13.8 - 14.3 volts
140° F (60° C)	13.6 - 14.1 volts

*Measured one inch (25 mm) from regulator.

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

Charging Circuit Test Values

Delco Remy Alternator

- Test No. 5 Key switch on, engine stopped
9-12 volts.
- Test No. 6 Key switch on, engine stopped 2
volts.
- Test No. 7 Engine running at 180 rpm—at
least 70 percent of rated output
amperage.
- Test No. 8 Engine running 9 volts.

Over Charged Battery Condition

- Test No. 2 Key switch on 9-12 volts.
- Alternator Output Engine running: 70% of rated out-
put amperage.

Regulator tests.

Temperature	Voltage
0°F (-18°C)	14.9 ± 2.5 volts
80°F (27°C)	14.2 ± 2.5 volts
160°F (71°C)	13.4 ± 2.5 volts

ELECTRICAL SYSTEM

SPECIAL TOOLS

Essential Tools

Tool Number

Use

Voltmeter - Check starting circuit, charging circuit, light circuit, accessory circuit and control circuits. Fig. 1.

Ammeter - Check charging circuit, injection pump solenoid winding and horn. Fig. 1.

Ohmmeter - Check injection pump solenoid, fuel gauge sender and control circuits. Fig. 1.

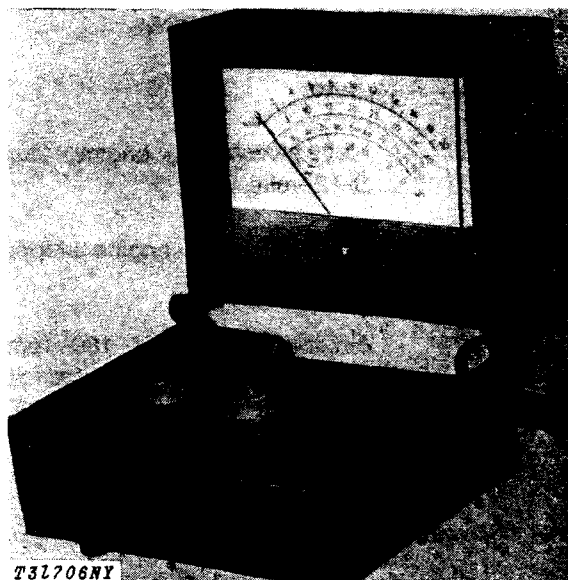


Fig. 1-Voltmeter, Ammeter and Ohmmeter