

CONNECTING RODS AND PISTONS (0403)**SPECIFICATIONS AND TORQUE VALUES—Continued**

Ring groove clearance (maximum) 0.008 inch
(0.20 mm)



Fig. 26-Rectangular Ring Groove Clearance

Connecting Rod Cap Screw Torque

Engine	Connecting Rod Cap Screw torque
3-164	65 ± 5 lb-ft (88 ± 7 Nm) (9 ± 0.7 kg-m)
4-219	65 ± 5 lb-ft (88 ± 7 Nm) (9 ± 0.7 kg-m)
4-276	95 ± 5 lb-ft (129 ± 7 Nm) (13 ± 0.7 kg-m)
6-329	65 ± 5 lb-ft (88 ± 7 Nm) (9 ± 0.7 kg-m)
6-414	95 ± 5 lb-ft (129 ± 7 Nm) (13 ± 0.7 kg-m)

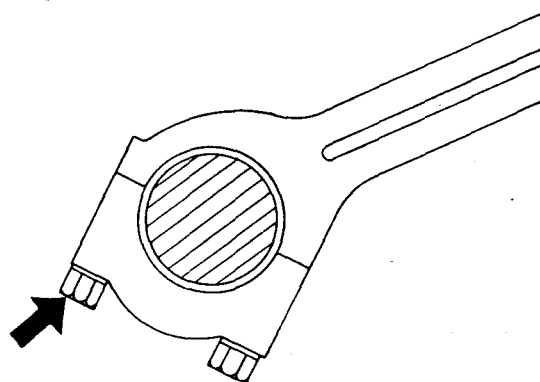


Fig. 27-Connecting Rod Cap Screw Torque

CAMSHAFT AND VALVE ACTUATING MEANS (0402)

SPECIFICATIONS AND TORQUE VALUES—Continued

Rocker arm shaft	
O.D. (new) (1, Fig. 20)	0.787 to 0.788 inch (19.99 to 20.02 mm)
Rocker arm shaft	
O.D. (minimum) (1)	0.785 inch (19.94 mm)
Rocker arm shaft	
support I.D. (new) (2)	0.790 to 0.792 inch (20.07 to 20.12 mm)
Rocker arm shaft support	
I.D. (maximum) (2)	0.794 inch (20.17 mm)
Rocker arm I.D.	
(new) (3)	0.790 to 0.792 inch (20.07 to 20.12 mm)
Rocker arm I.D.	
(maximum) (3)	0.794 inch (20.17 mm)

Rocker arm support cap screw	
torque	35 lb-ft (47 Nm) (5 kg-m)

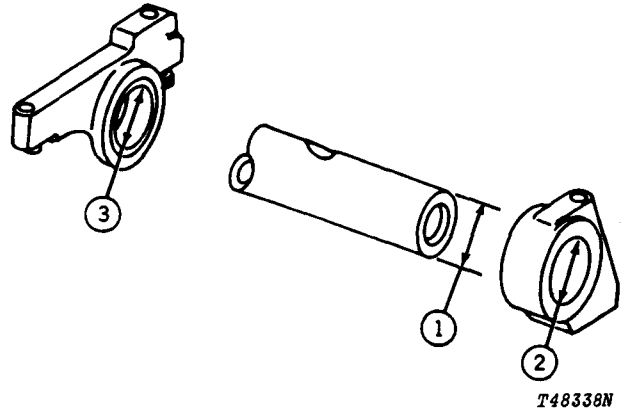
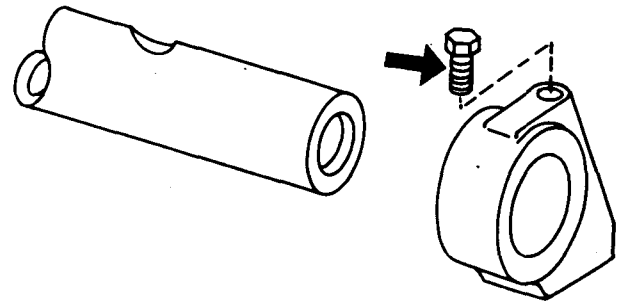


Fig. 20-Rocker Arm Measurement



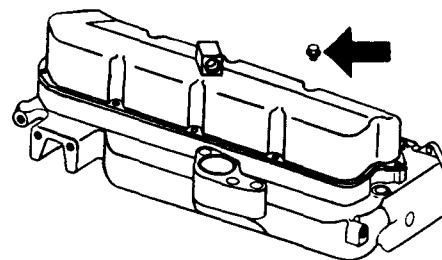
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Fig. 21-Rocker Arm Support Cap Screw Torque

CAMSHAFT AND VALVE ACTUATING MEANS (0402)

SPECIFICATIONS AND TORQUE VALUES—Continued

Rocker arm cover cap screw
torque 20 to 25 lb-in.
(2.3 to 2.8 Nm) (0.23 to 0.29 kg-m)

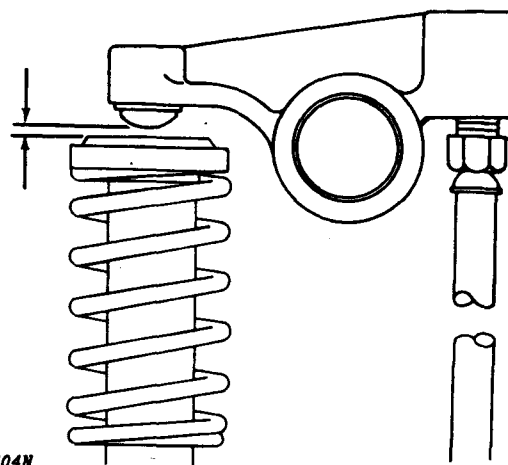


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Fig. 22-Rocker Arm Cover Cap Screw Torque

Intake valve clearance 0.014 inch
(0.36 mm)

Exhaust valve clearance 0.018 inch
(0.46 mm)



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Fig. 23-Valve Clearance

CAMSHAFT AND VALVE ACTUATING MEANS (0402)

SPECIFICATIONS AND TORQUE VALUES—Continued

Idler gear shaft O.D. 1.750 to 1.751 inch
(44.45 to 44.48 mm)

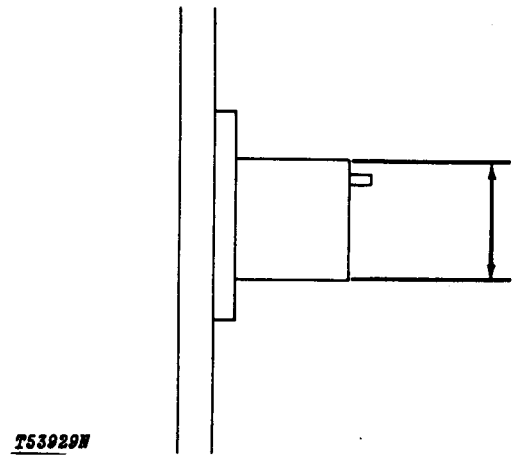


Fig. 14-Idler Gear Shaft Measurement

Idler gear shaft spring pin
height 0.20 to 0.28 inch
(5.1 to 7.1 mm)

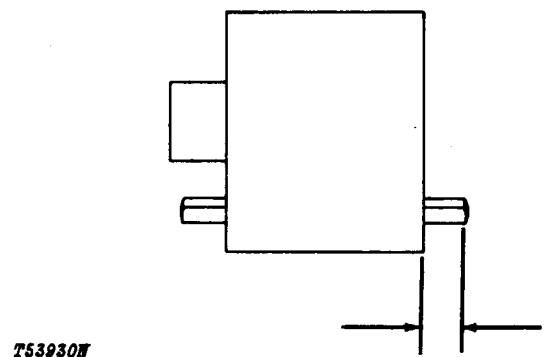


Fig. 15-Spring Pin Height

Idler gear bushing
I.D. (new) 1.752 to 1.753 inch
(44.50 to 44.53 mm)

Idler gear bushing oil
clearance (new) 0.002 to 0.004 inch
(0.05 to 0.10 mm)

Idler gear bushing oil
clearance (max.) 0.006 inch
(0.15 mm)

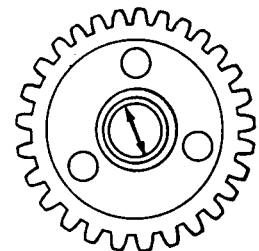
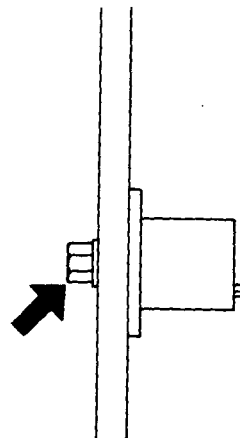


Fig. 16-Idler Gear Oil Clearance

CAMSHAFT AND VALVE ACTUATING MEANS (0402)**SPECIFICATIONS AND TORQUE VALUES—Continued**

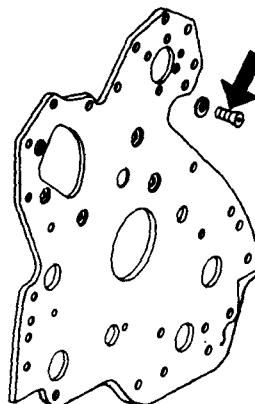
Lower idler gear shaft torque 95 lb-ft
(129 Nm) (13 kg-m)



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Fig. 17-Lower Idler Gear Shaft Torque

Engine front plate screw 20 to 25 lb-ft
torque (27 to 34 Nm) (2.8 to 3.5 kg-m)



T53933N

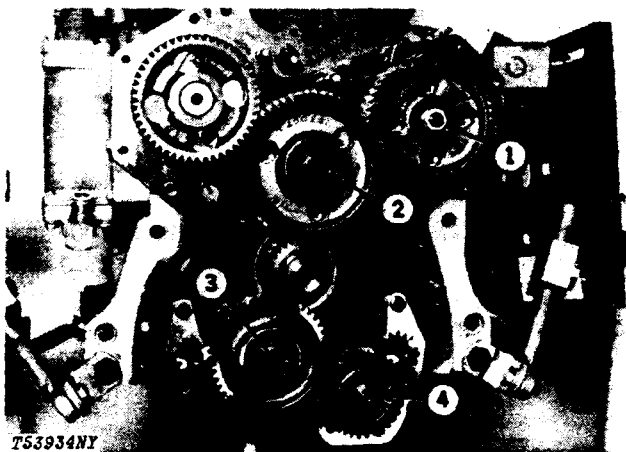
Fig. 18-Front Plate Screw Torque

Fuel injection pump gear 20 lb-ft
torque (1, Fig. 19) (27 Nm) (3 kg-m)

Upper idler gear torque (2) 65 lb-ft
(88 Nm) (9 kg-m)

Lower idler gear torque (3) 95 lb-ft
(129 Nm) (13 kg-m)

Pump gear torque (4) 35 to 45 lb-ft
(47 to 61 Nm) (5 to 6 kg-m)



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Fig. 19-Timing Gear Train Torque

CAMSHAFT AND VALVE ACTUATING MEANS (0402)

SPECIFICATIONS AND TORQUE VALUES—Continued

Camshaft end play (new) 0.003 to 0.009 inch
(0.08 to 0.23 mm)

Camshaft end play (max.) 0.015 inch
(0.38 mm)

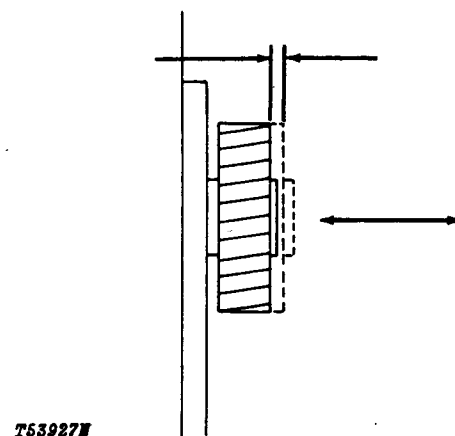


Fig. 9-Camshaft End Play

Camshaft gear backlash 0.003 to 0.014 inch
(0.08 to 0.36 mm)

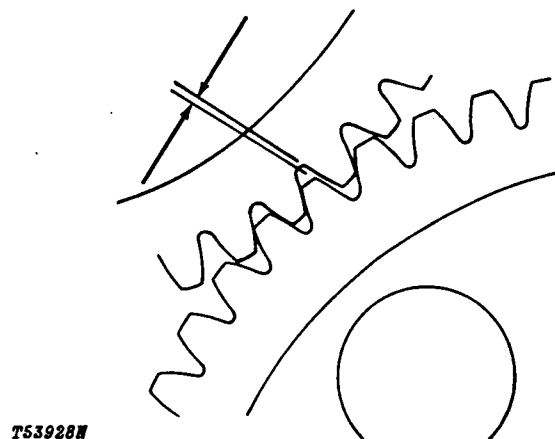


Fig. 10-Camshaft Gear Backlash

Camshaft bearing journal O.D. (new)
(1, Fig. 11) 2.200 to 2.201 inch
(55.87 to 55.90 mm)

Camshaft bearing journal O.D. (min.) 2.199 inch
(55.85 mm)

Thrust plate thickness (new) (2) ... 0.156 to 0.158 inch
(3.96 to 4.01 mm)

Thrust plate thickness (min.) 0.151 inch
(3.84 mm)

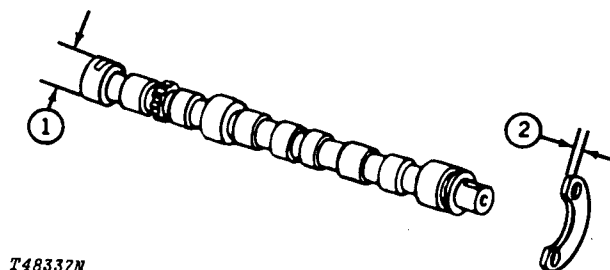
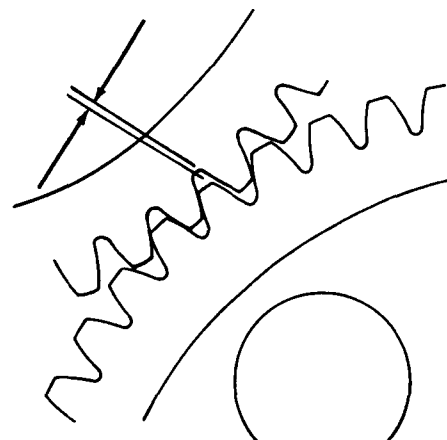


Fig. 11-Camshaft Measurement

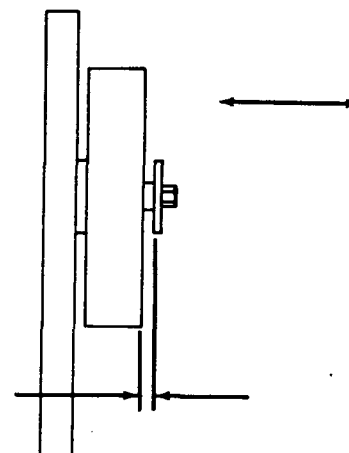
CAMSHAFT AND VALVE ACTUATING MEANS (0402)**SPECIFICATIONS AND TORQUE VALUES—Continued****Timing Gear Train Backlash**

Gear (New)	Backlash
Injection pump to upper idler . . .	0.003 to 0.014 inch (0.08 to 0.36 mm)
4 Crankshaft to upper idler	0.003 to 0.017 inch (0.08 to 0.43 mm)
Crankshaft to lower idler	0.003 to 0.014 inch (0.08 to 0.36 mm)
Oil pump to left balancer	0.002 to 0.014 inch (0.05 to 0.36 mm)
Oil pump to lower idler	0.003 to 0.014 inch (0.08 to 0.36 mm)
Lower idler to right balancer	0.002 to 0.016 inch (0.05 to 0.41 mm)
Upper idler to camshaft	0.003 to 0.014 inch (0.08 to 0.36 mm)
Idler gear end play (new)	0.001 to 0.007 inch (0.03 to 0.18 mm)
Idler gear end play (max.)	0.015 inch (0.38 mm)



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Fig. 12-Timing Gear Train Backlash



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Fig. 13-Idler Gear End Play

CRANKSHAFT AND MAIN BEARINGS (0401)

SPECIFICATIONS AND TORQUE VALUES—Continued

Main bearing cap screw torque 85 lb-ft
(115 Nm) (12 kg-m)

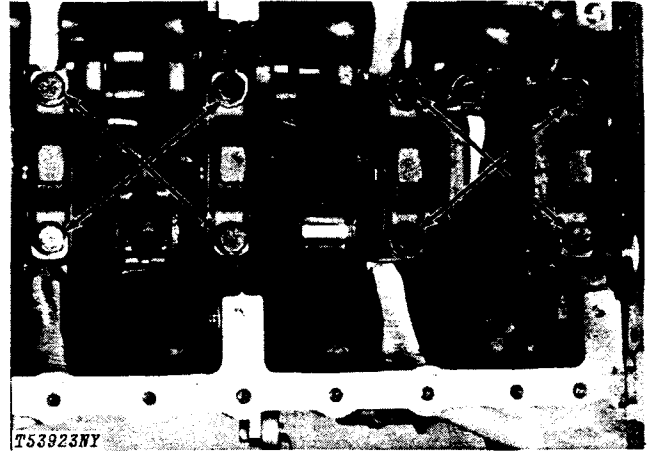


Fig. 4—Main Bearing Cap Screw Torque

Engine	Connecting Rod Cap Screw Torque
3-164D	65 lb-ft (88 Nm) (9 kg-m)
4-219D	65 lb-ft (88 Nm) (9 kg-m)
4-276T	95 lb-ft (129 Nm) (13 kg-m)
6-329D	65 lb-ft (88 Nm) (9 kg-m)
6-414D	95 lb-ft (129 Nm) (13 kg-m)
6-414T	95 lb-ft (129 Nm) (13 kg-m)

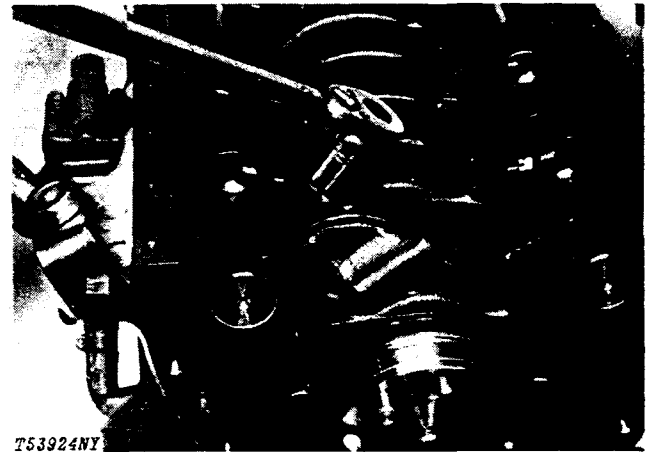
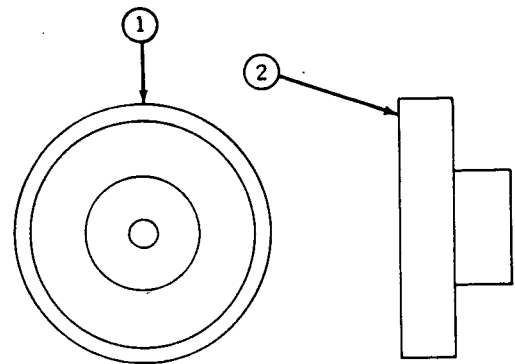


Fig. 5—Connecting Rod Cap Screw Torque

Vibration damper total run-out
(1, Fig. 6) 0.060 inch
(1.52 mm)

Vibration damper total wobble
(2, Fig. 6) 0.060 inch
(1.52 mm)



T53925N

Fig. 6—Vibration Damper Measurement

CRANKSHAFT AND MAIN BEARINGS (0401)

SPECIFICATIONS AND TORQUE VALUES—Continued

Vibration damper cap screw torque 85 lb-ft
(115 Nm) (12 kg-m)

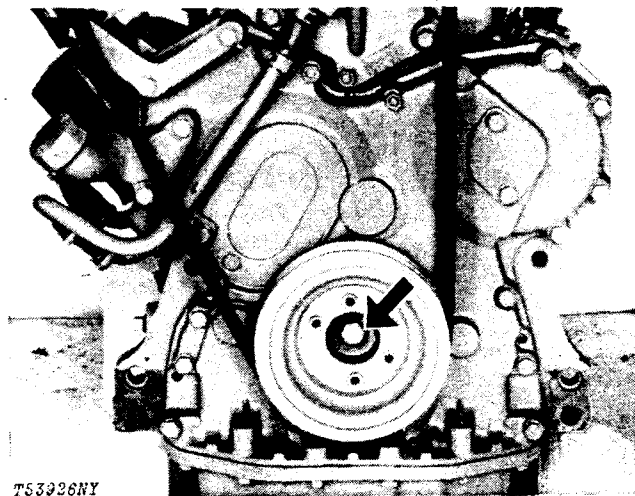


Fig. 7-Vibration Damper Cap Screw Torque

CAMSHAFT AND VALVE ACTUATING MEANS (0402)

SPECIFICATIONS AND SPECIAL TOOLS

Valve Lift

Intake 0.460 to 0.490 inch
(11.68 to 12.45 mm)

Exhaust 0.456 to 0.482 inch
(11.58 to 12.24 mm)

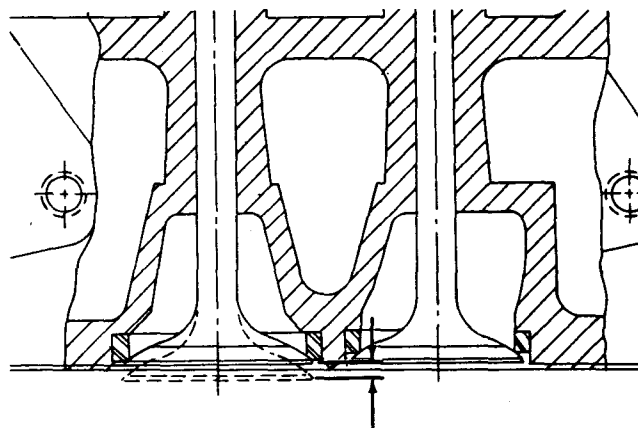


Fig. 8-Valve Lift

Group 0499

SPECIFICATIONS AND SPECIAL TOOLS

ENGINE BREAK-IN

SPECIFICATIONS AND TORQUE VALUES

NOTE: Whenever possible, use a dynamometer to provide a more accurate break-in, assuring proper initial seating of new piston rings.

Time	Load*	Engine Speed	Remarks
5 MINUTES	NO LOAD	800 RPM (SLOW IDLE)	CHECK OIL
5 MINUTES	NO LOAD	1500 TO 2000 RPM (1/2 THROTTLE)	PRESSURE,
5 MINUTES	1/4 LOAD	1900 TO 2200 RPM (3/4 THROTTLE)	COOLANT
10 MINUTES	1/2 LOAD		TEMPERATURE,
10 MINUTES	1/2 TO 3/4 LOAD		AND LEAKAGE
10 MINUTES**	3/4 TO FULL LOAD		
100 HOURS+ T49644N	ALL LOADS		FIELD ONLY

*Loads can be simulated in the field by controlled operation.

**After this run, loosen cylinder head bolts 45 degrees; then retighten bolts one at a time, in sequence (Group 0409), with 95 lb-ft (129 Nm) (13 kg-m) torque. Loosen rocker arm support cap screws; then retighten with 35 lb-ft (47 Nm) (5 kg-m) torque. Check and reset valve clearance.

+ After break-in, drain crankcase oil, and remove filter. Install new filter and fill crankcase with oil of proper viscosity and service classifications.

CRANKSHAFT AND MAIN BEARINGS (0401)

SPECIFICATIONS AND TORQUE VALUES

Crankshaft end play (new) 0.002 to 0.008 inch
(0.05 to 0.20 mm)

Crankshaft end play (max) 0.015 inch
(0.38 mm)

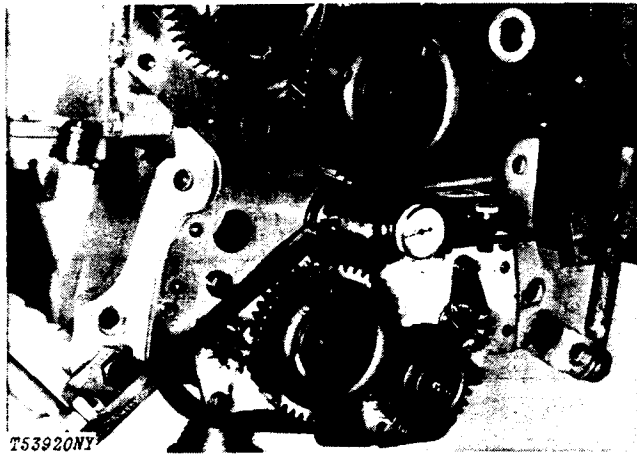


Fig. 1-Crankshaft End Play

Main bearing journal O.D.
(new) 3.123 to 3.124 inch
(79.32 to 79.35 mm)

Assembled main bearing I.D.
(new) 3.126 to 3.128 inch
(79.40 to 79.45 mm)

Main bearing clearance (max) 0.006 inch
(0.15 mm)

Main bearing clearance
(new) 0.0017 to 0.0047 inch
(0.043 to 0.119 mm)

Journal taper (max.)
(1, Fig. 3) 0.001 inch per 1.00 inch
(0.03 mm per 25.4 mm)

Journal out-of-round (max.) (2, Fig. 3) ... 0.003 inch
(0.08 mm)

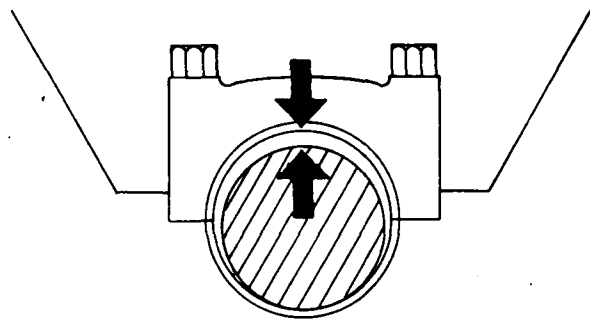


Fig. 2-Main Bearing Clearance

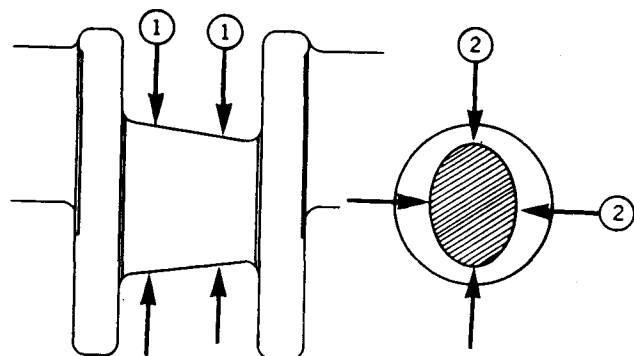


Fig. 3-Main Bearing Journal Measurement

Group 0433

FLYWHEEL, HOUSING AND FASTENINGS

GENERAL INFORMATION

The ring gear for the starting motor is shrunk in place on the front of the outer rim of the flywheel. On the front of the outer rim of the flywheel is a "TDC" (top dead center) mark which is used when timing the injection pump, and adjusting cam followers.

REMOVAL

Remove flywheel housing cover (2, Fig. 1).

Remove tachometer drive adapter and pinion if equipped.

CAUTION: Flywheel weighs approximately 85 lb. (39 kg). Plan proper handling procedures to avoid injuries.

Remove two flywheel attaching cap screws and install two pilot studs in their place.

Remove remaining flywheel attaching cap screws.

Remove flywheel.

Examine ring gear (Fig. 2) for worn or broken teeth.

Remove and replace ring gear if damaged.

CAUTION: Oil fumes or oil can ignite above 380°F (193°C). Use a thermometer and do not exceed 360°F (182°C). Do not allow a flame or heating element to be in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

Heat new ring gear evenly in oil (to 360°F [182°C] maximum) or in oven (to 450°F [232°C] maximum) and install hot, with ring gear tooth chamfer toward engine side of flywheel. Drive ring gear onto flywheel until it bottoms all the way around on flywheel shoulder.

Remove flywheel housing from cylinder block (1, Fig. 1).

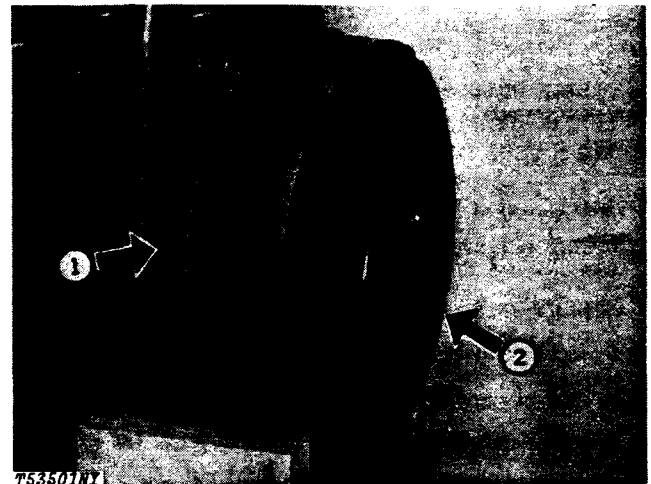


Fig. 1-Flywheel and Housing

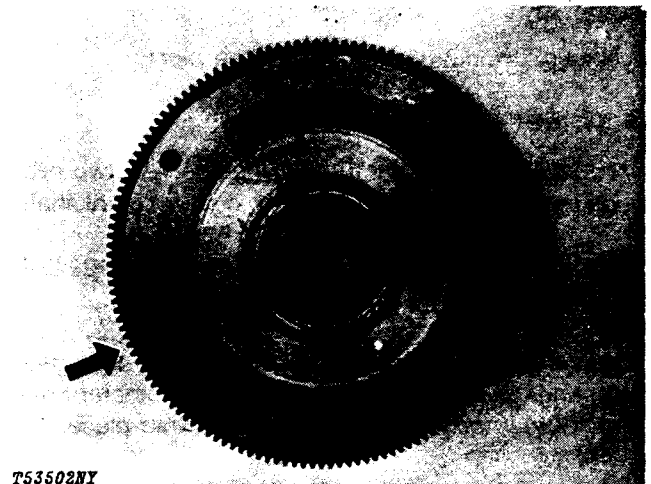


Fig. 2-Flywheel

Remove rear oil seal from flywheel housing.

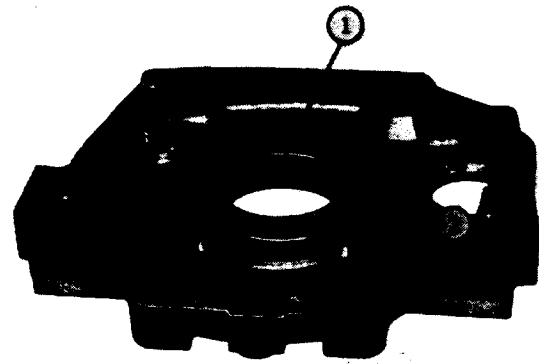
Place flywheel housing on a flat even surface. Install new rear oil seal.

Place JD297-2 Pilot (1, Fig. 3) and oil seal (2) in housing as shown.

It is not necessary to use 27409 Handle (1, Fig. 4) with the JD297-1 (2, Fig. 4) Driver to install the oil seal (3) but it does help.

Use a mallet to drive in the oil seal until the driver bottoms on the pilot.

Replace crankshaft wear ring (Group 0401).



T46608N

Fig. 3-Pilot and Oil Seal in Place

INSTALLATION

Replace flywheel housing gasket.

Position JD250-4 seal protector over rear of crankshaft and coat protector and wear ring with engine oil.

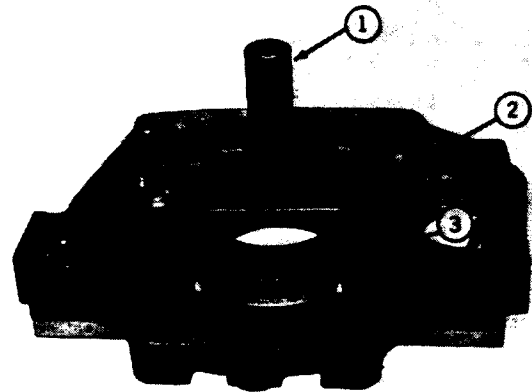
Install flywheel housing on engine block.

Flywheel

To facilitate installation of flywheel, screw two pilot studs into flywheel mounting screw holes in crankshaft.

Install and tighten attaching cap screws to 120 lb-ft (163 Nm) (17 kg-m) torque.

Install tachometer drive pinions making sure gear teeth engage with teeth on camshaft tachometer drive gear. Screw tachometer drive adapter into place.



T46609N

Fig. 4-Installing Crankshaft Rear Oil Seal

Group 0429

FAN DRIVE

GENERAL INFORMATION

The engine will be equipped with either a blower fan-blade or a suction fan-blade.

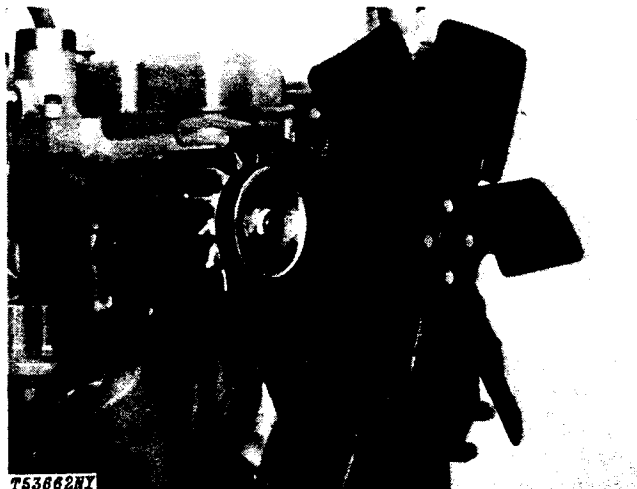


Fig. 1-Fan Removal

REMOVAL

Remove fan attaching cap screws (Fig. 1).

Remove fan.

Loosen alternator belts (1, Fig. 2).

Remove fan belt.

Remove fan pulley, see Group 0417.

Remove bolt on lower pulley (2, Fig. 2).

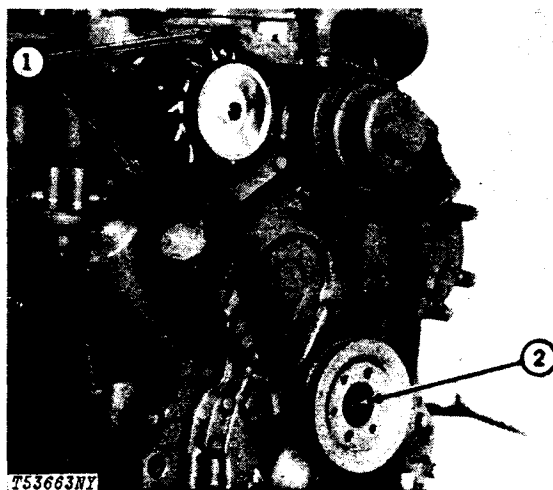


Fig. 2-Fan Drive Removal

Carefully remove lower pulley with a puller (Fig. 3).

IMPORTANT: The lower pulley on six cylinder engines is a vibration damper that prevents torsional damage to the crankshaft. Handle dampers with care. They are sensitive to impact and should not be dropped or hammered on.

Inspect fan for bent blades or missing blade rivets.

4

Inspect pulleys for damage.

Check belt for cracking and wear, replace if necessary.

INSTALLATION

To replace upper pulley refer to Group 0417.

Carefully fit the lower pulley on the crankshaft (Fig. 3).

Replace bolt on crankshaft pulley (Fig. 3).

Replace and bolt fan.

Replace fan belt.

Adjust fan belt.

Fan belt tension:

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

After 3 minutes of operation: 80 lb. minimum (356 N) (36 kg).

Without gauge: 3/4 inch (19 mm) flex with 20 lb. (89 N) (9 kg) force.

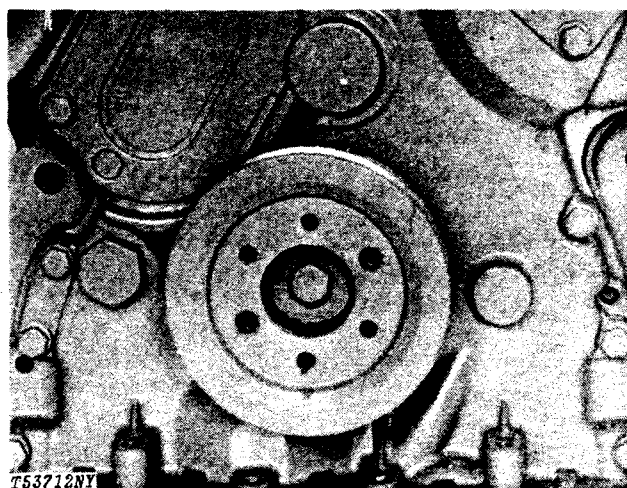


Fig. 3-Puller

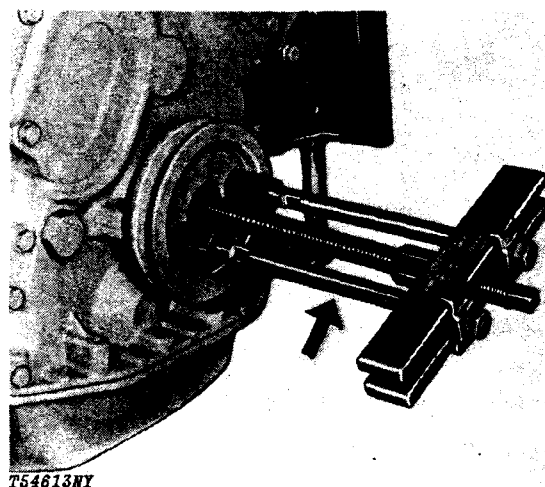


Fig. 4-Fan Drive Replacement (Lower Pulley)

Group 0423

ALTERNATOR AND GENERATOR MOUNTING

GENERAL INFORMATION

The alternator is located on the upper right side of the engine (Fig. 1).

REMOVAL

Loosen bolts (Fig. 1) that hold alternator to engine.

Remove belt from alternator pulley.

Remove bolts and lift off alternator.

INSTALLATION

Replace alternator and bolt in bracket. Set belt tension (Fig. 2).

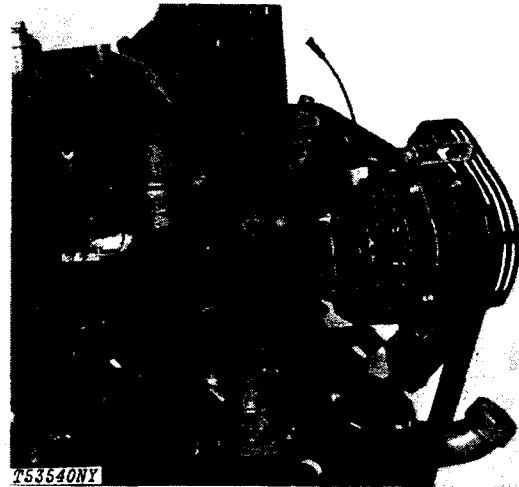


Fig. 1-Alternator Location

Belt Tension

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

After 3 min. of operation: 80 lb. minimum (356 N) (36 kg).

Without gauge: 3/4 inch (19 mm) flex with 20 lb. (89 N) (9 kg) force.

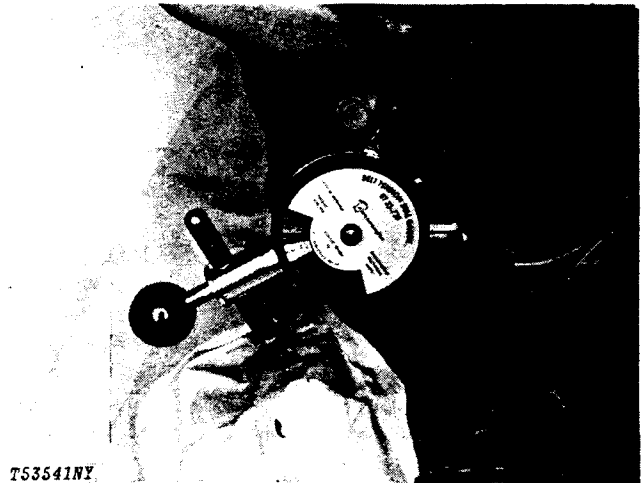


Fig. 2-Fan Belt Tension

When installing the brushes, twist brush leads 180 degrees (Fig. 30). Press the leads of the insulated brush down against the brush.

Give the assembled starting motor a no load test. Solenoid action during the test should be satisfactory.

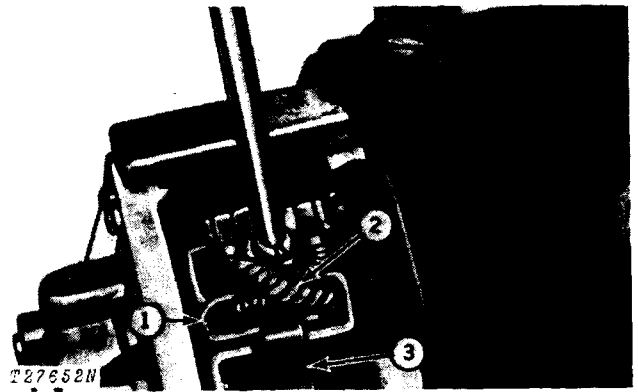


Fig. 30-Brush Installation

No Load Test

Connect a fully charged 12-volt battery (1) with a reserve capacity rating of 290 min., rheostat (2), ammeter (3), control switch (4), voltmeter (5), and tachometer (7) to the starting motor as shown in (Fig. 31).

Throw switch.

Starting motor should rotate smoothly at a constant speed of at least 3100 rpm at 11.7 volts with a current draw at less than 110 amps.

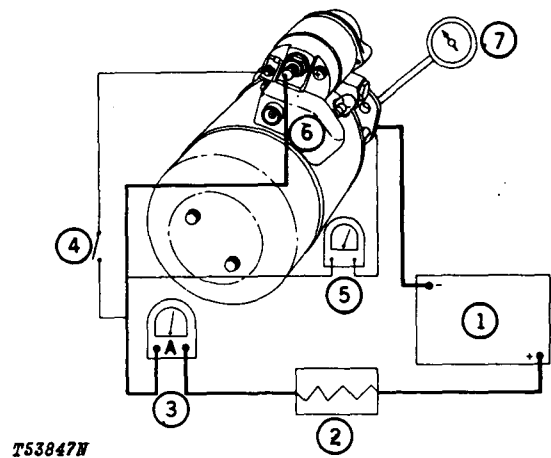


Fig. 31-No Load Test Circuit (After Assembly)

Install starting motor and secure to flywheel housing with cap screws.

Connect to solenoid (5, Fig. 31) terminal (1) the positive battery cable (1), the solenoid to starting circuit relay (6) and the solenoid to alternator output terminal (2). Connect the solenoid to starting circuit relay (3) to the 5 terminal.

Connect battery.

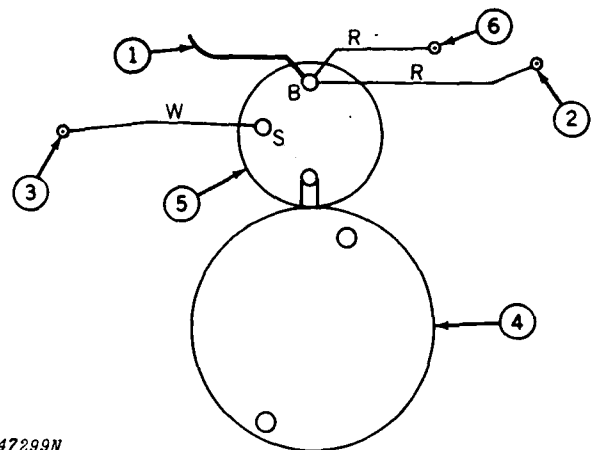


Fig. 32-Solenoid Wire Connections

4

Overrunning Clutch and Pinion

Do not immerse the overrunning clutch and pinion 4, Fig. 21 in a cleaning solvent. The unit has been pre-lubricated and solvent will wash lubricant away. It may be cleaned with a cloth moistened with a cleaning solvent and wiped dry.

Rotate the pinion. Pinion gear should rotate smoothly (but not necessarily easily) in one direction, and should not rotate in the opposite direction.

If the pinion gear does not rotate smoothly, or if it is worn, chipped, or burred, it should be replaced.

Field Windings and Shunt Windings

Grounded Circuit Test (Fig. 24)

Remove the screw and hang the eyelet terminal in the air. Using an ohmmeter set to read on its highest scale, place one test lead on the copper terminal bolt and the other lead on a clean spot of the field frame (Fig. 24). If the ohmmeter dial indicator swings toward zero, a grounded circuit is indicated. Replace the field windings.

Shunt Winding Open Circuit Test (Fig. 25)

To check the shunt windings, set the ohmmeter to read on its lowest scale. Place one test lead on the terminal bolt and the other lead on the eyelet terminal (Fig. 25). If the ohmmeter does not swing to zero, it is open circuited and the field winding assembly will have to be replaced.

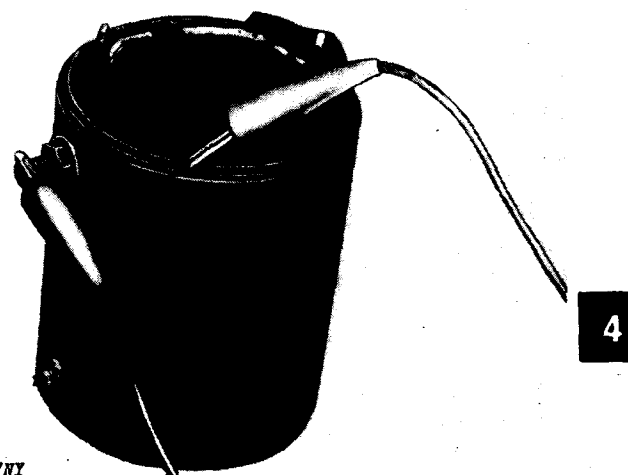
Field Winding Open Circuit Test (Fig. 26)

To check the field windings for an open circuit set the ohmmeter to read on its lowest scale and place one test lead on the copper terminal bolt and the other lead on the bare field end (Fig. 26). If the ohmmeter dial indicator does not swing to zero, the field windings are open-circuited. Replace the field windings.

Field Winding Installation

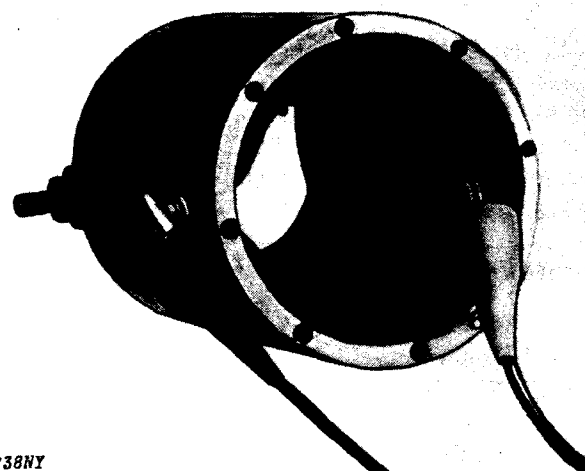
Before removing pole shoes, scribe marks on the pole shoe and the field frame to be sure they will be assembled in their original position.

Remove pole shoe screws from field frame.



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Fig. 24-Grounded Circuit Test



T53838NY

Fig. 25-Shunt Winding Open Circuit Test



T53839NY

Fig. 26-Field Winding Open Circuit Test

Remove pole shoe and windings.

Install new windings and replace proper pole shoes. Torque pole shoe screws to 30 lb-ft (41 Nm) (4 kg-m)

Brushes

Replace brushes if they are oil soaked or if they are worn shorter than 5/8 in. (15.9 mm). Check brush insulated holders for grounds.

4 Brush Holder Insulation Test (Fig. 27)

With the ohmmeter set to its highest reading scale, connect one test lead onto the commutator end frame and the other lead to the brush holder Fig. 27. If the dial indicator swings towards zero, the positive brush holder is grounded and should be replaced.

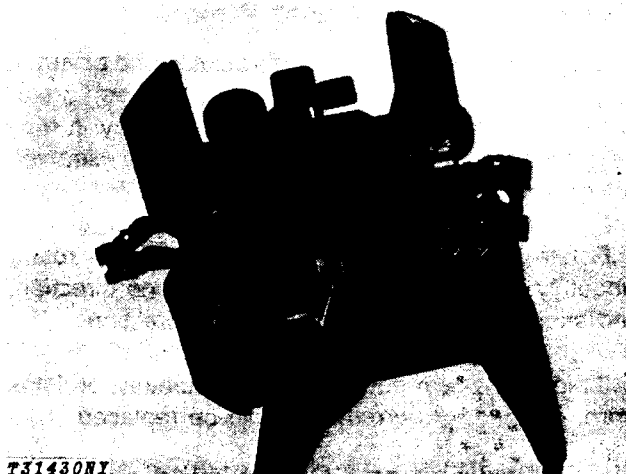


Fig. 27-Brush Holder Insulation Test

Brush Spring Tension (Fig. 28)

Measure the brush spring tension with a spring scale. The brush spring tension should be a minimum of 40 ounces (1 134 g) as the spring just leaves the brush holder. When taking the reading, the scale should be on a line parallel with the edge of the brush holder.

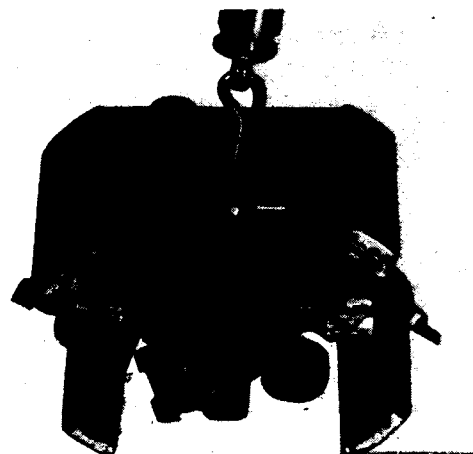


Fig. 28-Measuring Brush Spring Tension

Solenoid

Remove nuts from solenoid "S" terminal (2, Fig. 29) and from pull-in terminal (3). Then remove switch cover (1).

When installing switch cover (1, Fig. 29), place gaskets (4) on winding terminal, align main contact vertically, and place packing (5) on switch cover.

IMPORTANT: Solenoid contacts and plunger will be damaged if voltage is applied to solenoid when it is removed from starting motor.

ASSEMBLY

To assembly starting motor, reverse the disassembly procedures. Use new seals and packings.

Lubricate the shift lever, overrunning clutch, thrust washers, bushings, and armature bearing surfaces with John Deere Multi-Purpose Lubricant.

If the shift lever was removed, tighten the shift lever pivot screw with 30 lb-ft (41 Nm) (4 kg-m). Bend washered edge of screw down to prevent loosening.

Tighten center bearing housing to field frame bolts with 6 lb-ft (8 Nm) (0.8 kg-m). Tighten drive end and commutator end frame bolts with 10 lb-ft (14 Nm) (1 kg-m).

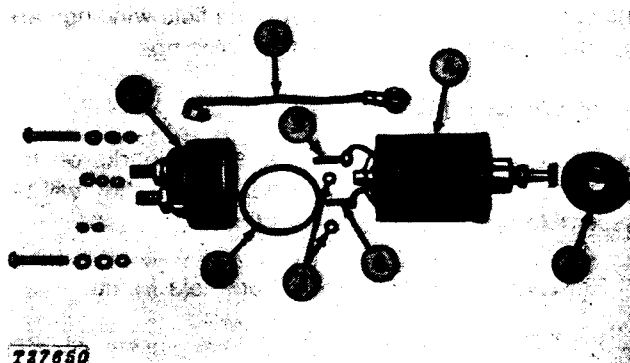


Fig. 29-Solenoid

Commutator and Drive End Bushing Tools

Component	Bushing Removal	Bushing Installation
Handle	27487	27487
Disk (spacers)	27491	
	27492	
Disk	27494	27495
Disk (pilot)	27493	27493

Center Bushing

Component	Bushing	Oil Seal
Handle	27487	27487
Disk	27505	27512
Disk (pilot)	27501	27501

Check new bushings using the table below.

Commutator and Drive End Bushing Specifications*

I.D. of bushing	0.6693 to 0.6704 in. (17.00 to 17.03 mm)
Oil clearance**	0.0036 to 0.0070 in. (0.091 to 0.178 mm)
Maximum clearance**	0.016 in. (0.41 mm)
Bushing depth	0.008 to 0.022 in. (0.20 to 0.56 mm)

*Reaming may be necessary after installation.

Center Bushing Specifications

I.D. of bushing	1.182 to 1.184 in. (30.02 to 30.07 mm)
Maximum clearance**	0.0236 in. (0.599 mm)
Bushing depth	0.017 to 0.032 in. (0.43 to 0.81 mm)

**The clearance is the difference between the shaft and the I.D. of the bushing.

Armature

Check armature for straightness. Runout should not exceed 0.006 inch (0.15 mm). Maximum commutator runout is 0.016 inch (0.41 mm). If necessary, turn commutator and undercut insulation to 1/32-inch (0.794 mm). Undercut should never be less than 0.008 inch (0.20 mm). Commutator O.D. must be 1.77 inches (45.0 mm) or more. Clean copper dust from between the segments.

Check armature for opens, shorts and grounds. Burned edge of commutator indicates an open circuit.

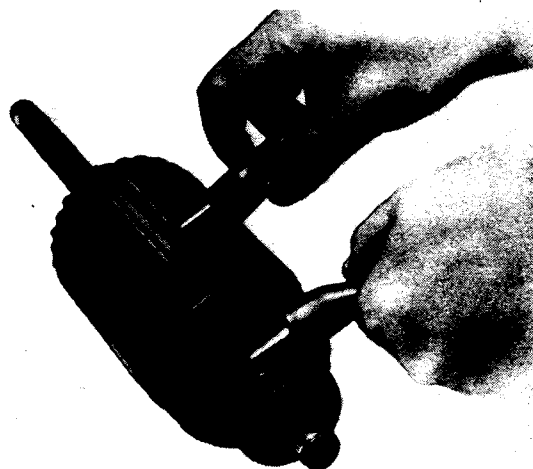
Short Circuit Test

Place the armature in a growler and hold a hacksaw blade above each slot while slowly rotating the armature. If a coil is shorted, the blade will be attracted to and repelled from the slot.

4

A short circuit most often occurs because of copper dust or filings between two commutator segments. A short of this nature can be corrected by removal of such material.

With the ohmmeter set to read on its highest scale, place one test lead on the commutator and the other lead on the armature core or shaft (Fig. 22). If the test meter indicator swings towards zero, the armature is grounded. Replace armature.



T53835NY

Fig. 22-Armature Ground Test

With the ohmmeter set to read on its lowest scale, place one test lead on the commutator segment and the other test lead on an adjacent segment (Fig. 23). Repeat this operation for all segments by moving one lead at a time. If the test meter indicator does not swing to zero and remains stationary, the armature coil between these two segments is open. Replace armature.



T53836NY

Fig. 23-Open Circuit Test

Burned commutator segments are usually an indication of an open circuited coil.

REPAIR

Refer to Fig. 21 for relative position of parts. Page 0422-17.

NOTE: Starting motor has metric bolts and nuts except for those on the solenoid switch cover.

Disconnect shunt winding lead (11, Fig. 21). Remove terminal cover (28), field coil connector (27), and solenoid assembly.

Remove end frame cover (30, Fig. 21) and gasket.

Remove brushes (33, Fig. 21), commutator end frame assembly (35) and brush ground strap (29).

Remove field frame (36).

Remove drive end housing (2, Fig. 21).

Drive pinion stop (18) toward pinion and remove snap ring (19) and pinion stop (18).

Remove armature (12) from center bearing housing (8).

Remove overrunning clutch assembly (4, Fig. 21) brake washer (17), and shift lever wear pads.

Remove shift lever pivot and shift lever (7, Fig. 21).

Cleaning

4 When cleaning component parts, do not immerse the solenoid, field windings or armature in cleaning solvent. Immersing any of these in solvent may damage their insulation. These may be cleaned by wiping the parts with a cloth that has been slightly moistened with cleaning solvent and then wiped dry with a clean dry cloth.

Do not immerse the drive end housing, overrunning clutch, center bearing housing, or commutator end frame in cleaning solvent. All of these parts have been prelubricated and solvent will wash this lubricant away. These components should be cleaned in the same method just mentioned, using a cloth slightly moistened with cleaning solvent and then wiped dry with a clean dry cloth.

All other parts which are not made of rubber or mentioned above can be dipped in clean solvent to remove all oil and dirt.

If replacing center bushing (15, Fig. 21), install a new oil seal (14, Fig. 21) and a new oil felt (16) saturated with engine oil.

When replacing bushings, press the new bushings in from the chamfered end. Make a bushing drive as shown in Group 0499 or use the following handle and disks from the D01046AA Universal Driver Set. Align hole in commutator and lubrication wick.

No Load Test

Make the connections shown in Fig. 20 starting with the battery (1) positive (+) terminal. Run a heavy wire to the positive terminal of the amp meter (3). From the negative (-) terminal of the amp meter run a heavy wire to the "Bat" terminal of the solenoid. Connect a switch (5) between the "Bat" and the "S" terminal. Reconnect the field coil connector. Connect the starter case to the negative of the battery. Connect a carbon pile resistor (2) across the positive (+) and negative (-) of the battery (1). Connect a voltmeter across the "Bat" and the starter case. Connect a tachometer to the starter drive.

Throw the switch.

The starting motor should draw 70 to 110 amps at 9.0 volts.

The armature speed should be 2500 to 4500 rpm.

Low Speed, High Current Draw

- Excessive friction.
- Shorted armature.
- Grounded armature or fields.

High Speed, Low Current Draw

- Open shunt field circuit.

High Speed, High Current Draw

- Shorted series field coils.

No Load Test Diagnosis

Fails to Operate, Low Current Draw (Approx. 25 amps)

- Open series field circuit.
- Open armature coils.
- Defective brush contact with commutator.

Fails to Operate, High Current Draw

- Grounded terminal or fields.
- Seized bearings.

Low Speed, Low Current Draw

- High internal resistance.
- Defective brush contact with commutator.

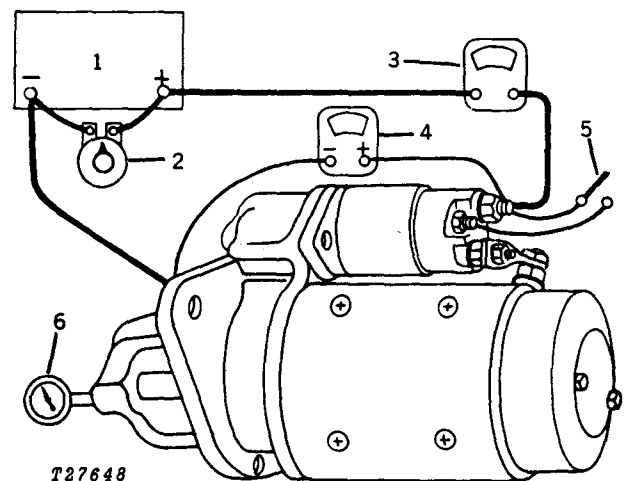
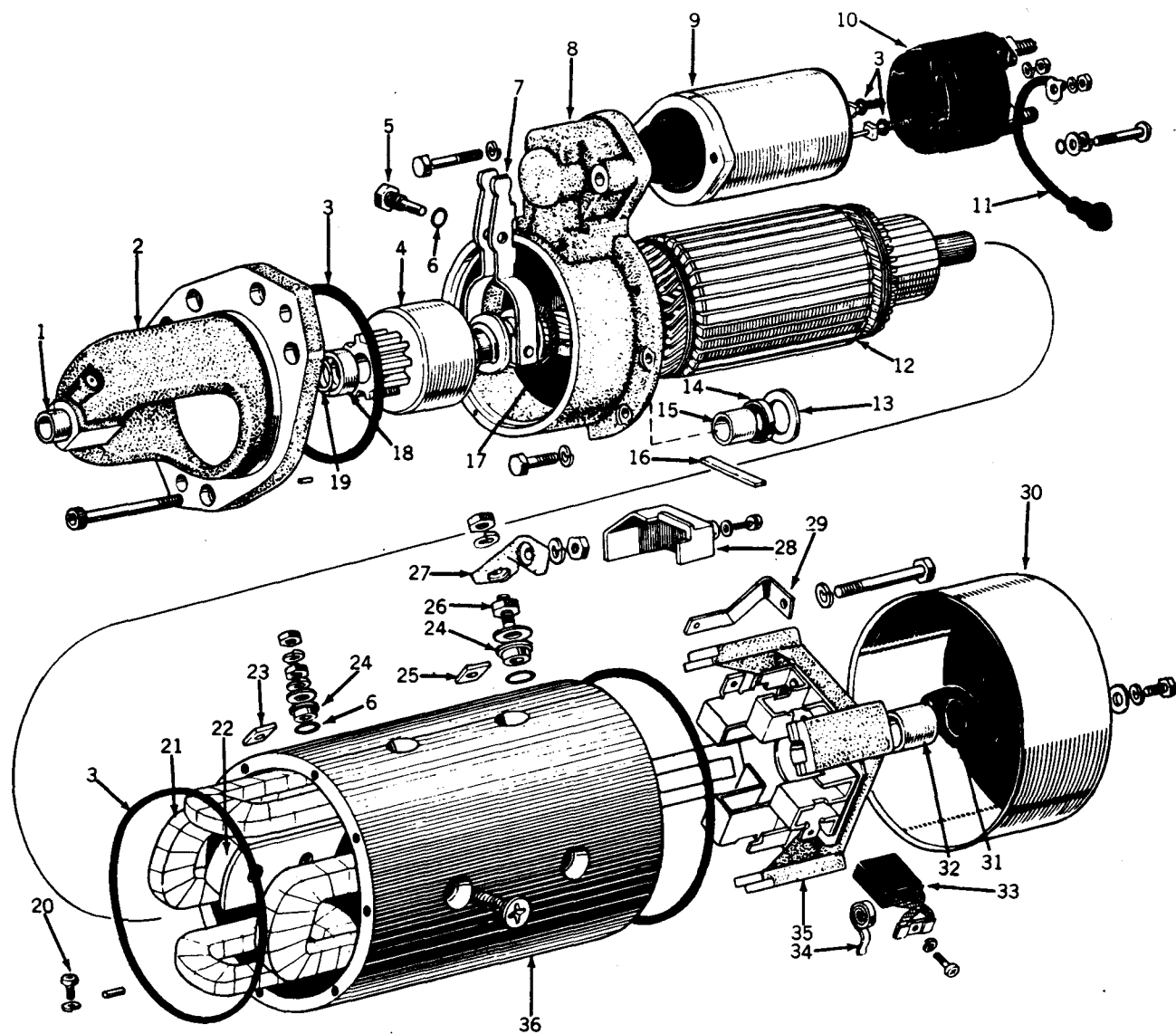


Fig. 20-No Load Test



T31424N

- | | | | |
|--------------------------|-------------------------------|-------------------------|--------------------------|
| 1—Drive End Bushing | 11—Shunt Winding Lead | 21—Field Winding | 31—Gasket |
| 2—Drive End Housing | 12—Armature | 22—Pole Shoe (4 used) | 32—Commutator End |
| 3—Packing | 13—Bakelite Washer | 23—Square Washer | Frame Bushing |
| 4—Overrunning Clutch | 14—Oil Seal | 24—Insulating Bushing | 33—Brush (4 used) |
| 5—Shift Lever Pivot | 15—Center Bearing Bushing | 25—Square Insulator | 34—Brush Spring (4 used) |
| 6—O-Ring | 16—Oil Felt | 26—Special Bolt | 35—Commutator End Frame |
| 7—Shift Lever | 17—Brake Washer | 27—Field Coil Connector | 36—Field Frame |
| 8—Center Bearing Housing | 18—Pinion Stop | 28—Terminal Cover | |
| 9—Solenoid Winding | 19—Snap Ring | 29—Brush Ground Strap | |
| 10—Solenoid Switch Cover | 20—Shunt Winding Ground Screw | 30—End Frame Cover | |

Fig. 21-Starting Motor

JOHN DEERE STARTING MOTOR

The John Deere starting motor is located at the rear of the engine on the right or left side. A left side mount is shown in (Fig. 16).

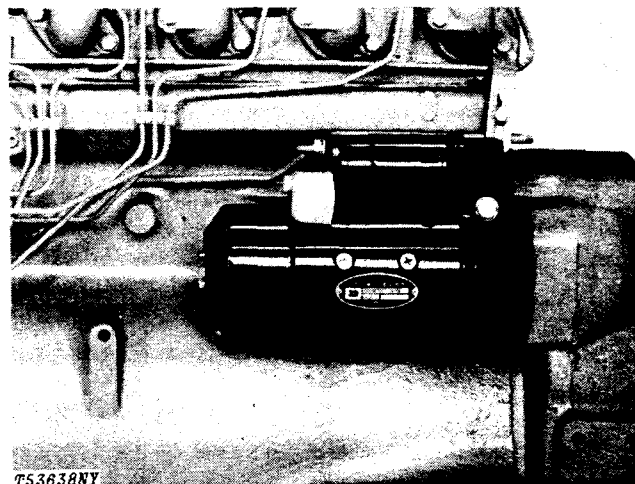


Fig. 16-Starter Location

REMOVAL

Disconnect battery ground straps.

Disconnect wires from starting motor.

Remove three cap screws attaching starting motor to flywheel housing (Fig. 17).

Remove starting motor.

NOTE: The JDE-80 Starter Wrench might be necessary to remove the rear attaching cap screws.

Refer to Fig. 21 page 0422-17 for relative position of parts.

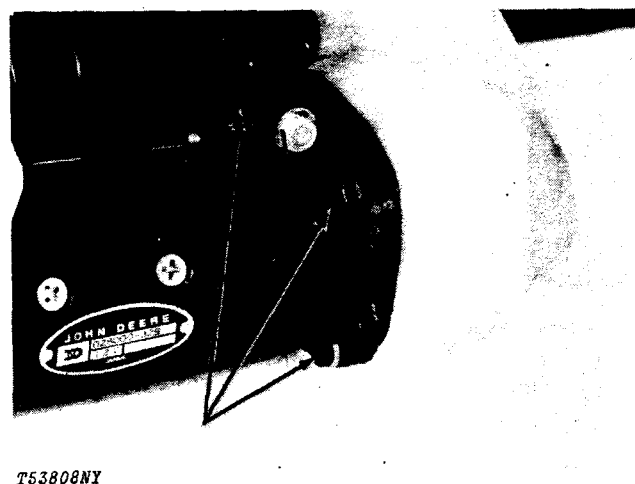


Fig. 17-Starter Motor Removal

To prevent damage, solenoid must be on starting motor when testing windings.

Remove terminal cover and field coil connector (27, Fig. 21).

Refer to Fig. 21 for the location of various parts called out.

TESTS

4 Solenoid Tests (Starting Motor Removed)

Disconnect the shunt field winding lead (11, Fig. 21).

Replace the solenoid if it fails one of the following tests.

Solenoid Pull-In Test

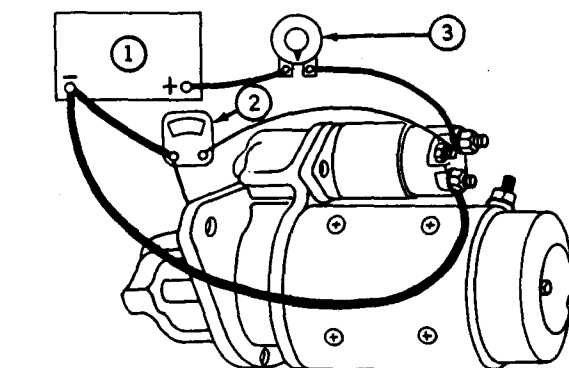
Connect the circuit shown in Fig. 18. Run a heavy wire from the positive terminal of the battery (1) to one side of the carbon pile resistor (3). From the other side of the resistor run a heavy wire to the "Bat" terminal of the solenoid. Then run a heavy wire from the "M" terminal of the solenoid to the negative (-) terminal of the battery. Connect a voltmeter (2) across the negative terminal of the battery and the "S" terminal of the solenoid.

Adjust the carbon pile to apply 8 volts to the solenoid. The solenoid should push the pinion out to the pinion stop when the jumper wire is connected. The drive should remain out at the pinion stop. Current through the jumper wire will be approximately 90 amps, so heavy jumper wire will be necessary.

Solenoid Return Test

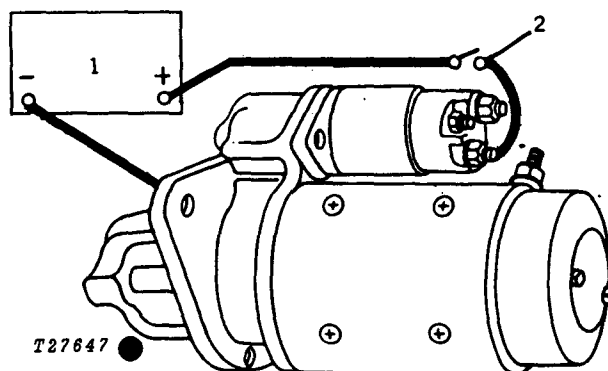
Make the connections shown in Fig. 19. Starting with the positive terminal of the battery (1, Fig. 19), run a heavy wire to a switch (2) then run a heavy wire to the "M" terminal of the solenoid and connect it. Run a wire from the case of the starter to the negative terminal of the battery.

When the switch is thrown, the drive should return without hesitation.



T53834B

Fig. 18-Solenoid Pull-In Test



T27647

Fig. 19-Solenoid Return Test

CYLINDER HEAD AND VALVES (0409)

SPECIFICATIONS AND TORQUE VALUES—Continued

Valve seat width:

Engine	Valve Seat Width
3-164	0.078 to 0.094 inch (1.98 to 2.39 mm)
4-219	0.063 to 0.078 inch (1.60 to 1.98 mm)
4-276	0.083 to 0.093 inch (2.11 to 2.36 mm)
6-329	0.047 to 0.078 inch (1.19 to 1.98 mm)

Valve seat run-out (maximum)	0.002 inch (0.05 mm)
------------------------------	-------------------------

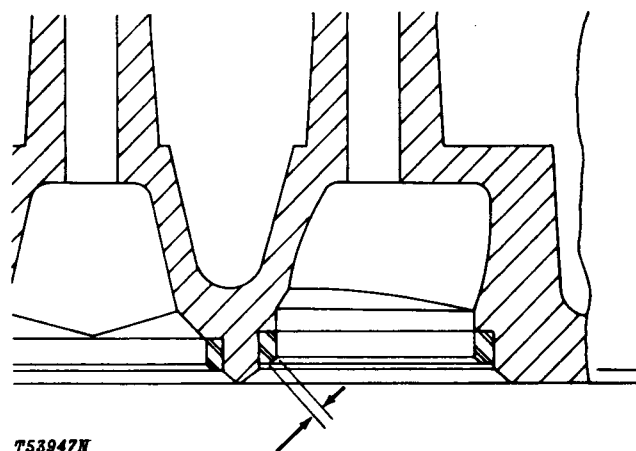


Fig. 39-Valve Seat Width

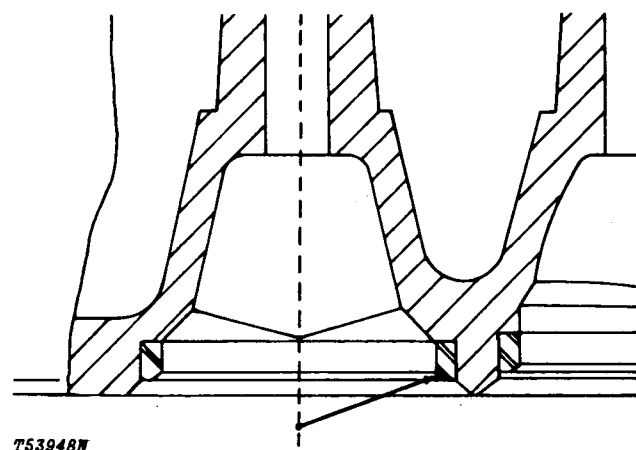


Fig. 40-Valve Seat Run-out

Valve stem O.D. (new) (1, Fig. 41)	0.372 to 0.373 inch (9.45 to 9.47 mm)
---------------------------------------	--

Valve guide I.D. (new) (2)	0.375 to 0.376 inch (9.53 to 9.55 mm)
-------------------------------	--

Valve stem oil clearance (new)	0.002 to 0.004 inch (0.05 to 0.10 mm)
-----------------------------------	--

Valve stem oil clearance (maximum)	0.006 inch (0.15 mm)
---------------------------------------	-------------------------

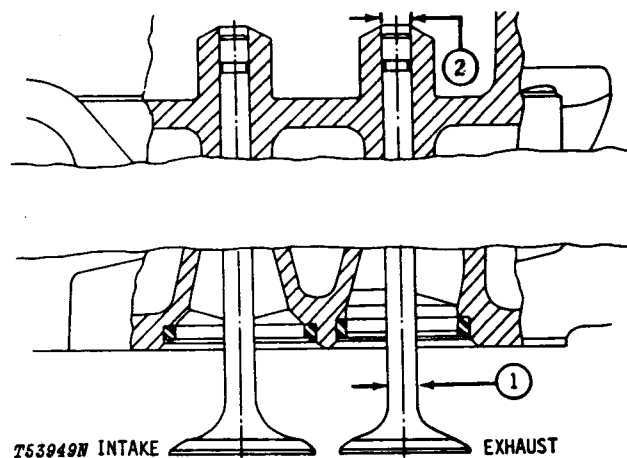
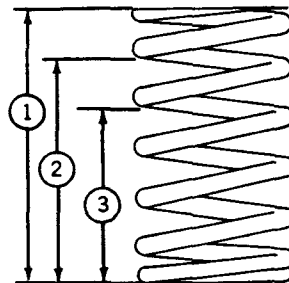


Fig. 41-Valve Stem Oil Clearance

CYLINDER HEAD AND VALVES (0409)

SPECIFICATIONS AND SPECIAL TOOLS—Continued

Valve spring free length (approx.) (1, Fig. 42)	2.12 in. (53.8 mm)
Valve spring (2)	1.81 in. (46.0 mm)
when compressed with 54 to 62 lb. (240 to 276 N) (24 to 28 kg)	
Valve spring (3)	1.36 in. (34.5 mm)
when compressed with 133 to 153 lb. (592 to 681 N) (60 to 69 kg)	



T48353N

Fig. 42-Valve Spring Length

Cylinder head cap screw torque	95 lb-ft (129 Nm) (13 kg-m)
--------------------------------	--------------------------------

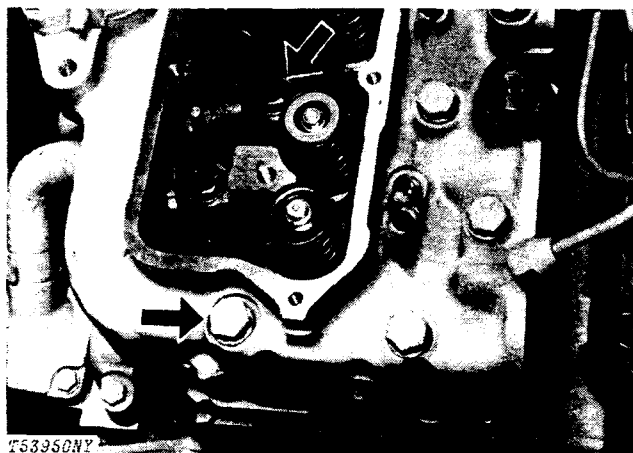


Fig. 43-Cylinder Head Cap Screw Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES (JDB331MD2406-AR49904)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

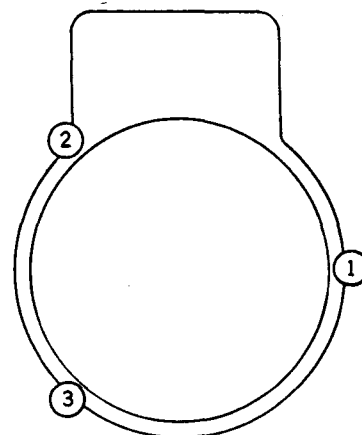
Electric shut-off connected to 12-volt D.C. negative (-) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (1250 rpm) ... 85 to 95 psi
(5.9 to 6.5 bar) (6.0 to 6.7 kg/cm²)

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608



T53890N

Fig. 44-Injection Line Connection

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB331MD2406-AR49904)

Automatic Speed Advance

rpm

325 to 525	1°
750 to 850	5°
by 1125	7-1/2° minimum

Minimum cranking speed
delivery (75 rpm)

Volume	42 cm ³ /1000 strokes
Transfer pump pressure (minimum)	12 psi (1 bar) (1 kg/cm ²)

Fuel delivery (1250 rpm)

Volume	63 to 66 cm ³ /1000 strokes
Maximum variation between cylinders	3 cm ³ /1000 strokes

Fuel delivery (750 rpm)

Volume	64 to 68 cm ³ /1000 strokes
Maximum variation between cylinders	5 cm ³ /1000 strokes

High idle (WOT) (1340 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation between cylinders	4 cm ³ /1000 strokes

Governor cut-off (1365 rpm)

Volume	5 cm ³ max/1000 strokes
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Low idle (400 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation between cylinders	4 cm ³ /1000 strokes

Check shut-off at (200 rpm)

Volume	2 cm ³ max/1000 strokes
--------------	------------------------------------

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB331MD2406-AR49904)

- 1 - Fuel injection pump-
to-engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 45 lb-ft
(61 Nm) (6 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)

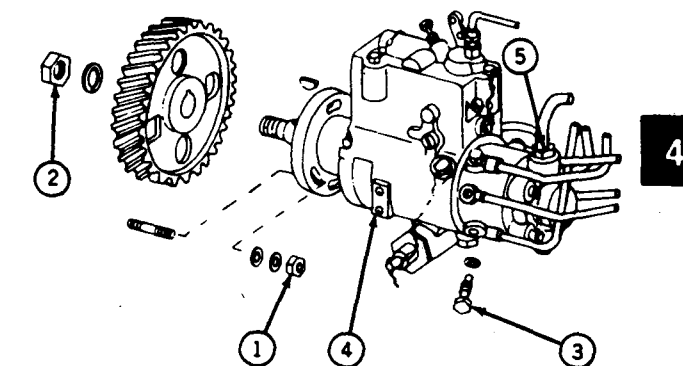


Fig. 45-Roosa-Master Model JDB Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB635AL2446-AR51568)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

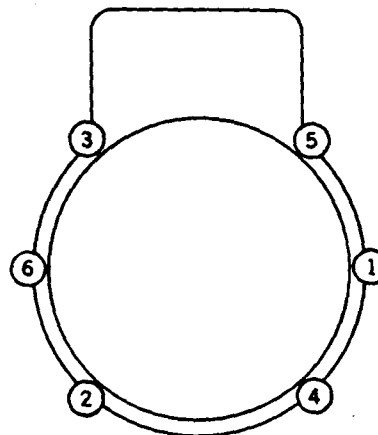
Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (1250 rpm) 85 to 90 psi
(5.9 to 6.2 bar) (6.0 to 6.3 kg/cm²)

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608



T63882N

Fig. 46-Injection Line Connection

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB635AL2446-AR51568)

Automatic Speed Advance

rpm

350 to 550	1°
900 to 1000	5°
by 1100	5-1/2° minimum

Minimum cranking speed

delivery (75 rpm)

Volume 33 cm³/1000 strokes

Transfer pump pressure

(minimum) 12 psi

(1 bar) (1 kg/cm²)

Fuel delivery (1250 rpm)

Volume 59 to 62 cm³/1000 strokes

Maximum variation

between cylinders 3 cm³/1000 strokes

Fuel delivery (750 rpm)

Volume 63 to 67 cm³/1000 strokes

Maximum variation

between cylinders 4 cm³/1000 strokes

High idle (WOT) (1325 rpm)

Volume 10 to 12 cm³/1000 strokes

Maximum variation

between cylinders 4 cm³/1000 strokes

Governor cut-off (1350 rpm)

Volume 5 cm³ max/1000 strokes

Low idle (400 rpm)

Volume 10 to 12 cm³/1000 strokes

Maximum variation

between cylinders 4 cm³/1000 strokes

Check shut-off at (200 rpm)

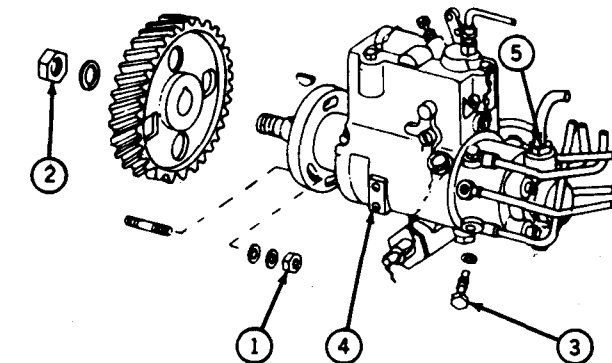
Volume 2 cm³ max/1000 strokes

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB635AL2446-AR51568)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 45 lb-ft
(61 Nm) (6 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)



T53896N

Fig. 47-Roosa-Master Model JDB Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB435AL2442-AR51747)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

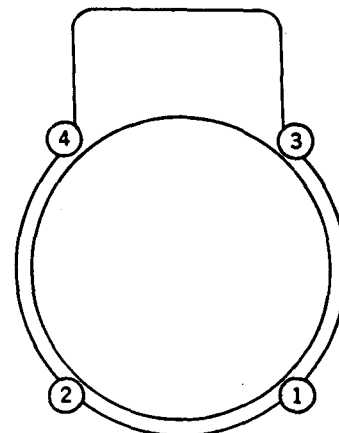
Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required to pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (1250 rpm) 85 to 90 psi
(5.9 to 6.2 bar) (6.0 to 6.3 kg/cm²)

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608



T53891N

Fig. 48-Injection Line Connection

FUEL INJECTION SYSTEMS (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB435AL2442-AR51747)

Automatic Speed Advance

rpm

325 to 525	1°
800 to 900	5°
by 1200	6-1/2°

Minimum cranking speed
delivery (75 rpm)

Volume	37 cm ³ /1000 strokes
Transfer pump pressure (minimum)	12 psi (1 bar) (1 kg/cm ²)

Fuel delivery (1250 rpm)

Volume	60 to 63 cm ³ /1000 strokes
Maximum variation between cylinders	5 cm ³ /1000 strokes

Fuel delivery (750 rpm)

Volume	64 to 68 cm ³ /1000 strokes
Maximum variation between cylinders	5 cm ³ /1000 strokes

High idle (WOT) (1325 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation between cylinders	5 cm ³ /1000 strokes

Governor cut-off (1350 rpm)

Volume	6 cm ³ max/1000 strokes
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Low idle (400 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation between cylinders	5 cm ³ /1000 strokes

Check shut-off at (200 rpm)

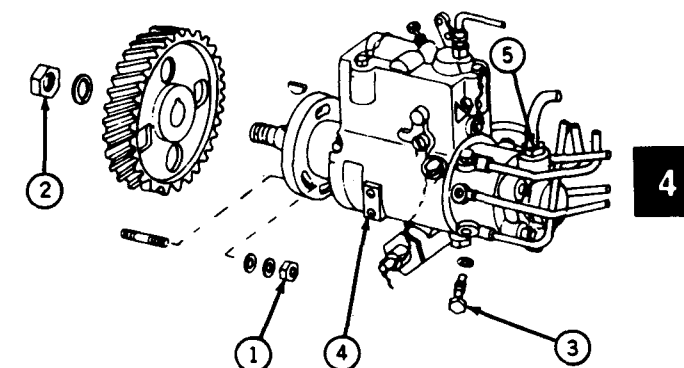
Volume	2 cm ³ max/1000 strokes
--------------	------------------------------------

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB435AL2442-AR51747)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 45 lb-ft
(61 Nm) (6 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)



T53895N

Fig. 49-Roosa-Master Model JDB Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB331CM2667-AR66282)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

4

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

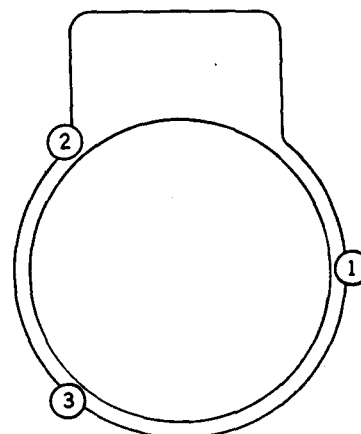
Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (900 rpm) 73 to 83 psi
(5.0 to 5.7 bar) (5.1 to 5.8 kg/cm²)

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608



T53890N

Fig. 50-Injection Line Connection

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB331CM2667-AR66282)

Automatic Speed Advance

rpm
250 to 450 1°
by 700 5-1/2°

Minimum cranking speed delivery (75 rpm)

Volume 42 cm³/1000 strokes
Transfer pump pressure (minimum) 12 psi
(1 bar) (1 kg/cm²)

Fuel delivery (900 rpm)

Volume 63 to 66 cm³/1000 strokes
Maximum variation
between cylinders 3 cm³/1000 strokes

Fuel delivery (750 rpm)

Volume 64 to 68 cm³/1000 strokes
Maximum variation
between cylinders 5 cm³/1000 strokes

High idle (WOT) (927 rpm)

Volume 10 to 12 cm³/1000 strokes
Maximum variation
between cylinders 4 cm³/1000 strokes

Governor cut-off (955 rpm)

Volume 5 cm³ max/1000 strokes

Low idle (200 rpm)

Volume to cm³/1000 strokes
Maximum variation
between cylinders 4 cm³/1000 strokes

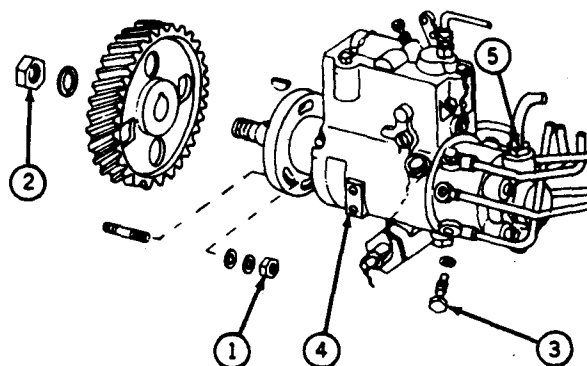
Check shut-off at (200 rpm)

Volume 2 cm³ max/1000 strokes

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB331CM2667-AR66282)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 45 lb-ft
(61 Nm) (6 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)



T53895N

Fig. 51-Roosa-Master Model JDB Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627MD2684-AR66395)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (1100 rpm) 80 to 90 psi
(5.5 to 6.2 bar) (5.6 to 6.3 kg/cm²)

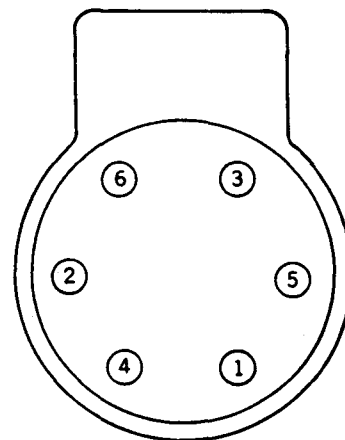


Fig. 52-Injection Line Connection

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627MD2684-AR66395)

Automatic Speed Advance

rpm	
300 to 500	1°
700 to 800	5°
by 925	6°

Minimum cranking speed

delivery (75 rpm)

Volume 40 cm³/1000 strokes

Transfer pump pressure

(minimum) 10 psi
(1 bar) (1 kg/cm²)

Fuel delivery (1100 rpm)

Volume 70 to 73 cm³/1000 strokes

Maximum variation

between cylinders 3 cm³/1000 strokes

Fuel delivery (750 rpm)

Volume 73 to 78 cm³/1000 strokes

Maximum variation

between cylinders 5 cm³/1000 strokes

High idle (WOT) (1200 rpm)

Volume 10 to 12 cm³/1000 strokes

Maximum variation

between cylinders 4 cm³/1000 strokes

Governor cut-off (1225 rpm)

Volume 5 cm³ max/1000 strokes

Low idle (200 rpm)

Volume 10 to 12 cm³/1000 strokes

Maximum variation

between cylinders 4 cm³/1000 strokes

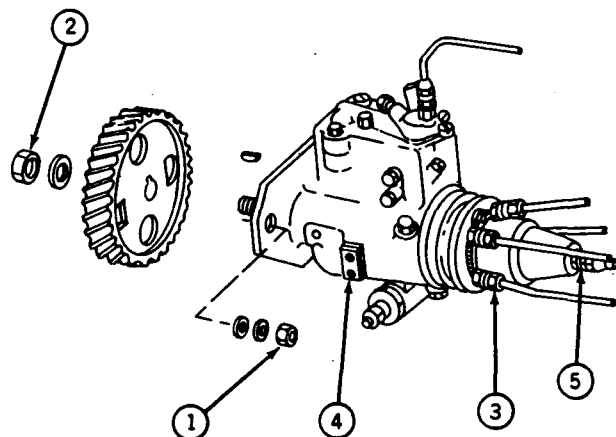
Check shut-off at (200 rpm)

Volume 2 cm³ max/1000 strokes

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627MD2684-AR66395)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 140 to 150 lb-ft
(190 to 203 Nm) (19 to 21 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)



T53896N

Fig. 53-Roosa-Master Model DM Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB431CM2701-AR66995)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

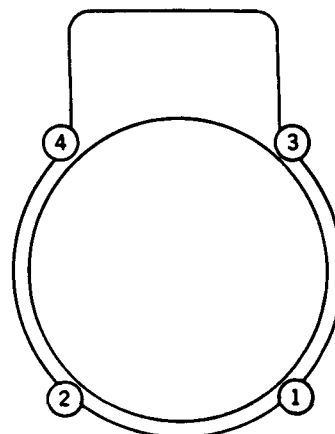
Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18. in. Hg.
(609.5 mbar)

Transfer pump pressure (900 rpm) 75 to 80 psi
(5.2 to 5.5 bar) (5.3 to 5.6 kg/cm²)



T53891N

Fig. 54-Injection Line Connection

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB431CM2701-AR66995)

Automatic Speed Advance

rpm	
250 to 450	1°
by 1350	5°

Minimum cranking speed

delivery (75 rpm)

Volume	35 cm ³ /1000 strokes
Transfer pump pressure	
(minimum)	12 psi
	(1 bar) (1 kg/cm ²)

Fuel delivery (900 rpm)

Volume	61 to 64 cm ³ /1000 strokes
Maximum variation	
between cylinders	3 cm ³ /1000 strokes

Fuel delivery (750 rpm)

Volume	60 to 64 cm ³ /1000 strokes
Maximum variation	
between cylinders	5 cm ³ /1000 strokes

High idle (WOT) (927 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation	
between cylinders	4 cm ³ /1000 strokes

Governor cut-off (955 rpm)

Volume	5 cm ³ max/1000 strokes
--------------	------------------------------------

Low idle (200 rpm)

Volume	to	cm ³ /1000 strokes
Maximum variation		
between cylinders		cm ³ /1000 strokes

Check shut-off at (200 rpm)

Volume	2 cm ³ max/1000 strokes
--------------	------------------------------------

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB431CM2701-AR66995)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 4 2 - Fuel injection pump
drive gear nut torque 45 lb-ft
(61 Nm) (6 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)

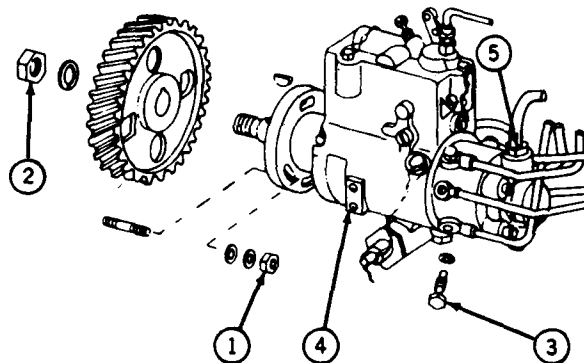


Fig. 55-Roosa-Master Model JDB Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB635CM2757-AR66996)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

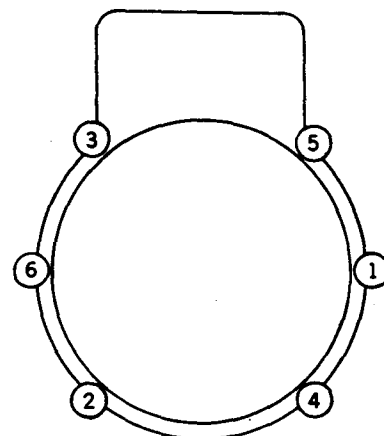
Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (900 rpm) 58 to 63 psi
(4.0 to 4.3 bar) (4.1 to 4.4 kg/cm²)



T53892H

Fig. 56-Injection Line Connection

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB635CM2757-AR66996)

Automatic Speed Advance

rpm

250 to 450 1°
by 700 4-1/2° minimum

Minimum cranking speed
delivery (75 rpm)

Volume 33 cm³/1000 strokes
Transfer pump pressure
(minimum) 12 psi
(1 bar) (1 kg/cm²)

Fuel delivery (900 rpm)

Volume 59 to 62 cm³/1000 strokes
Maximum variation
between cylinders 3 cm³/1000 strokes

Fuel delivery (750 rpm)

Volume 63 to 67 cm³/1000 strokes
Maximum variation
between cylinders 4 cm³/1000 strokes

High idle (WOT) (927 rpm)

Volume 10 to 12 cm³/1000 strokes
Maximum variation
between cylinders 4 cm³/1000 strokes

Governor cut-off (955 rpm)

Volume 5 cm³ max/1000 strokes

Low idle (rpm)

Volume to cm³/1000 strokes
Maximum variation
between cylinders cm³/1000 strokes

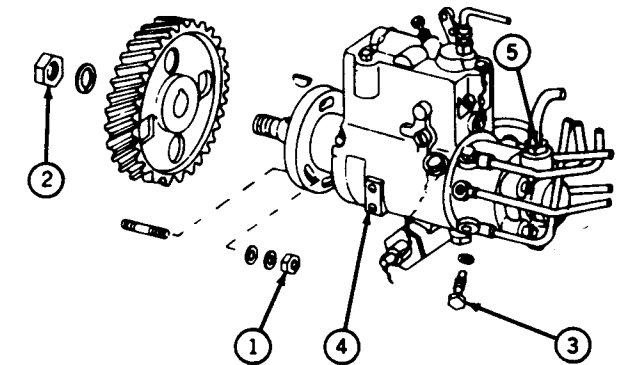
Check shut-off at (200 rpm)

Volume 2 cm³ max/1000 strokes

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB635CM2757-AR66996)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 45 lb-ft
(61 Nm) (6 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)



T53895N

Fig. 57-Roosa-Master Model JDB Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB435MD2793-AR70530)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

4

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

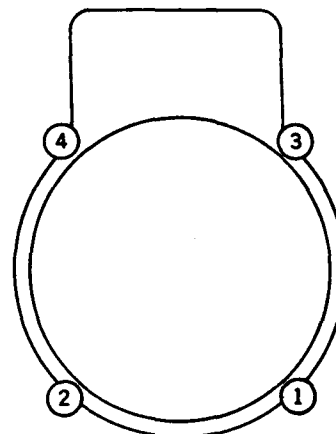
Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (1250 rpm) 85 to 95 psi
(5.9 to 6.5 bar) (6.0 to 6.7 kg/cm²)



T53891N

Fig. 58-Injection Line Connection

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB435MD2793-AR70530)

Automatic Speed Advance

rpm	
300 to 500	1°
750 to 850	5°
by 1150	7-1/2°

Minimum cranking speed delivery (75 rpm)

Volume	44 cm ³ /1000 strokes
Transfer pump pressure (minimum)	12 psi (1 bar) (1 kg/cm ²)

Fuel delivery (1250 rpm)

Volume	70 to 73 cm ³ /1000 strokes
Maximum variation between cylinders	3 cm ³ /1000 strokes

Fuel delivery (750 rpm)

Volume	73 to 77 cm ³ /1000 strokes
Maximum variation between cylinders	5 cm ³ /1000 strokes

High idle (WOT) (1325 rpm)

Volume	15 to 17 cm ³ /1000 strokes
Maximum variation between cylinders	4 cm ³ /1000 strokes

Governor cut-off (1350 rpm)

Volume	8 cm ³ max/1000 strokes
--------------	------------------------------------

Low idle (400 rpm)

Volume	15 to 17 cm ³ /1000 strokes
Maximum variation between cylinders	4 cm ³ /1000 strokes

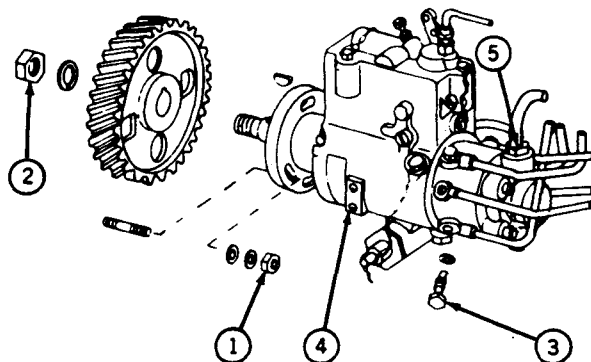
Check shut-off at (200 rpm)

Volume	2 cm ³ max/1000 strokes
--------------	------------------------------------

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB435MD2793-AR70530)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (2 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 45 lb-ft
(61 Nm) (6 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)



T53895N

Fig. 59-Roosa-Master Model JDB Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB435CM2819-AR70531)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

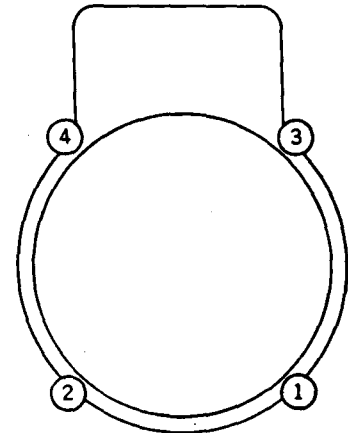
Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (900 rpm) 75 to 80 psi
(5.2 to 5.5 bar) (5.3 to 5.6 kg/cm²)

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608



T53891N

Fig. 60-Injection Line Connection

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(JDB435CM2819-AR70531)

Automatic Speed Advance

rpm
250 to 450 1°
by 675 5°

4

Minimum cranking speed delivery (75 rpm)

Volume 35 cm³/1000 strokes
Transfer pump pressure
(minimum) 12 psi
(1 bar) (1 kg/cm²)

Fuel delivery (900 rpm)

Volume 74 to 78 cm³/1000 strokes
Maximum variation
between cylinders 3 cm³/1000 strokes

High idle (WOT) (927 rpm)

Volume 10 to 12 cm³/1000 strokes
Maximum variation
between cylinders 4 cm³/1000 strokes

Governor cut-off (955 rpm)

Volume 5 cm³ max/1000 strokes

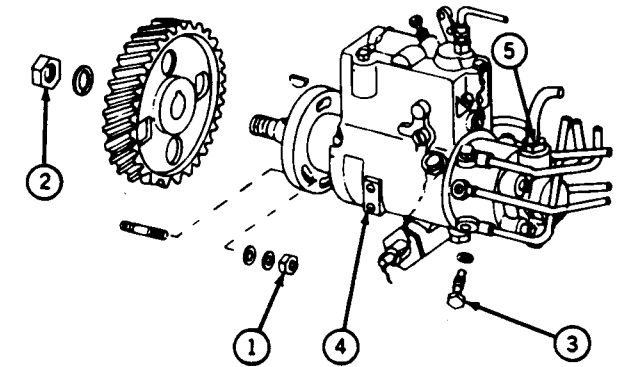
Check shut-off at (200 rpm)

Volume 2 cm³ max/1000 strokes

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB435CM2819-AR70531)

- | | |
|---|---|
| 1 - Fuel injection pump
to engine nut torque | 20 lb-ft
(27 Nm) (3 kg-m) |
| 2 - Fuel injection pump
drive gear nut torque | 45 lb-ft
(61 Nm) (6 kg-m) |
| 3 - Injection line to
pump connector torque | 35 lb-ft
(47 Nm) (5 kg-m) |
| 4 - Timing cover screw
torque | 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m) |
| 5 - Fuel injection pump
fuel inlet connector
torque | 20 lb-ft
(27 Nm) (3 kg-m) |



T53895N

Fig. 61-Roosa-Master Model JDB Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(DM4427HB2915-AR70538)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

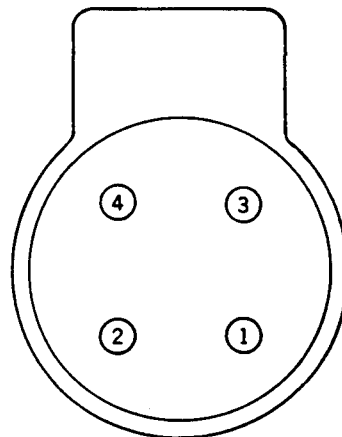
Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (900 rpm) 73 to 83 psi
(5.0 to 5.7 bar) (5.1 to 5.8 kg/cm²)

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608



T53888W

Fig. 62-Injection Line Connection

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(DM4427HB2915-AR70538)

Automatic Speed Advance

rpm

250 to 450 1°
by 650 3°

Minimum cranking speed
delivery (75 rpm)

Volume 54 cm³/1000 strokes
Transfer pump pressure
(minimum) 12 psi
(1 bar) (1 kg/cm²)

Fuel delivery (900 rpm)

Volume 91 to 95 cm³/1000 strokes
Maximum variation
between cylinders 5 cm³/1000 strokes

Fuel delivery (750 rpm)

Volume 92 to 96 cm³/1000 strokes
Maximum variation
between cylinders 7 cm³/1000 strokes

High idle (WOT) (927 rpm)

Volume 10 to 12 cm³/1000 strokes
Maximum variation
between cylinders 4 cm³/1000 strokes

Governor cut-off (950 rpm)

Volume 5 cm³ max/1000 strokes

Check shut-off at (200 rpm)

Volume 2 cm³ max/1000 strokes

FUEL INJECTION SYSTEM (0413) **SPECIFICATIONS AND TORQUE VALUES—Continued** **(DM4427HB2915-AR70538)**

- Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- Fuel injection pump
drive gear nut torque 140 to 150 lb-ft
(190 to 203 Nm) (19 to 21 kg-m)
- Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)

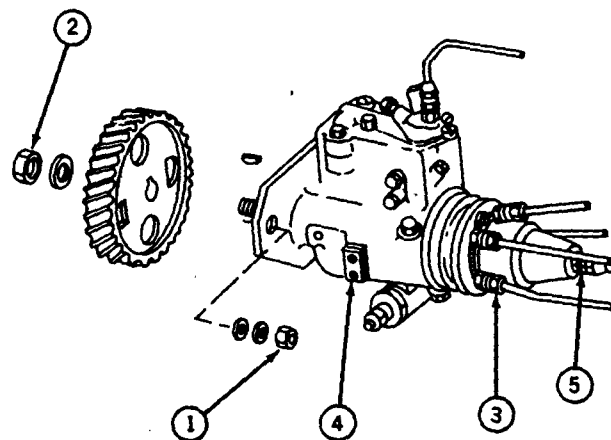


Fig. 63-Roosa-Master Model DM Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(DM4627HB2825-AR70551)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46° C).

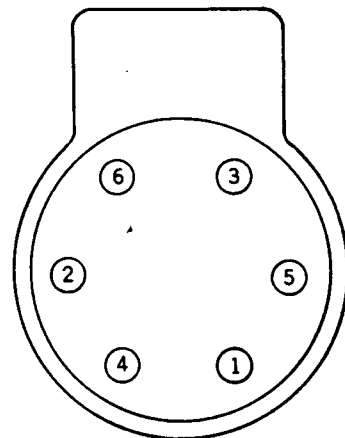
Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (900 rpm) 75 to 80 psi
(5.2 to 5.5 bar) (5.3 to 5.6 kg/cm²)



T53889W

Fig. 64-Injection Line Connection

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627HB2825-AR70551)

Automatic Speed Advance

rpm	
250 to 450	1°
by 650	3°

Minimum cranking speed

delivery (75 rpm)

Volume..... 40 cm³/1000 strokes

Transfer pump pressure

(minimum) 10 psi
(1 bar) (1 kg/cm²)

Fuel delivery (900 rpm)

Volume..... 71 to 74 cm³/1000 strokes

Maximum variation

between cylinders 3 cm³/1000 strokes

High idle (WOT) (925 rpm)

Volume..... 10 to 12 cm³/1000 strokes

Maximum variation

between cylinders 4 cm³/1000 strokes

Governor cut-off (955 rpm)

Volume..... 5 cm³ max/1000 strokes

Check shut-off at (200 rpm)

Volume..... 2 cm³ max/1000 strokes

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627HB2825-AR70551)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 140 to 150 lb-ft
(190 to 203 Nm) (19 to 21 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (2 kg-m)

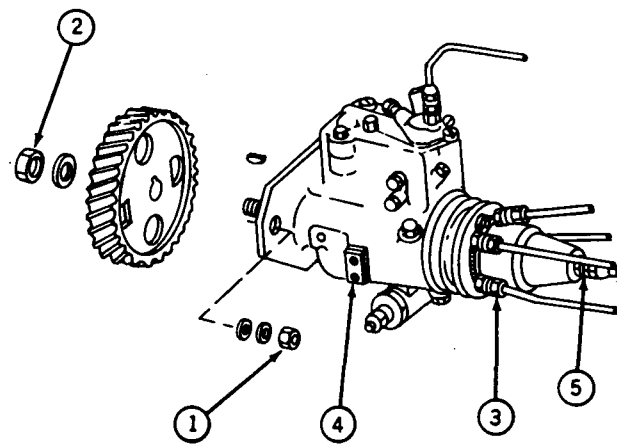


Fig. 65-Roosa-Master Model DM Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627AL2824-AR70778)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

4 Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46° C).

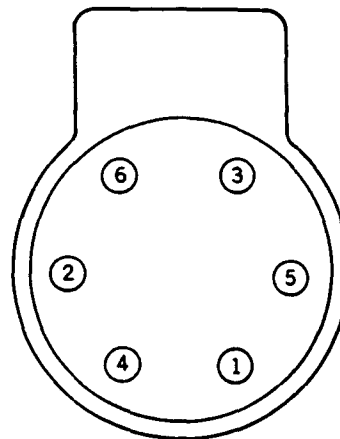
Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (1100 rpm) 80 to 90 psi
(5.5 to 6.2 bar) (5.6 to 6.3 kg/cm²)



T53889N

Fig. 66-Injection Line Connection

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627AL2824-AR70778)

Automatic Speed Advance

rpm	
300 to 500	1°
700 to 800	5°
by 925	6°

Minimum cranking speed delivery (75 rpm)

Volume	50 cm ³ /1000 strokes
Transfer pump pressure (minimum)	10 psi (1 bar) (1 kg/cm ²)

Fuel delivery (1100 rpm)

Volume	88 to 91 cm ³ /1000 strokes
Maximum variation between cylinders	3 cm ³ /1000 strokes

Fuel delivery (750 rpm)

Volume	91 to 95 cm ³ /1000 strokes
Maximum variation between cylinders	5 cm ³ /1000 strokes

High idle (WOT) (1200 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation between cylinders	4 cm ³ /1000 strokes

Governor cut-off (1225 rpm)

Volume	5 cm ³ max/1000 strokes
--------------	------------------------------------

Low idle (400 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation between cylinders	4 cm ³ /1000 strokes

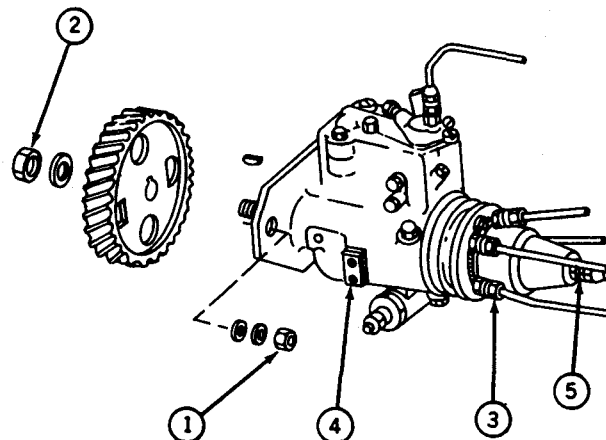
Check shut-off at (200 rpm)

Volume	2 cm ³ max/1000 strokes
--------------	------------------------------------

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627AL2824-AR70778)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 140 to 150 lb-ft
(190 to 203 Nm) (19 to 21 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)



T53896N

Fig. 67-Roosa-Master Model DM Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627HB2826-AR70780)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

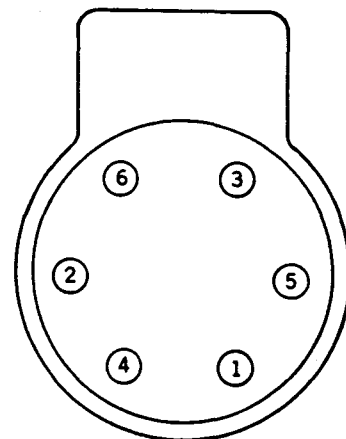
Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure
(900 rpm) 75 to 80 psi
(5.2 to 5.5 bar) (5.3 to 5.6 kg/cm²)



T53889N

Fig. 68-Injection Line Connection

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608

FUEL INJECTION SYSTEM (0413)**SPECIFICATIONS AND TORQUE VALUES—Continued**
(DM4627HB2826-AR70780)**Automatic Speed Advance**

rpm	
250 to 450	1°
by 650	3°

Minimum cranking speed
delivery (75 rpm)

Volume	50 cm ³ /1000 strokes
Transfer pump pressure	
(minimum)	10 psi
	(1 bar) (1 kg/cm ²)

Fuel delivery (900 rpm)

Volume	95 to 99 cm ³ /1000 strokes
Maximum variation	
between cylinders	3 cm ³ /1000 strokes

Fuel delivery (750 rpm)

Volume	98 to 102 cm ³ /1000 strokes
Maximum variation	
between cylinders	5 cm ³ /1000 strokes

High idle (WOT) (925 rpm)

Volume	15 to 17 cm ³ /1000 strokes
Maximum variation	
between cylinders	5 cm ³ /1000 strokes

Governor cut-off (955 rpm)

Volume	8 cm ³ max/1000 strokes
--------------	------------------------------------

Check shut-off at (200 rpm)

Volume	2 cm ³ max/1000 strokes
--------------	------------------------------------

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4627HB2826-AR70780)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 140 to 150 lb-ft
(190 to 203 Nm) (19 to 21 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
toque 20 lb-ft
(27 Nm) (3 kg-m)

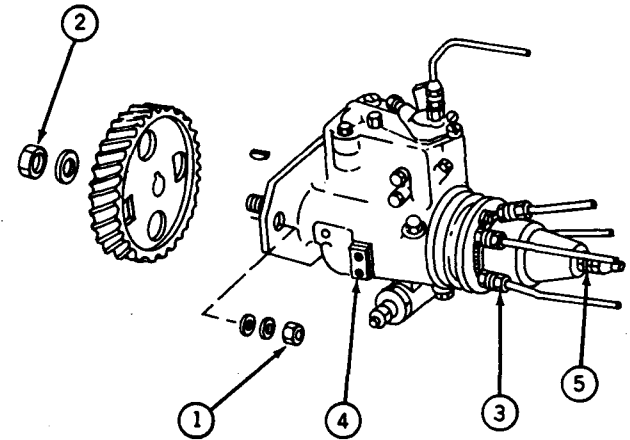


Fig. 69-Roosa-Master Model DM Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(DM4427MD2876-AR71421)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

4 Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

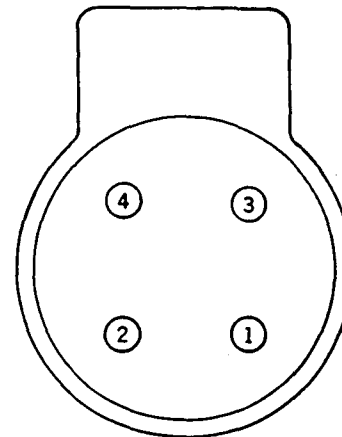
Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (1100 rpm) 80 to 90 psi
(5.5 to 6.2 bar) (5.6 to 6.3 kg/cm²)

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608



T53888N

Fig. 70-Injection Line Connection

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(DM4427MD2876-AR71421)

Automatic Speed Advance

rpm	
300 to 500	1°
600 to 700	5°
by 1100	7-1/2°

Minimum cranking speed delivery (75 rpm)

Volume	54 cm ³ /1000 strokes
Transfer pump pressure	
(minimum)	12 psi
	(1 bar) (1 kg/cm ²)

Fuel delivery (1100 rpm)

Volume	91 to 95 cm ³ /1000 strokes
Maximum variation	
between cylinders	3 cm ³ /1000 strokes

Fuel delivery (750 rpm)

Volume	94 to 98 cm ³ /1000 strokes
Maximum variation	
between cylinders	4 cm ³ /1000 strokes

High idle (WOT) (1190 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation	
between cylinders	4 cm ³ /1000 strokes

Governor cut-off (1215 rpm)

Volume	5 cm ³ max/1000 strokes
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Low idle (400 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation	
between cylinders	4 cm ³ /1000 strokes

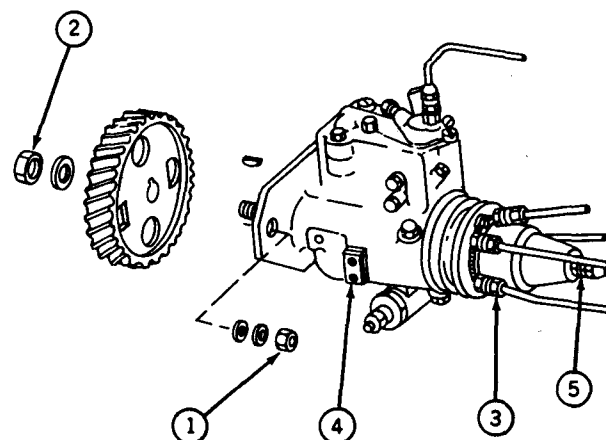
Check shut-off at (200 rpm)

Volume	2 cm ³ max/1000 strokes
--------	------------------------------------

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4427MD2876-AR71421)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 140 to 150 lb-ft
(190 to 203 Nm) (19 to 21 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)



T53896N

Fig. 71-Roosa-Master Model DM Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4427NH2957-AR76503)

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use Viscor Number L1485*, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

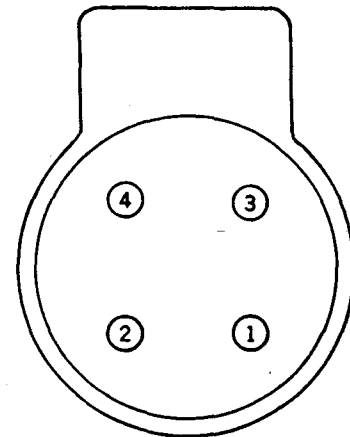
Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

Electric shut-off connected to 12-volt D.C. negative (–) ground power source.

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Transfer pump vacuum (200 rpm)
(minimum) 18 in. Hg.
(609.5 mbar)

Transfer pump pressure
(1100 rpm) 75 to 85 psi
(5.2 to 5.9 bar) (5.3 to 6.0 kg/cm²)



T53888B

Fig. 72-Injection Line Connection

*Available from: Viscosity Oil Company
3200 So. Western Avenue
Chicago, Illinois 60608

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

(DM4427NH2957-AR76503)

Automatic Speed Advance

rpm	
550 to 650	1°
by 800	3°

4

Light load advance

rpm	cm ³ /1000 strokes	
1100	40 to 50	3° maximum
1100	0 to 15	7-1/2° minimum
400	0 to 15	4° minimum

Minimum cranking speed

delivery (75 rpm)

Volume	54 cm ³ /1000 strokes
Transfer pump pressure	
(minimum)	12 psi
	(1 bar) (1 kg-cm ²)

Fuel delivery (1100 rpm)

Volume	91 to 95 cm ³ /1000 strokes
Maximum variation	
between cylinders	3 cm ³ /1000 strokes

Fuel delivery (750 rpm)

Volume	94 to 98 cm ³ /1000 strokes
Maximum variation	
between cylinders	4 cm ³ /1000 strokes

High idle (WOT) (1190 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation	
between cylinders	4 cm ³ /1000 strokes

Governor cut-off (1215 rpm)

Volume	5 cm ³ max/1000 strokes
--------------	------------------------------------

Low idle (400 rpm)

Volume	10 to 12 cm ³ /1000 strokes
Maximum variation	
between cylinders	4 cm ³ /1000 strokes

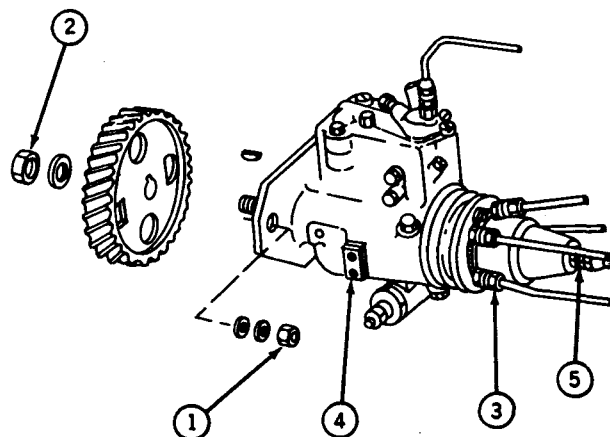
Check shut-off at (200 rpm)

Volume	2 cm ³ max/1000 strokes
--------------	------------------------------------

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued (DM4427NH2957 - AR76503)

- 1 - Fuel injection pump
to engine nut torque 20 lb-ft
(27 Nm) (3 kg-m)
- 2 - Fuel injection pump
drive gear nut torque 140 to 150 lb-ft
(190 to 203 Nm) (19 to 21 kg-m)
- 3 - Injection line to
pump connector torque 35 lb-ft
(47 Nm) (5 kg-m)
- 4 - Timing cover screw
torque 15 to 20 lb-in
(1.7 to 2.3 Nm) (0.17 to 0.23 kg-m)
- 5 - Fuel injection pump
fuel inlet connector
torque 20 lb-ft
(27 Nm) (3 kg-m)



T53896N

Fig. 73-Roosa-Master Model DM Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

Stanadyne (Roosa-Master) 9.5 millimeter Injection Nozzle Specifications (19763-AR56290)

GENERAL INFORMATION

4 Number of orifices 4

Orifice size 0.011 in.
(0.28 mm)

NOZZLE SETTINGS

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

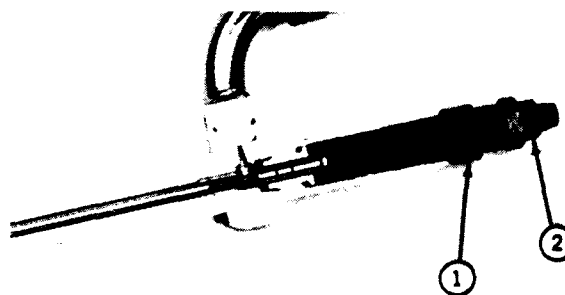
Nozzle opening
pressure (used) 2950 to 3050 psi
(203 to 210 bar) (207 to 214 kg/cm²)

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

Nozzle valve lift $1/2 \pm 1/8$ turn from bot-
tom (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. 74-Injection Nozzle Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

Stanadyne (Roosa-Master) 9.5 millimeter Injection Nozzle Specifications (20501-AR56290)

GENERAL INFORMATION

Number of orifices 4

Orifice size 0.011 in.
(0.28 mm)

NOZZLE SETTINGS

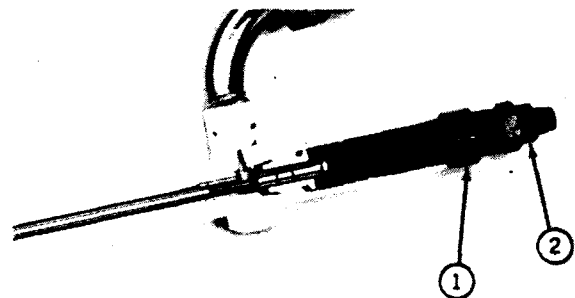
Nozzle opening
pressure (new) 3150 to 3250 psi
(217 to 224 bar) (221 to 228 kg/cm²)

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 bot-
tom (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)



TS3899NY

Fig. 75-Injection Nozzle Torque

FUEL INJECTION SYSTEM (0413)

SPECIFICATIONS AND TORQUE VALUES—Continued

Stanadyne (Roosa-Master) 9.5 millimeter Injection Nozzle Specifications (20272-AR68364)

GENERAL INFORMATION

- 4** Number of orifices 4
- Orifice size 0.012 in.
(0.30 mm)

NOZZLE SETTINGS

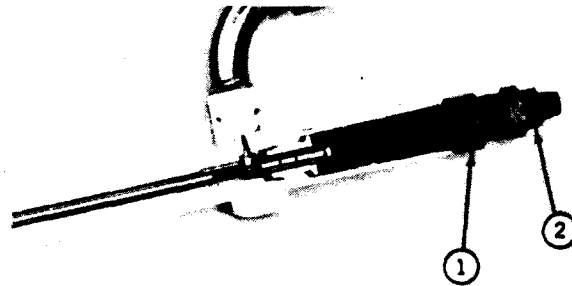
Nozzle opening
pressure (new) 3150 to 3250 psi
(217 to 224 bar) (221 to 228 kg/cm²)

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 (ser-
vice only)

Nozzle valve lift $1/2 \pm 1/8$ turn from bot-
tom (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. 76-Injection Nozzle Torque