POWERTECH® 8.1 L Diesel Engines

Base Engine

TECHNICAL MANUAL

POWERTECH® 8.1 L Diesel Engines — Base Engine

CTM86 15JUL05 (ENGLISH)

For complete service information also see:

POWERTECH® 8.1 L Diesel Engines—Mechanical Fuel Systems	CTM243
POWERTECH® 6.8 L & 8.1 L Diesel Engines—Level 3 Electronic Fuel Systems with Bosch In-Line Pump	CTM134
POWERTECH® 8.1 L Diesel Engines—Level 9 Electronic Fuel Systems with Denso In-Line Pump	CTM255
Electronic Fuel Injection Systems	CTM68
OEM Engine Accessories	CTM67
Alternators and Starting Motors	CTM77

John Deere Power Systems

LITHO IN U.S.A.

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Handle Fluids Safely—Avoid Fires

When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags; they can ignite and burn spontaneously.

TS227 –UN–23AUG88

DX,FLAME –19–29SEP98–1/1

Handle Starting Fluid Safely

Starting fluid is highly flammable.

Keep all sparks and flame away when using it. Keep starting fluid away from batteries and cables.

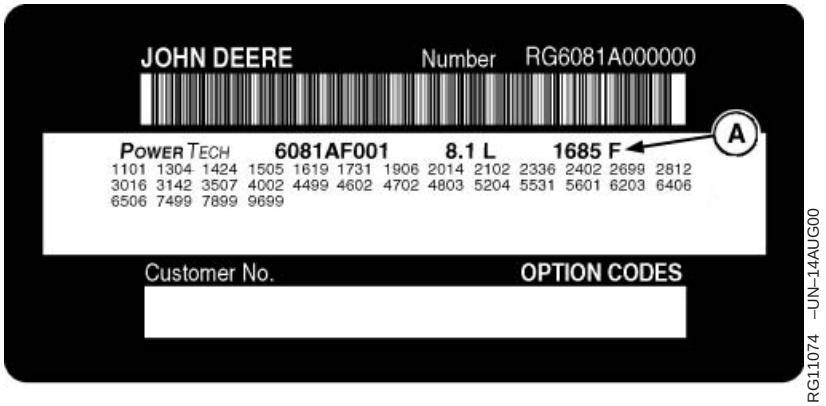
To prevent accidental discharge when storing the pressurized can, keep the cap on the container, and store in a cool, protected location.

Do not incinerate or puncture a starting fluid container.

TS1356 –UN–18MAR92

DX,FIRE3 –19–16APR92–1/1

Engine Option Code Label



Option Code Label

In addition to the serial number plate, later OEM engines have an engine option code label affixed to the rocker arm cover. These codes indicate which of the engine options were installed on your engine at the factory. When in need of parts or service, furnish your authorized servicing dealer or engine distributor with these numbers.

DPSG,OUO1004,900 –19–19MAY99–1/1

Engine Application Chart (John Deere Agricultural Equipment)

Machine Model

DES MOINES—COTTON PICKERS & SPRAYERS

9970 Cotton Picker	6081AN001
9976 Cotton Picker	6081HN001, 003
9986 Cotton Picker	6081HN003
4920 Sprayer	6081HN005

HARVESTER—COMBINES

9510 Low Power Combine	6081HH001
9510 High Power Combine	6081HH002
9550 Low Power Combine	6081HH008
9550 High Power Combine	6081HH009
9610 Combine	6081HH003
9650 and 9650CTS Combine	6081HH010
9650 CTS-(Europe) Combine	6081HH011
9650 STS Combine	6081HH006
9750 STS Combine	6081HH005
CTS II Combine (Europe-1998 Model Year	6081HH003
CTS II Combine (Europe-1999 Model Year)	6081HH004
CTS II Combine (North America)	6081HH003
Amadus Peanut Combine	6081HH007

Continued on next page

RE38635,000003B –19–18JUL05–1/3

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002
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Extended Diesel Engine Oil Service Intervals

When John Deere PLUS-50™, ACEA E5, or ACEA E4 oils are used with specified John Deere filter, the service interval for engine oil and filter changes may be increased by 50% but not to exceed a maximum of 500 hours.

If John Deere PLUS-50, ACEA E5, or ACEA E4 oils are used with other than the specified John Deere filter, change the engine oil and filter at the normal service interval.

If John Deere TORQ-GARD SUPREME™, API CI-4, API CH-4, or ACEA E3 oils are used, change the engine oil and filter at the normal service interval.

If API CG-4, API CF-4, or ACEA E2 oils are used, change the engine oil and filter at 50% of the normal service interval.

PLUS-50 is a trademark of Deere & Company
TORQ-GARD SUPREME is a trademark of Deere & Company

DX,ENOIL6 –19–07NOV03–1/1

Alternative and Synthetic Lubricants

Conditions in certain geographical areas may require lubricant recommendations different from those printed in this manual.

Some John Deere brand coolants and lubricants may not be available in your location.

Consult your John Deere dealer to obtain information and recommendations.

Synthetic lubricants may be used if they meet the performance requirements as shown in this manual.

The temperature limits and service intervals shown in this manual apply to both conventional and synthetic oils.

Re-refined base stock products may be used if the finished lubricant meets the performance requirements.

DX,ALTER –19–15JUN00–1/1

Engine Disassembly Sequence for Overhaul

The following sequence is suggested when complete disassembly for overhaul is required. Refer to the appropriate repair group when removing individual engine components.

1. Drain all coolant and engine oil. Check engine oil for metal contaminates.
2. Remove turbocharger oil inlet line and oil return line. Remove turbocharger.
3. Remove fan pulley and coolant manifold assembly.
4. Remove coolant pump assembly from timing gear cover.

NOTE: DO NOT damage option code label (if equipped), when removing rocker arm cover.

5. Remove breather hose from rocker arm cover. Remove rocker arm cover. Remove carrier, if equipped.
6. Remove rocker arm assembly(ies) and push rods. Identify parts for reassembly.
7. Remove front crankshaft pulley and damper assembly.
8. Remove fuel injection lines, fuel connectors, and injection nozzles.
9. Remove engine oil filter, filter base, and valve housing.
10. Remove fuel filter and mounting base. Remove injection pump gear cover and remove injection pump. Remove all remaining fuel lines.
11. Remove high pressure common rail, if equipped.
12. Remove engine oil cooler assembly.
13. Remove front and rear exhaust manifolds.
14. Remove air intake manifold.

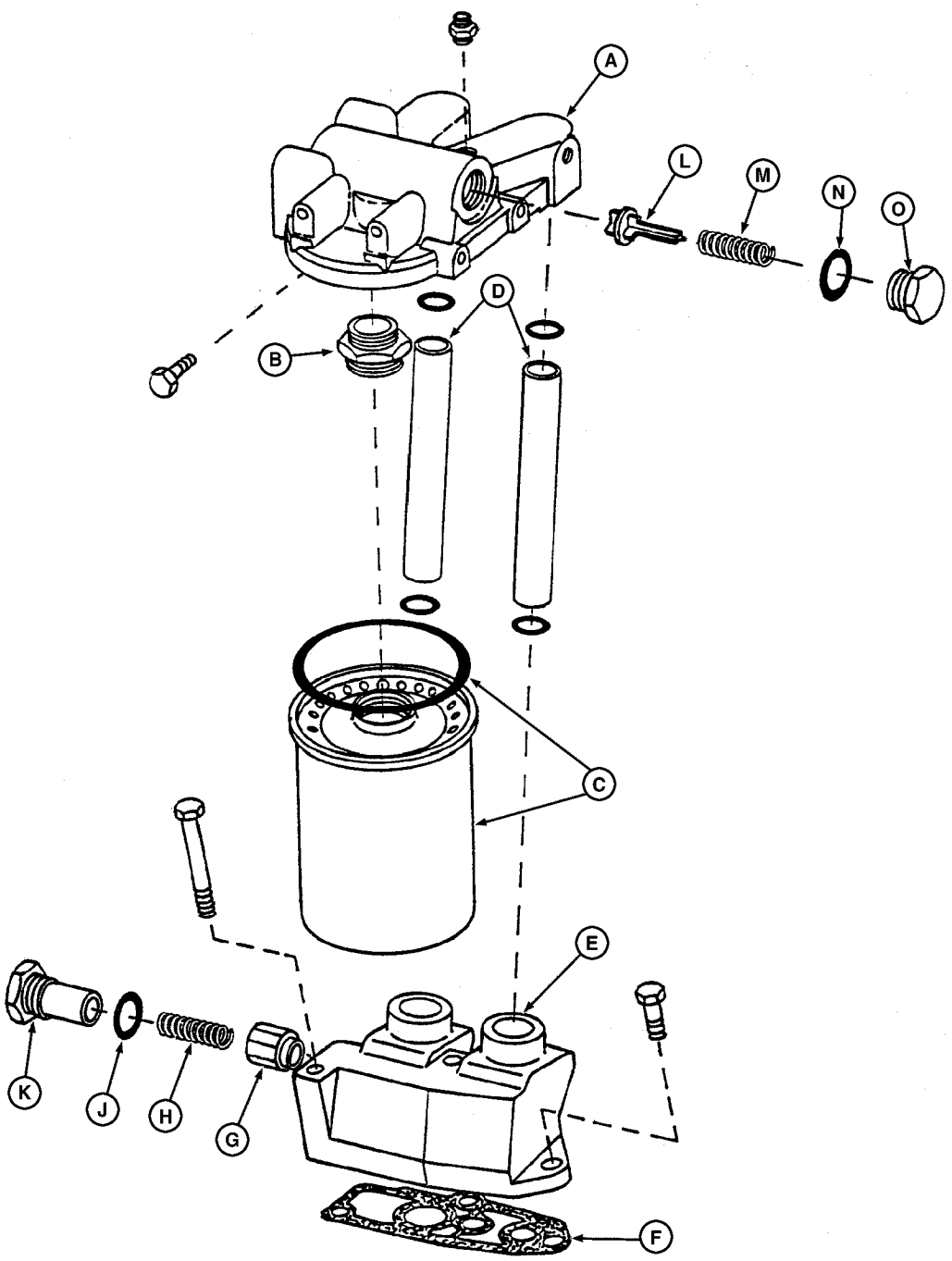
NOTE: ALWAYS bolt down liners when rotating engine flywheel with cylinder head removed.

15. Remove cylinder head with assembly. Remove head gasket.
16. Revolve engine on repair stand and remove engine oil pump assembly.
17. Remove front timing gear cover.
18. Revolve engine to vertical position. Remove pistons and connecting rods. Identify for reassembly. Perform bearing-to-journal wear checks with PLASTIGAGE®.
19. On SAE No. 3 flywheel housings, remove flywheel housing and then remove flywheel.
20. On SAE No. 1 and 2 flywheel housings, remove flywheel and then remove flywheel housing.
21. Remove main bearing caps and remove crankshaft. Perform bearing-to-journal wear checks with PLASTIGAGE®.
22. Remove camshaft and cam followers. Identify for reassembly.
23. Revolve engine to horizontal position, remove liners, O-rings, and packings. Mark liners for reassembly in same bore from which removed.
24. Remove piston cooling orifices from cylinder block.
25. Remove any sensors/gauges, cylinder block plugs and engine serial number plate, if block is to be put in a “hot tank”.
26. Refer to appropriate group for inspection and repair of engine components.

PLASTIGAGE is a registered trademark of DANA Corp.

RG,RG34710,1050 –19–19MAY99–1/1

Oil Filter Base and Oil Pressure Regulating Valve Housing Assembly



RG7008 –UN–05DEC97

Oil Filter Base and Oil Pressure Regulating Valve Housing Assembly

A—Oil Filter Base
B—Oil Filter Adapter
C—Oil Filter With Packing
D—Oil Tubes
E—Oil Pressure Regulating Valve Housing
F—Gasket
G—Oil Pressure Regulating Valve
H—Spring
J—O-Ring
K—Plug
L—Oil Filter Bypass Valve
M—Spring
N—O-Ring
O—Plug

RG,RG34710,1216 –19–23OCT97–1/1

Turbocharger Failure Analysis

The following is a guide for diagnosing the cause of turbocharger failures after removal from the engine.

Problem	Possible Cause	Suggested Remedy
COMPRESSOR HOUSING INLET DEFECTS		
Foreign Object Damage	Objects left in intake system.	Disassemble and inspect intake system for foreign objects (this group). Inspect engine for internal damage.
	Leaking and/or defective intake system.	Inspect air intake system connections including air filter; repair as required (this group). Inspect air intake related engine components.
Compressor Wheel Rub	Bearing failure.	Determine if engine and/or operator contributed to lack of lubrication, contaminated lubrication, excessive temperature, or debris generating engine failure in progress. Correct as required.
	Manufacturing defects.	Correct as required.
COMPRESSOR HOUSING OUTLET DEFECTS		
Oil and/or Dirt in Housing	Restricted air intake system. Prolonged periods of low rpm engine idling. Defective oil seal ring. Restricted oil drain line.	Inspect and clean air cleaner. Check with operator to confirm conditions. (See Operator's Manual.) Repair as required (this group). Inspect and clear oil drain line as required.
TURBINE HOUSING INLET DEFECTS		
Oil in Housing	Internal engine failure.	Inspect and repair engine as required. **Make certain to check all ail lines/hoses for oil residue. If oil is found, it is ABSOLUTELY NECESSARY to make certain the lines and Charge Air Cooler or Heat Exchanger have been thoroughly cleaned out. Failure to do so can result in engine failure. Remove CAC and use John Deere Coolant System Cleaner PMCC2638, or equivalent. Dry the components with compressed air and BE CERTAIN all water is removed.**
	Oil leaking from compressor housing seal.	Verify that oil is in compressor housing and refer to "Compressor Housing Outlet Defects" as listed earlier in this chart.
Center Wall Deteriorated	Excessive operating temperature.	Check for restricted air intake. Check engine for overfueling. Check injection pump timing.

Continued on next page

General OEM Engine Specifications

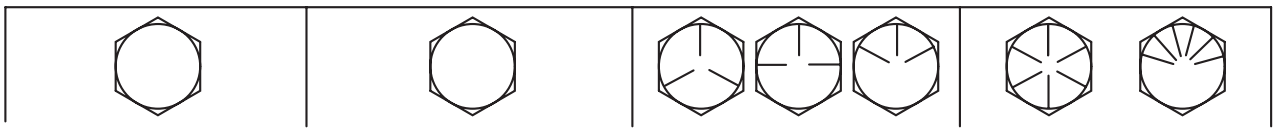
NOTE: For John Deere vehicle engines, see Machine Technical Manual.

ITEM	UNIT OF MEASURE	6081TF	6081AF
General Data			
Engine Type	——	In-line, 4 cycle diesel	In-line, 4 cycle diesel
Aspiration	——	Turbocharged	Turbocharged, water-to-air aftercooled
Number of Cylinders	——	6	6
Bore	mm (in.)	116 (4.56)	116 (4.56)
Stroke	mm (in.)	129 (5.06)	129 (5.06)
Displacement	L (cu in.)	8.1 (496)	8.1 (496)
Combustion System	——	Direct Injection	Direct Injection
Compression Ratio	——	16.5:1	16.5:1
Physical Dimensions:			
Width	mm (in.)	599 (23.8)	698 (27.5)
Height	mm (in.)	1138 (44.8)	1138 (44.8)
Length	mm (in.)	1200 (47.6)	1200 (47.6)
Basic Dry Weight	kg (lb)	735 (1620)	796 (1755)
Performance Data (Industrial Applications)			
Net Rated Power (Cont.) at 2200 rpm	kW (hp)	127 (170)	160 (215)
Net Peak Torque(Cont.) at 1200 rpm	N•m (lb-ft)	758 (559)	967 (713)
Net Rated Power (Intermit.) at 2200 rpm	kW (hp)	149 (200)	168 (225)
Net Peak (Intermit) at 1200 rpm	N•m (lb-ft)	891 (656)	1012 (747)
Low Idle Speed	rpm	850	850
Fast Idle Speed	rpm	2300	2300
Performance Data (Generator Applications)			
Net Rated Power (Prime) at 1800 rpm	kW (hp)	142 (190)	168 (225)
Net Rated Power (Standby) at 1800 rpm	kW (hp)	157 (211)	187 (250)
Net Rated Power (Prime) at 1500 rpm	kW (hp)	119 (160)	142 (190)
Net Rated Power (Standby) at 1500 rpm	kW (hp)	130 (175)	157 (210)
Low Idle Speed	rpm	850	850
Fast Idle Speed	rpm	1900/1600	1900/1600
Lubrication System			
Oil Pressure at Rated rpm	kPa (psi)	345 (50)	345 (50)
Oil Pressure at Low Idle	kPa (psi)	210 (30)	210 (30)
In-Crankcase Oil Temp at Rated rpm	°C (°F)	115°C (240°F)	115°C (240°F)
Cooling System (Liquid, pressurized with centrifugal pump)			
Recommended Pressure Cap	kPa (psi)	69 (10)	69 (10)
Coolant Temperature Operating Range	°C (°F)	82°-94°C (180°-202F°)	82°-94°C (180°-202F°)
Coolant Flow (Industrial)	L/min (gal/min)	330 (87)	330 (87)
Coolant Flow (Generator)			
at 1800 rpm	L/min (gal/min)	270 (71)	270 (71)
at 1500 rpm	L/min (gal/min)	210 (55)	210 (55)
Engine Operation System			

Continued on next page

Unified Inch Bolt and Screw Torque Values

TS1671 –UN–01MAY03



Bolt or	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
Screw	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]	
Size	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N•m	lb-ft	N•m	lb-ft
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N•m	lb-ft	N•m	lb-ft				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N•m	lb-ft	N•m	lb-ft	N•m	lb-ft								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N•m	lb-ft														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a]Grade 2 applies for hex cap screws (not hex bolts) up to 6. in (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

[b]"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C zinc flake coating.

[c]"Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B zinc flake coating.

DX,TORQ1 –19–24APR03–1/1

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Indx 1

- Starting and charging systems are covered in this new group.

SECTION 03, GROUP 120 (Base Engine Operation)

- Base engine theory of operation is covered in this new group.

NOTE: Fuel system theory of operation has been moved to Section 03 in the three following technical manuals:

- *CTM243—Mechanical Fuel Systems*
- *CTM134—Level 3 Electronic Fuel Systems*
- *CTM255—Level 9 Electronic Fuel Systems*

SECTION 04, GROUP 150 (Observable Diagnostics and Tests)

- Base engine observable diagnostics and tests are covered in this new section/group.

NOTE: Fuel system diagnostics and testing has been moved to Section 04 in the three following technical manuals:

- *CTM243—Mechanical Fuel Systems*
- *CTM134—Level 3 Electronic Fuel Systems*
- *CTM255—Level 9 Electronic Fuel Systems*

SECTION 05 (Tools and Other Materials)

- All essential tools, service tools, dealer fabricated tools, and other materials listed throughout this manual are consolidated in this section for ease of reference.

SECTION 06 (Specifications)

- All repair, test, and diagnostic specifications listed throughout this manual are consolidated in this section for ease of reference.
- Updated bolt and cap screw torque values.
- Updated General OEM specifications.
- Updated dynamometer specifications.
- Updated turbocharger boost specifications

DPSG,OUO1004,898 –19–19MAY99–2/2

Diesel Engine Coolants, Supplemental Additive Information

Engine coolants are a combination of three chemical components: ethylene glycol (antifreeze), inhibiting coolant additives, and quality water.

Coolant Specifications

Some products, including John Deere COOL-GARD Prediluted Coolant, are fully formulated coolants that contain all three components in their correct concentrations. Do not add an initial charge of supplemental coolant additives to these fully formulated products.

Some coolant concentrates, including John Deere COOL-GARD Coolant Concentrate, contain both ethylene glycol antifreeze and inhibiting coolant additives. Mix these products and quality water, but do not add an initial charge of supplemental coolant additives.

Coolants meeting ASTM D5345 (prediluted coolant) or ASTM D4985 (coolant concentrate) require an initial charge of supplemental coolant additives.

Replenish Coolant Additives

The concentration of coolant additives is gradually depleted during engine operation. Periodic replenishment of inhibitors is required, even when John Deere COOL-GARD is used. Follow the recommendations in this manual for the use of supplemental coolant additives.

Why Use Supplemental Coolant Additives?

Operating without proper coolant additives will result in increased corrosion, cylinder liner erosion and pitting, and other damage to the engine and cooling system. A simple mixture of ethylene glycol and water will not give adequate protection.

Use of supplemental coolant additives reduces corrosion, erosion, and pitting. These chemicals reduce the number of vapor bubbles in the coolant and help form a protective film on cylinder liner surfaces. This film acts as a barrier against the harmful effects of collapsing vapor bubbles.

Avoid Automotive-Type Coolants

Never use automotive-type coolants (such as those meeting ASTM D3306 or ASTM D4656). These coolants do not contain the correct additives to protect heavy-duty diesel engines. They often contain a high concentration of silicates and may damage the engine or cooling system.

Non-Aqueous Propylene Glycol

Non-aqueous propylene glycol should not be used with John Deere diesel engines. This coolant works best with coolant temperatures above the acceptable engine operating range. This could decrease engine life due to lower engine oil viscosity. In addition, electronically controlled engines could experience premature power de-rate due to high coolant temperature.

Water Quality

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol base engine coolant concentrate. All water used in the cooling system should meet the following minimum specifications for quality:

Chlorides	40 mg/L or less
Sulfates	100 mg/L or less
Total Dissolved Solids	340 mg/L or less
Total Hardness	170 mg/L or less
pH Level	5.5 to 9.0

Freeze Protection

The relative concentrations of ethylene glycol and water in the engine coolant determine its freeze protection limit. Refer to the chart on the following page.

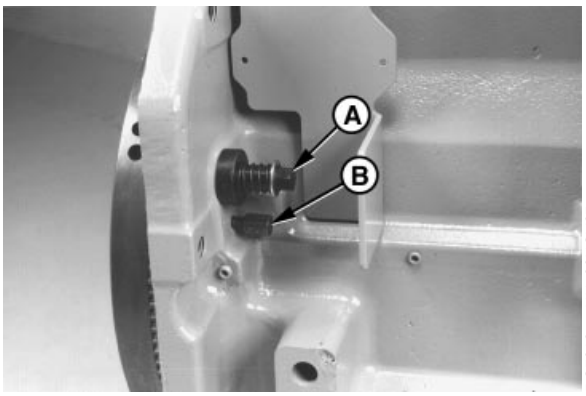
Continued on next page

2. Remove plastic plug from cylinder block bores and install JDE81-1 or JDG820 Flywheel Turning Tool (A) and JDE81-4 Timing Pin (B).

3. Rotate engine with the flywheel turning tool until timing pin engages timing hole in flywheel.

   If the rocker arms for No. 1 (front) cylinder are loose, the engine is at No. 1 “TDC-Compression.”

   If the rocker arms for No. 6 (rear) cylinder are loose, the engine is at No. 6 “TDC-Compression.” Rotate the engine one full revolution (360°) to No. 1 “TDC-Compression.”



Flywheel Turning Tool and Timing Pin

A—Flywheel Turning Tool
B—Timing Pin

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DPSG,OUO1004,829 –19–13DEC00–2/4

Complete Final Assembly of Injection Pump Side of Engine Serial Number (—199,999)

1. Adjust valve clearance, if not previously done.

NOTE: Apply AR31790 SCOTCH-GRIP® Adhesive or equivalent to seal gasket to rocker arm cover (B). Follow manufacturer's directions on the package for correct application procedure and curing time.

2. Position rocker arm cover gasket on cylinder head and install rocker arm cover. Tighten cap screws to specifications.

Specification

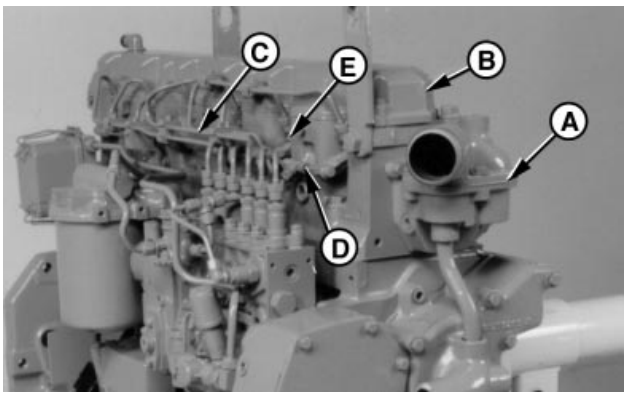
Rocker Arm Cover-to-Cylinder Head Cap Screw—Torque ..... 8 N•m (6 lb-ft) (72 lb-in.)

3. Install fuel injection nozzles (E), fuel leak-off lines (D) and fuel delivery lines (C). If mechanical fuel system, see INSTALL FUEL INJECTION NOZZLES in Group 090 of CTM243. If Level 3 Electronic fuel system, see INSTALL FUEL INJECTION NOZZLES in Group 090 of CTM134.

NOTE: Make sure ventilator outlet hose is open and adapter is clean. A restriction could cause high oil pressure and possible loss of oil.

4. Connect ventilator outlet hose to adapter on rocker arm cover and tighten clamp securely.

5. Install coolant manifold (A). See INSTALL COOLANT MANIFOLD in Group 070.



RG7023 –UN–26NOV97

Final Assembly of Injection Pump Side of Engine

A—Coolant Manifold
B—Rocker Arm Cover
C—Fuel Delivery (Pressure) Lines
D—Fuel Leak-off Lines
E—Fuel Injection Nozzles

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RG,RG34710,1105 –19–23OCT97–1/1

Measure Cylinder Liner Standout (Height Above Block) - Serial Number (200,000—)

1. Bolt down liners using cap screws and flat washers in the seven locations as shown. Flat washers should be at least 3.18 mm (1/8 in.) thick. Tighten cap screws to 68 N•m (50 lb-ft) to achieve an accurate standout reading.

NOTE: Liners having obvious defects must be replaced.

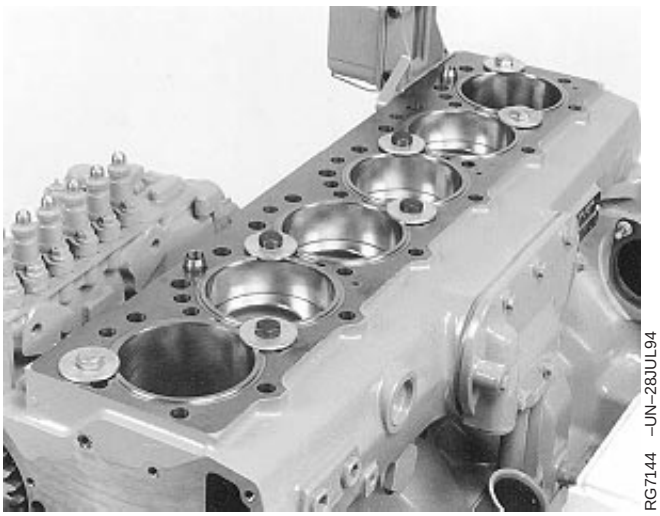
2. Using JDG451 Gauge (A) along with D17526CI (English) or D17527CI (Metric scale) Dial Indicator (B) or KJD10123 Gauge, measure the height of bolted down liners that are not obviously defective before removal from block.

NOTE: Variations in measurement readings may occur within one cylinder and/or between adjacent cylinders.

3. Measure each liner in four places, approximately at 1, 5, 7 and 11 O'clock positions as viewed from the rear of the engine (flywheel end). Record all measurements by cylinder number and compare to the following specifications.

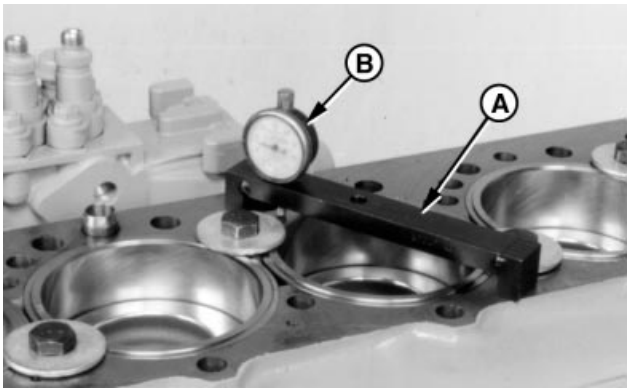
Specification	
Liner—Height Above Block	0.051—0.127 mm (0.002—0.005 in.) above block

4. Remove any liner that does not meet standout specification at any location and install liner shims or replace piston/liner sets as necessary. See INSTALL LINER SHIMS—IF REQUIRED in Group 030



RG7144 –UN–28JUL94

Bolting Down Cylinder Liners



RG7145 –UN–26NOV97

Checking Cylinder Liner Height Above Block

A—JDG451 Gauge
B—Dial Indicator

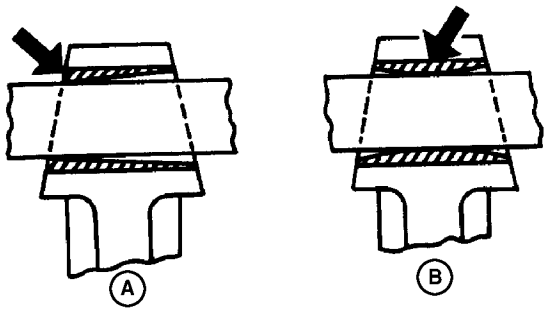
RG41165,0000063 –19–22DEC00–1/1

4. Insert pin from either side of rod bushing. If pin is free on one end, but tight on the other, the bore could be tapered (A). If pin enters freely from both sides, but is tight in the center, bore is bell-mouthed (B).

5. Measure I.D. of rod pin bushing and O.D. of piston pin. Compare measurements with specifications given below:

	Specification
Piston Pin—OD	47.597—47.613 mm (1.8739—1.8745 in.)
Piston Pin Bore in Piston—ID	47.620—47.630 mm (1.8748—1.8752 in.)
Installed Connecting Rod Pin Bushing (After Boring)—ID	47.655—47.681 mm (1.8762—1.8772 in.)
Connecting Rod Pin-to-Bushing—Oil Clearance	0.042—0.084 mm (0.0017—0.0033 in.)
Wear Limit	0.102 mm (0.0040 in.)

6. If necessary, remove and replace piston pin bushing. See REMOVE PISTON PIN BUSHING, CLEAN AND INSPECT PIN BORE, later in this group.



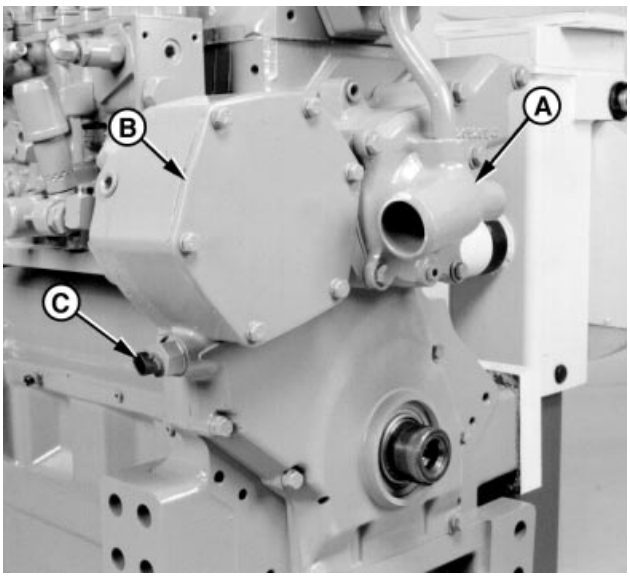
Inspecting Piston Pin Bores

A—Tapered Bore
B—Bell-Mouthed Bore

DPSG,OUO1004,891 –19–18MAY99–2/2

Remove Timing Gear Cover—Engine Removed

1. Remove engine oil pan. Remove engine oil pump assembly if crankshaft is to be removed.
2. Disconnect engine speed sensor connector (shown disconnected) from sensor (C).
3. Remove injection pump drive gear cover (B).
4. Disconnect coolant piping and remove coolant pump cover (A) with coolant bypass tube. Remove and discard gaskets.
5. Remove front auxiliary drive assembly, if equipped. See REMOVE, INSPECT AND INSTALL CRANKSHAFT GEAR-DRIVEN AUXILIARY DRIVE in Group 050.
6. Remove remaining cap screws and remove timing gear cover with coolant pump. Remove and discard gasket.
7. Remove front oil seal from timing gear cover and discard seal.
8. Remove front wear sleeve from crankshaft flange and discard sleeve.



Removing Timing Gear Cover

A—Coolant Pump Cover
B—Injection Pump Drive Gear Cover
C—Sensor

RG,RG34710,1157 –19–23OCT97–1/1

Install SAE 2 and 3 Flywheel Housing

On SAE 1 and all aluminum flywheel housings, the flywheel housing is installed AFTER the flywheel.

CAUTION: Flywheel housing (A) is heavy. Plan a handling procedure to avoid personal injuries.

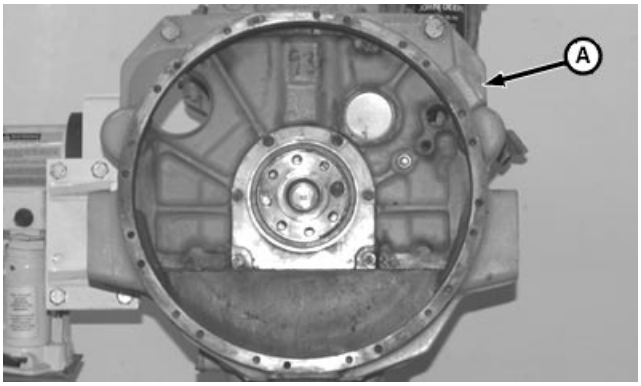
NOTE: Engines not requiring a gasket are usually dry clutch applications and are metal to metal connection.

1. On engines requiring a gasket between block and flywheel housing, inspect cylinder block and flywheel housing gasket surfaces to see that they are clean. Scrape off all old gasket material.
2. Place a bead of LOCTITE®515 across the “T Joint” where the rear of the block and oil pan joint is located.
3. Position flywheel housing gasket over the two dowel pins, with the rubber bead side of the gasket toward the block.
4. Apply Loctite 515 once again on the “T Joint” area on the block. The gasket will thus have sealant on both sides in the T Joint areas.
5. Install flywheel housing on cylinder block.

NOTE: Use new cap screws when installing flywheel housing.

6. Dip threads of cap screw in engine oil before installing. Install and tighten cap screws to specifications.

Specification	
SAE 2 and 3 Flywheel Housing-to-Cylinder Block Cap Screws—Torque	365 N•m (269 lb-ft)
SAE 3 Flywheel Housing-to-Oil Pan 1/2 in. Cap Screws—Torque	129 N•m (95 lb-ft)
SAE 3 Flywheel Housing-to-Oil Pan 3/8 in. Cap Screws—Torque	47 N•m (35 lb-ft)



RG10214 –UN–23JUN99

Installing SAE 3 Flywheel Housing

A—Flywheel Housing

LOCTITE is a trademark of Loctite Corp.

Continued on next page

RG,RG34710,1190 –19–03JAN01–1/2

Remove, Inspect, and Install Engine Oil Cooler

See ENGINE OIL COOLER ASSEMBLY, earlier in this group for exploded view of engine oil cooler assembly.

02
060
10

Remove Oil Cooler Assembly:

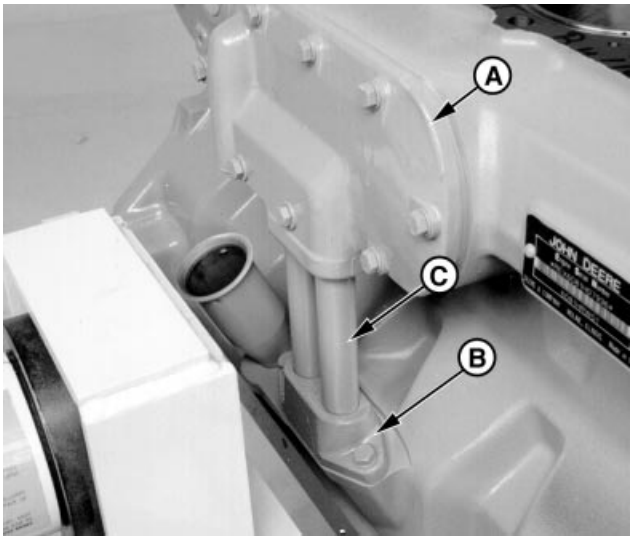
1. Remove eight cap screws securing oil cooler cover (A).
2. Remove two cap screws securing oil cooler tube adapter (B). Remove cover, tubes (C), and adapter as an assembly.
3. Remove oil cooler (D) from block bore. Clean all gasket material from mating surfaces.

Inspect Oil Cooler Assembly:

1. Inspect oil cooler for physical damage, plugging, or leakage which may allow mixing of oil and coolant.
2. Back flush oil cooler to clean all debris from core.
3. Pressure test oil cooler in liquid and compressed air if mixing of oil and coolant is suspected.

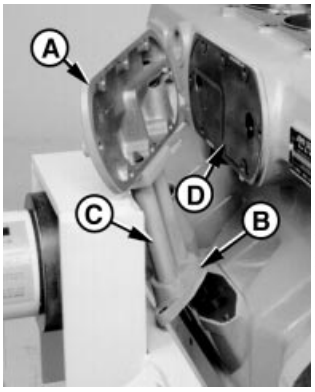
   Oil cooler should show no leakage when 140-170 kPa (1.4—1.7 bar) (20—25 psi) air pressure is applied for a minimum of 30 seconds.
4. Inspect all remaining parts of oil cooler assembly.

   Replace parts as needed. DO NOT attempt to repair oil cooler.



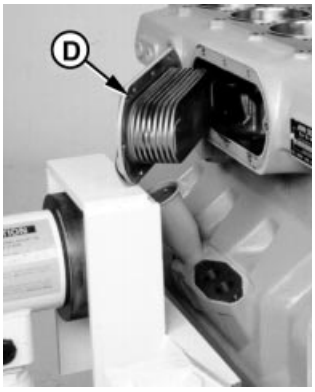
RG7217 –UN–12JAN98

Removing Oil Cooler



RG7218 –UN–26NOV97

Removing Oil Cooler



RG7219 –UN–28NOV97

Oil Cooler Removed

A—Oil Cooler Cover/Bypass Valve Housing
B—Oil Cooler Tube Adapter
C—Oil Cooler Tubes
D—Oil Cooler

Continued on next page

DPSG,OUO1004,821 –19–27APR99–1/2

3. Remove thermostats.

4. Inspect thermostats for debris or damage, and test each thermostat using an approved testing procedure. See INSPECT THERMOSTAT AND TEST OPENING TEMPERATURE in Group 150 for testing procedure. Thermostats should start to open within the range specified below.

Specification

Thermostat 82°C (180°F)—
Opening Temperature ..... 80—84°C (175—182°F)

If either thermostat fails to open within this range, replace both thermostats as a set.

Removing Thermostats

RG,RG34710,1247 –19–23OCT97–2/2

Remove Coolant Manifold

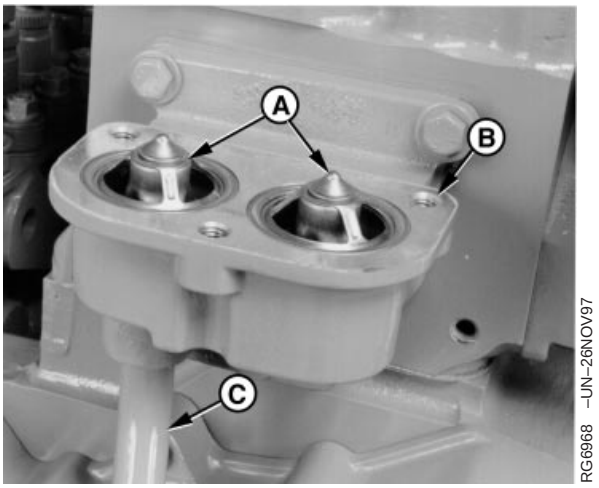
1. Drain coolant and remove thermostat cover from coolant manifold (shown removed). Remove thermostats (A).

2. Remove three coolant manifold-to-cylinder head cap screw, remove coolant manifold (B) and dislodge coolant bypass tube as manifold is removed.

NOTE: Pull coolant manifold straight out (toward front of engine) approximately 6.35 mm (0.25 in.) to disengage from locator (spring) pin, then lift straight up to disengage from bypass tube (C).

3. Remove and discard O-ring from bore of coolant manifold.

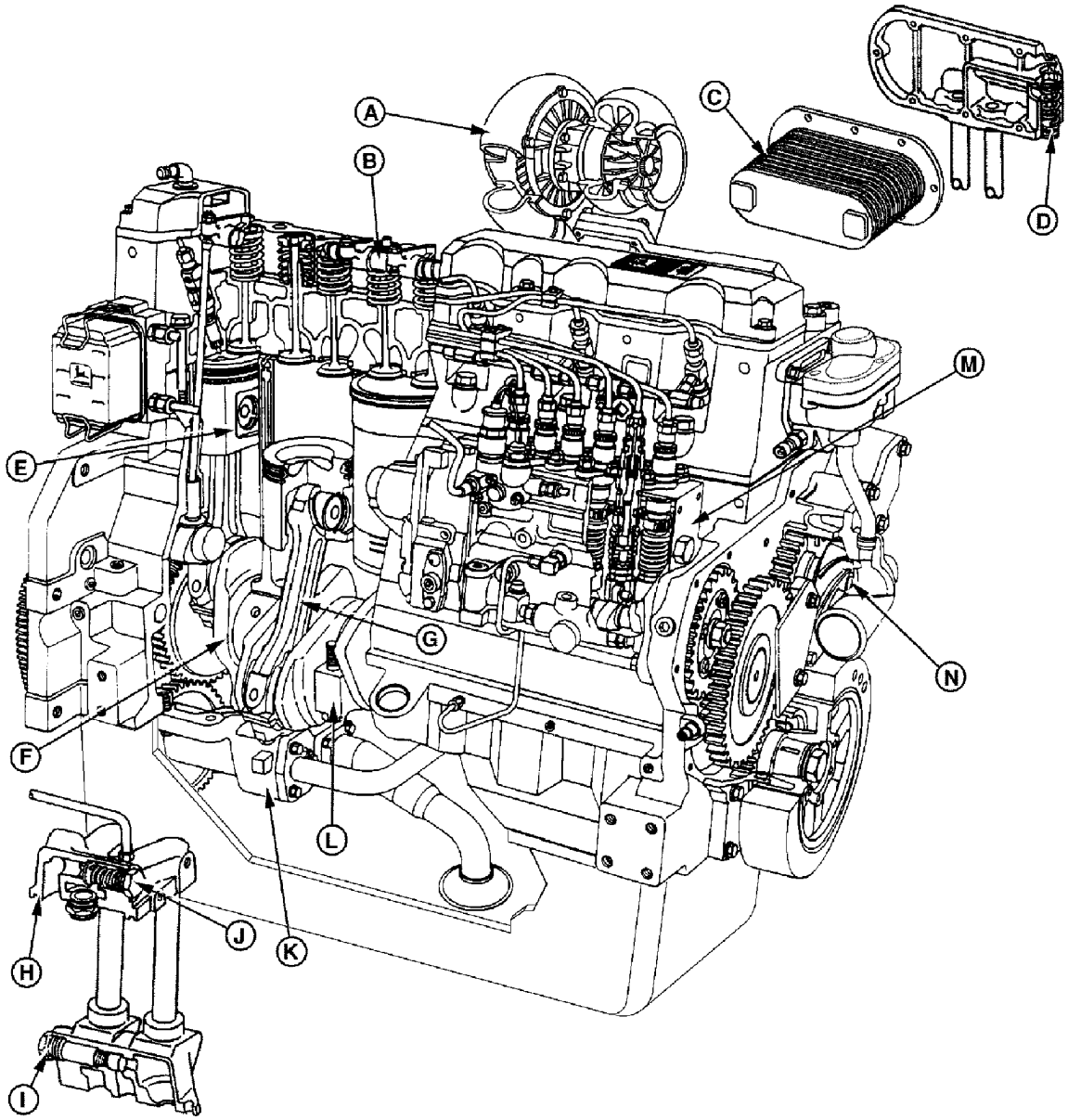
A—Thermostats
B—Bore of Coolant Manifold
C—Bypass Pipe



Removing Coolant Manifold

RG,RG34710,1249 –19–23OCT97–1/1

Engine Sectional View Serial Number (—199,999)



RG10051 –UN–03JUN99

A—Turbocharger
B—Rocker Arm Shaft
C—Oil Cooler
D—Oil Cooler Bypass Valve
E—Piston
F—Crankshaft
G—Connecting Rod
H—Oil Filter Base
I—Oil Pressure Regulating Valve
J—Oil Filter Bypass Valve
K—Oil Pump Assembly
L—Main Bearing Cap
M—Fuel Injection Pump
N—Coolant Pump

DPSG,OUO1004,901 –19–19MAY99–1/1

Check for Turbocharger Oil Seal Leak

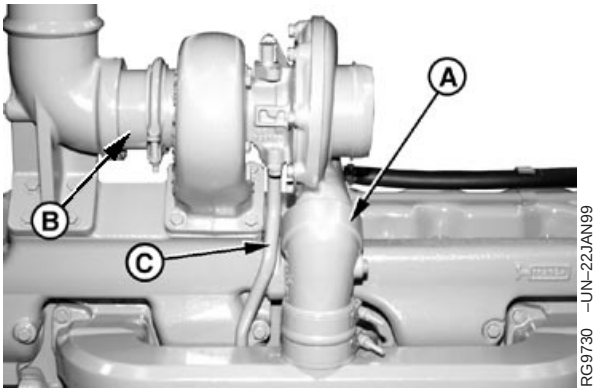
CAUTION: After operating engine, allow exhaust system to cool before removing turbocharger.

IMPORTANT: Any time there has been a turbocharger failure, it is ABSOLUTELY NECESSARY to check turbo housings and air tubes or lines for signs of residual oil. If oil is found, MAKE CERTAIN that all air hoses, tubes, lines, Charge Air Coolers (CAC) or Heat Exchangers have been thoroughly cleaned. All contamination, especially oil, MUST BE REMOVED.

FAILURE TO THOROUGHLY CLEAN ALL OIL OUT OF THE CAC AND LINES CAN RESULT IN AN ENGINE OVER SPEED SITUATION, RESULTING IN SEVERE ENGINE DAMAGE.

Procedure for cleaning CAC: Remove CAC from machine. Use John Deere Coolant System Cleaner PMCC2638, or equivalent, per the instructions, to clean the oil residue from the CAC. Use compressed air to completely dry the inside of the CAC and lines.

All water MUST BE REMOVED from the CAC.



A—Intake Hose
B—Exhaust Pipe
C—Oil Return Line

Seals are used on both sides of the turbocharger rotor assembly. The seals are used to prevent exhaust gases and air from entering the turbocharger housing. Oil leakage past the seals is uncommon but can occur.

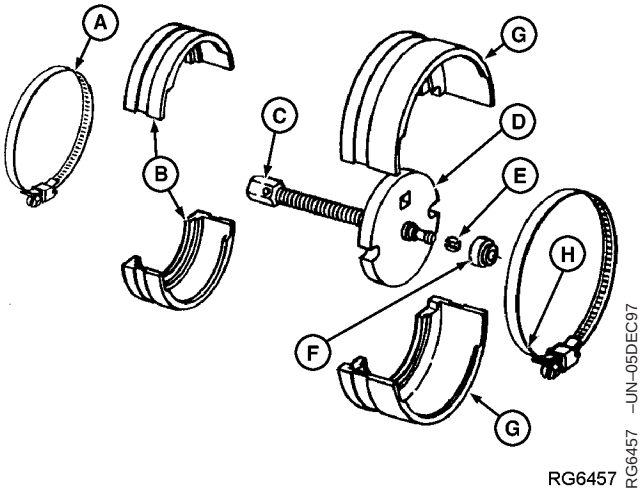
A restricted or damaged turbocharger oil return line can cause the housing to pressurize causing oil to leak by the seals. Additionally, intake or exhaust restrictions can cause a vacuum between the compressor and turbocharger housing causing oil to leak by the seals.

1. Remove intake tube (A) and exhaust pipe (B).

Continued on next page

Rear Wear Sleeve Puller Kit JDG790

Used to remove rear wear sleeve with oil seal housing installed on Series 400, 450, and 500 Engines. Set consists of 219469 Hose Clamp (Series 500), JDG790-1 Collet Halves (Series 400/450), 35945 Forcing Screw, JDG790-2 Pulling Plate (Series 400/450/500), 13876 Retainer Clip (Series 400/450/500, 215177 Shaft Protector (Series 400/450/500), JDG790-3 Collet Halves (Series 500), 19311 Hose Clamp (Series 400/450).



JDG790

RG41183,000000D –19–03JAN01–10/13

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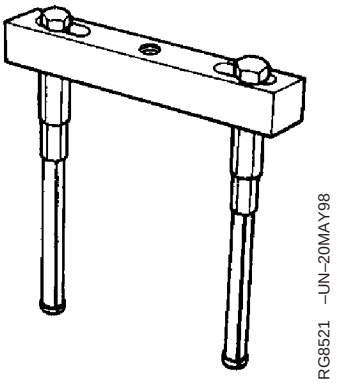
18

Main Bearing Cap Puller/Installer JDG1069

Use to remove and install the main bearing caps. Due to wider bearing surface, these caps are installed with an increased interference fit.



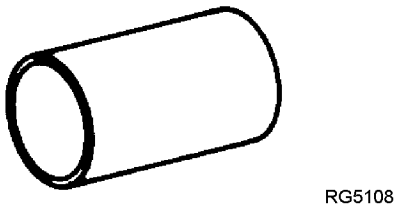
JDG1069

RG41183,000000D –19–03JAN01–11/13

RG5108 –UN–05DEC97

Gear Driver JDH7

Install crankshaft drive gear.



JDH7

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RG41183,000000D –19–03JAN01–12/13

Item	Measurement	Specification
Crankshaft Main Journal	Taper per 25.4 mm (1.0 in.) length Out-of-Roundness	0.0025 mm (0.0001 in.) 0.025 mm (0.0010 in.)
Crankshaft Main Bearing Cap	Surface Width	36.28—36.78 mm (1.428—1.448 in.)
Main Bearing Cap Bore	ID Without Bearings (Standard) Diameter Variation Diameter Taper Straightness Variation (Any Bore-to-Adjacent Bore) Straightness Variation (5 Center Bore-to-End Bore Centerline of Bore-to-Top Deck	101.651—101.677 mm (4.0020—4.0030 in.) 0.013 mm (0.0005 in.) maximum 0.008 mm (0.0003 in.) maximum 0.038 mm (0.0015 in.) maximum 0.076 mm (0.0030 in.) maximum 352.35—352.50 mm (13.872—13.878 in.)
Thrust Washer Clearance[1]	Base Circle OD	129.286—130.810 mm (5.09—5.15 in.)
Thrust Bearing Cap	Surface Width	37.44—37.54 mm (1.474—1.478 in.)
Thrust Washer Clearance	Relief Angle	45°
Thrust Bearing Cap	Overall Width (—1995) Overall Width (1995—)	41.81—42.31 mm (1.646—1.666 in.) 39.16—39.66 mm (1.542—1.561 in.)
Thrust Bearing Surface	Maximum Runout	0.25 mm (0.0010 in.)
Undersized Main Bearings Available	OD	0.292 mm (0.0115 in.) and 0.552 mm (0.0217 in.)
Undersized Rod (Pin) Journal Bearings Available	OD	0.292 mm (0.0115 in.)
Oversize Thrust Washer Available	OD	0.18 mm (0.007 in.)
Crankshaft	End Play	0.038—0.380 mm (0.0015—0.0150 in.)
Piston Cooling Orifices into Cylinder Block	Torque	11 N•m (97 lb-in.)

06
200
19

[1] Thrust (washer) surfaces on bearing cap must be flat in respect to mating thrust (washer) surfaces in cylinder block.

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