POWERTECH® 10.5 L & 12.5 L Diesel Engines

Base Engine

TECHNICAL MANUAL

POWERTECH 10.5 L & 12.5 L Diesel Engines—Base Engine

CTM100 06APR04 (ENGLISH)

For complete service information also see:

POWERTECH® 10.5 L & 12.5 L Diesel Engines—Delphi/Lucas Electronic Fuel Systems With Delphi/Lucas EUIs CTM115

POWERTECH® 10.5 L & 12.5 L Diesel Engines—Level 6 Electronic Fuel Systems With Delphi/Lucas EUIs. CTM188

OEM Engine Accessories . . . . . CTM67 (English Only)

Alternators and Starter Motors. CTM77

John Deere Power Systems

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Contents

SECTION 01—General Information
- Group 000—Safety
- Group 001—Engine Identification and Applications
- Group 002—Fuels, Lubricants and Coolant

SECTION 02—Repair and Adjustments
- Group 010—Engine Rebuild Guide, Break-In and Tune-Up
- Group 020—Cylinder Head and Valves
- Group 030—Cylinder Block, Liners, Pistons, and Rods
- Group 040—Crankshaft, Main Bearings, and Flywheel
- Group 050—Camshaft and Timing Gear Train
- Group 060—Lubrication System
- Group 070—Cooling System
- Group 080—Air Intake and Exhaust System
- Group 090—Fuel System
- Group 100—Starting and Charging Systems

SECTION 03—Theory of Operation
- Group 120—Base Engine Operation

SECTION 04—Diagnostics
- Group 150—Observable Diagnostics and Tests

SECTION 05—Tools and Other Materials
- Group 170—Repair Tools and Other Materials
- Group 180—Diagnostic Service Tools
- Group 190—Dealer Fabricated Service Tools

SECTION 06—Specifications
- Group 200—Repair and General OEM Specifications
- Group 210—Diagnostic Specifications

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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.



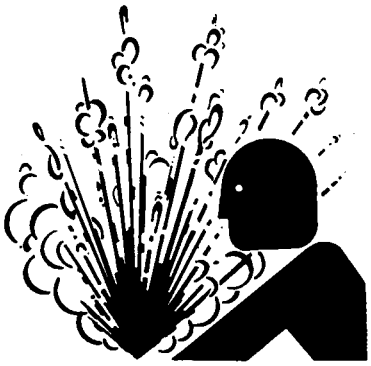
TS227 –UN–23AUG88

DX,FLAME –19–29SEP98–1/1

Service Cooling System Safely

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



TS281 –UN–23AUG88

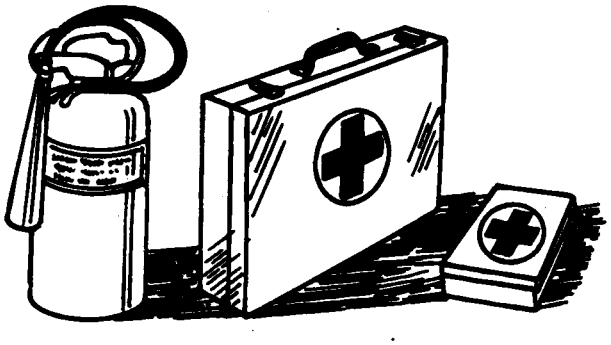
DX,RCAP –19–04JUN90–1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



TS291 –UN–23AUG88

DX,FIRE2 –19–03MAR93–1/1

Engine Application Chart

John Deere Agricultural Equipment Applications

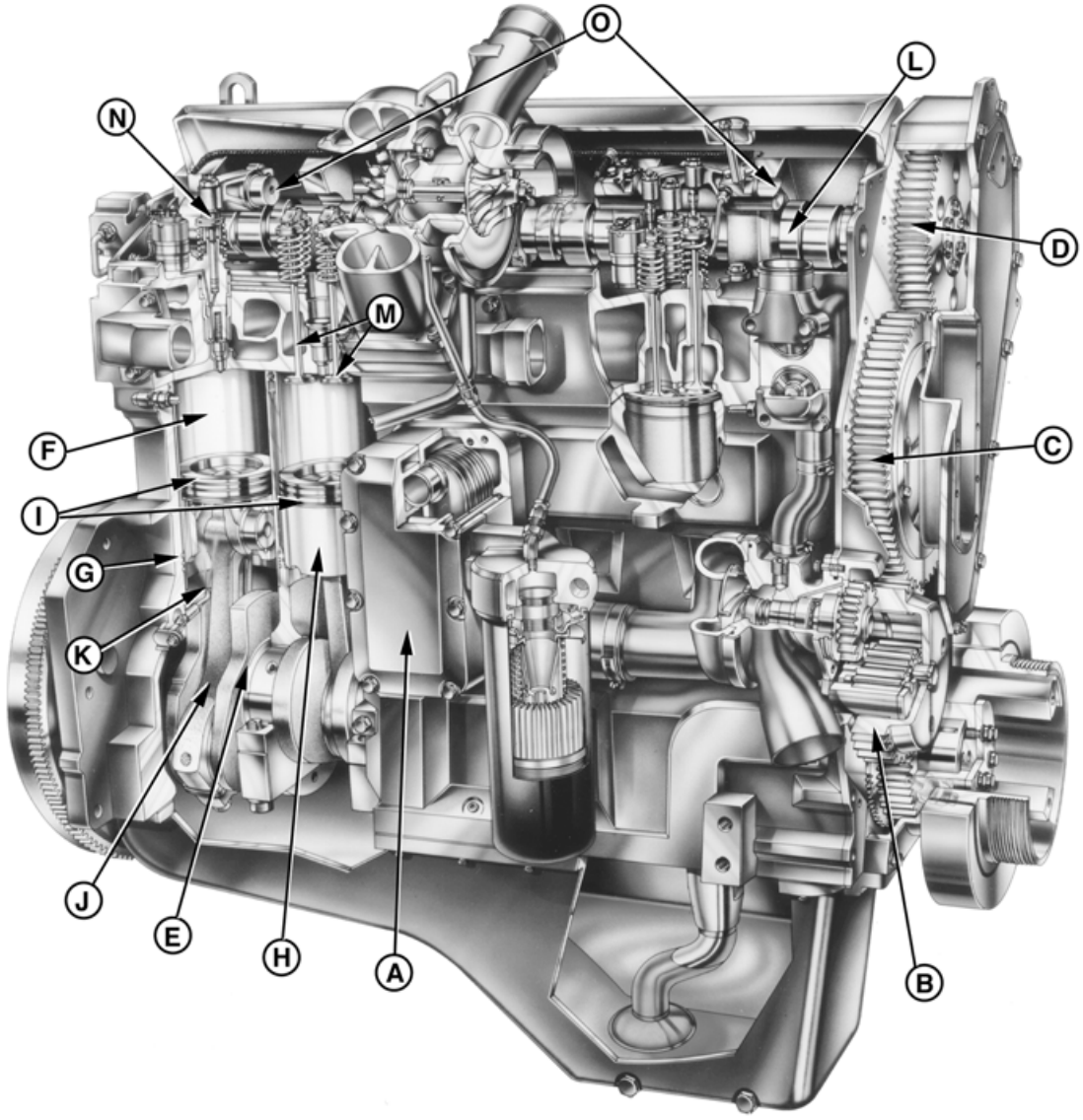
Machine Model No.	Engine Model
WATERLOO TRACTORS—4-WHEEL DRIVE	
9200	6105HRW01, 6105HRW02, 6125HRW05 (30000—)
9220	6125HRW10, 6125HRW13, 6125HRW16
9300	6125HRW01, 6125HRW11, 6125HRW07 (30000—)
9320	6125HRW13, 6125HRW16
9400	6125HRW02, 6125HRW12, 6125HRW09 (30000—)
9420	6125HRW15, 6125HRW17
9520	6125HRW15, 6125HRW17
9620	6125HRW18
WATERLOO TRACTORS—TRACK TYPE	
9300T	6125HRW03, 6125HRW06 (30000—)
9320T	6125HRW13, 6125HRW16
9400T	6125HRW04, 6125HRW08 (30000—)
9420T	6125HRW15, 6125HRW17
9520T	6125HRW15, 6125HRW17
9620T	6125HRW18
HARVESTER—COMBINES	
9860	6125HH003
ZWEIBRUCKEN—COMBINES/FORAGE HARVESTERS	
6750	6125HZ002, 6125HZ006
6850	6125HZ001, 6125HZ005
7300 (Europe)	6125HZ007
7400 (Europe)	6125HZ008
7500 (Europe)	6125HZ009
7700 (Europe)	6125HZ009
7300 (North America)	6125HZ011
7400 (North America)	6125HZ012
7500 (North America)	6125HZ013
7700 (North America)	6125HZ013
9880 STS Combine (Europe)	6125HZ004
CANE HARVESTER (CAMECO—THIBODAUX, LA)	
CH2500	6125AT801

John Deere Construction and Forestry Equipment Applications

Machine Model No.	Engine Model
744H/HMH Loader	6125ADW01, 6125HDW01
LX230 Loader (Hitachi Construction Machinery)	6125ADW70
450C LC Excavator	6125HT001 (30000—)
824J Loader	6125HDW01
844J Loader (production summer 2005)	6125HT003
744J Loader	6125HDW01

Continued on next page

6105 and 6125 Engine Cutaway View



Engine Cutaway View

A—Oil Cooler
B—Oil Pump Drive Gear
C—Idler Gear
D—Camshaft Gear
E—Crankshaft
F—Cylinder Liner
G—Cylinder Liner O-Rings
H—Piston
I—Piston Rings
J—Connecting Rod
K—Oil Spray Jet
L—Camshaft
M—Valves
N—Electronic Unit Injector
O—Two-Piece Rocker Arm Shaft

RG,RG34710,8 –19–30SEP97–1/1

Remove and Install Rocker Arm Cover

Remove Rocker Arm Cover

1. Remove air intake cross-over tube (shown removed).

NOTE: Turbocharger is removed for photographic purposes only. It is not necessary to remove turbocharger for rocker arm cover removal.

2. Remove center hold-down cap screw with isolator.

3. Remove two outside cap screws with isolators (A), and thread cap screws into rocker arm cover as shown.

NOTE: Rocker arm cover gasket is reusable if no visible damage is detected. Do not store cover resting on gasket surface.

4. Lift rocker arm cover off engine.

Install Rocker Arm Cover

IMPORTANT: Always check routing of unit injector wiring (B) before installing rocker arm cover. Wiring should be positioned so that rocker arms never contact wire.

1. Inspect rocker arm cover gasket to ensure that gasket is properly seated in groove and that contact face is clean.

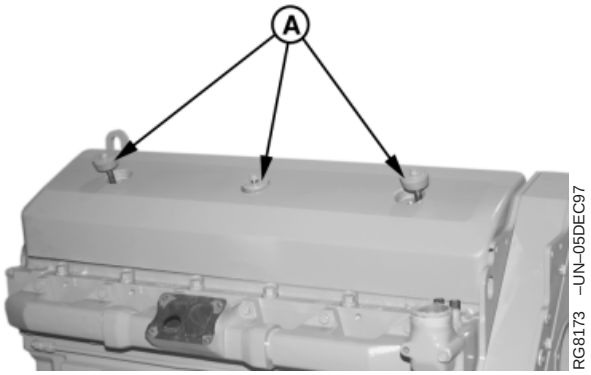
2. Position rocker arm cover onto two locating dowels in cylinder head.

3. Install center hold-down cap screw with isolator. Tighten to specifications.

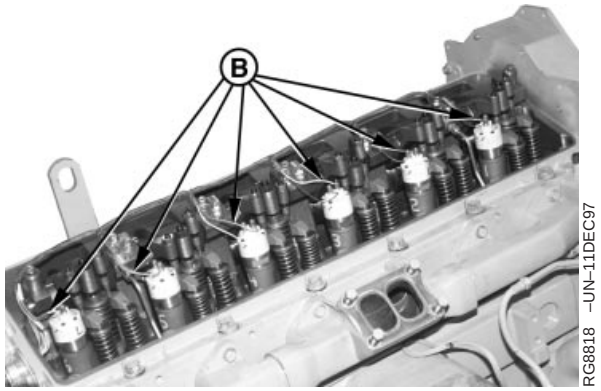
Specification

Rocker Arm Cover Hold-Down Cap Screws[1]—Torque ..... 30 N•m (22 lb-ft)

4. Install two outside hold-down cap screws with isolators. Tighten to specifications.



Isolators



Unit Injector Wiring

A—Isolators
B—Unit Injector Wiring

[1]Tighten center cap screw first, then tighten sides.

Continued on next page

Torque-Turn Cylinder Head Cap Screws

Arrow (A) points toward front of engine.

IMPORTANT: DO NOT use multi-viscosity oils to lubricate cap screws.

1. Lubricate cap screws with clean SAE 30 engine oil and install in their proper locations as outlined previously.

2. If not done, initially tighten cap screw No. 17 to specification to prevent head from tipping during tightening sequence.

Specification

Step 1—Cylinder Head No. 17 Cap Screw—Initial Torque ..... 100 N•m (74 lb-ft)

Following figure on previous page, sequentially start at cap screw No. 1 and proceed through cap screw No. 26 and tighten all cap screws to 163 N•m (120 lb-ft).

Specification

Step 2—All Cap Screws (Nos. 1—26)—Initial Torque ..... 163 N•m (120 lb-ft)

3. Wait 5 minutes and verify above torque.

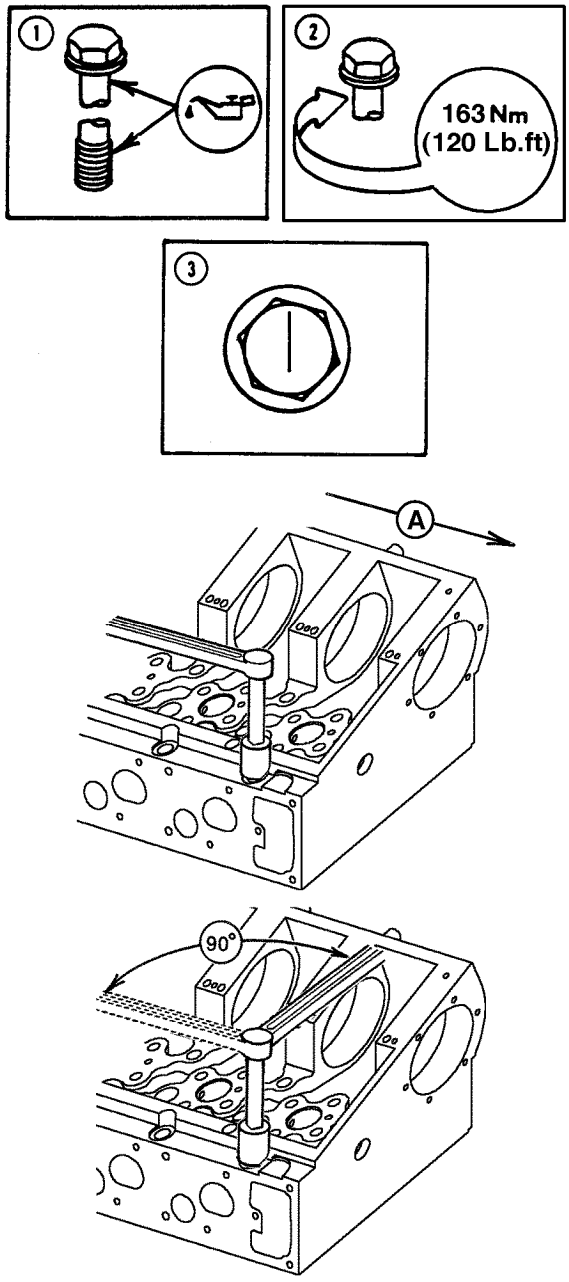
Specification

Step 3—Verify All Cap Screws (Nos. 1—26)—Torque ..... 163 N•m (120 lb-ft)

4. Using an oil-proof pen, pencil, or marker, draw a line parallel to the crankshaft across the entire top of each cap screw head. This line will be used as a reference mark.

IMPORTANT: If a cap screw is accidentally tightened more than 90° in first sequence, DO NOT loosen cap screw but make adjustments in the next tightening sequence.

5. Sequentially (start at cap screw No. 1 and proceed through cap screw No. 26) turn each cap screw 90°. Line on top of cap screw will be perpendicular to crankshaft.



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Torque-Turn Cylinder Head Cap Screws

A—Front of Engine

Continued on next page

10.5L/12.5L - L2 Engine Oil Pressure High

Symptom	Problem	Solution
10.5L/12.5L - L2 - Engine Oil Pressure High	Improper oil classification	Drain crankcase and refill with correct oil.
	Oil pressure regulating valve bushing loose (wanders)	Remove and inspect oil pressure regulating valve. See REMOVE, INSPECT, AND INSTALL OIL PRESSURE REGULATING VALVE in Section 02, Group 060.
	Improperly operating regulating valve	Remove and inspect oil pressure regulating valve. See REMOVE, INSPECT, AND INSTALL OIL PRESSURE REGULATING VALVE in Section 02, Group 060.
	Plugged piston spray jet	Replace piston spray jet. See REMOVE AND INSTALL PISTON SPRAY JETS in Section 02, Group 030.
	Stuck or damaged filter bypass valve	Remove and inspect filter bypass valve. See REMOVE, INSPECT, AND INSTALL OIL COOLER AND OIL FILTER BYPASS VALVES in Section 02, Group 060.
	Stuck or damaged oil cooler bypass valve	Remove and inspect oil cooler bypass valve. See REMOVE, INSPECT, AND INSTALL OIL COOLER AND OIL FILTER BYPASS VALVES in Section 02, Group 060.

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Cylinder Head and Valves (Group 020) Specifications

Item	Measurement	Specification
Rocker Arm Cover Hold-Down Cap Screws[1]	Torque	30 N•m (22 lb-ft)
Crankcase Vent Baffle-to-Rocker Arm Cover Cap Screws	Torque	15 N•m (11 lb-ft) (133 lb-in.)
Valve Stem-to-Bridge Clearance (Engine Cold)		
Intake Valve	Clearance	0.58 ± 0.05 mm (0.023 ± 0.002 in.)
Exhaust Valve	Clearance	1.08 ± 0.05 mm (0.043 ± 0.002 in.)
Intake and Exhaust Valve Adjusting Screw Lock Nuts	Torque	50 N•m (37 lb-ft)
Electronic Unit Injector	Preload	0.00 mm (in.) clearance plus 1/2 turn in (180°)
Electronic Unit Injector Adjusting Screw Lock Nuts	Torque	65 N•m (48 lb-ft)
Timing Pin Plug (Below Oil Cooler)	Torque	33 N•m (24 lb-ft)
Rocker Arm Bushing	ID	38.064 ± 0.013 mm (1.4986 ± 0.0005 in.)
Rocker Arm Shaft	OD	38.000 ± 0.013 mm (1.4961 ± 0.0005 in.)
Rocker Arm Shaft-to-Bushing	Oil Clearance	0.064 ± 0.026 mm (0.0025 ± 0.0010 in.)
Rocker Arm Shaft Intake and Exhaust Roller	OD	39.995—40.045 mm (1.5746—1.5766 in.)
Rocker Arm Shaft Unit Injector Roller	OD	37.995—38.045 mm (1.4959—1.4978 in.)
Intake and Exhaust Valves	Recess	1.85—2.35 mm (0.073—0.093 in.)

[1]Tighten center cap screw first, then tighten sides.

Continued on next page

ENGINE ASSEMBLY SEQUENCE—CONTINUED	
Procedure	**Reference**
Install water manifold/thermostat housing assembly.	See REMOVE AND INSTALL THERMOSTAT HOUSING in Group 070.
Install oil filter housing/oil cooler assembly.	See INSTALL OIL COOLER/OIL FILTER VALVE HOUSING ASSEMBLY OR OIL COOLER COVER/VALVE HOUSING ASSEMBLY in Group 060.
Install exhaust manifold assembly.	See REMOVE, INSPECT AND INSTALL EXHAUST MANIFOLD in Group 080.
Install turbocharger. Connect all turbocharger oil lines and intake/exhaust piping.	See INSTALL TURBOCHARGER in Group 080.
Install alternator.	See REMOVE AND INSTALL ALTERNATOR in Group 100.
Install compressor.	See CTM67, OEM Engine Accessories.
Install fan drive, fan and fan belt.	See Group 070.
Mount engine into vehicle.	See vehicle repair manual.
Flush cooling system. Fill engine systems with recommended fuel, lubricant, and coolant.	See FLUSH AND SERVICE COOLING SYSTEM in Section 01, Group 002.
Perform engine break-in and normal standard performance checks.	See PERFORM ENGINE BREAK-IN in this group.

RG,RG34710,52 –19–21AUG02–3/3

Engine Break-In Guidelines

Engine break-in should be performed after overhaul or when the following repairs have been made:

Main bearings, rod bearings, crankshaft, or any combination of these parts have been replaced.

Pistons, rings, or liners have been replaced.

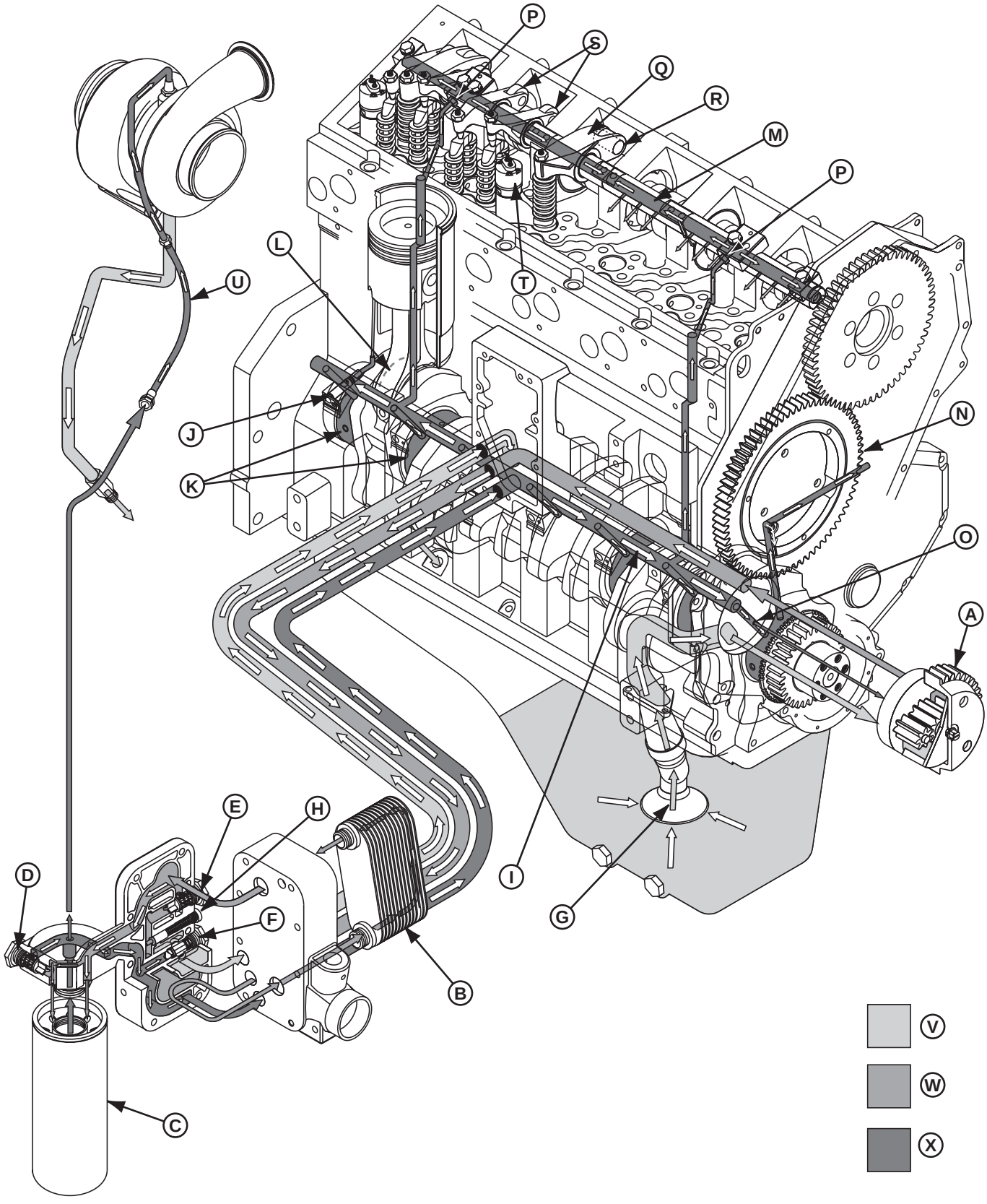
Rear crankshaft oil seal and wear sleeve have been replaced. (Primary objective is to see if oil seal still leaks).

Cylinder head has been removed.

Electronic unit injectors have been removed or critical adjustments have been made while they are on the engine. (Primary objective of break-in is to check power).

RG,RG34710,1053 –19–05DEC00–1/1

Lubrication System Operation



Continued on next page

RG,RG34710,1519 –19–16SEP02–1/3

Extended Diesel Engine Oil Service Intervals

When John Deere PLUS-50™, ACEA E5, or ACEA E4 oils are used with the 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.

DX,ENOIL8 –19–03NOV03–1/1

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

SECTION 02—GROUP 090 and 091(Fuel System)

NOTE: Repair procedures for fuel systems has been moved to the following manuals:

- CTM115—Delphi/Lucas Electronic Fuel Systems With Delphi/Lucas EUIs, Section 02, Group 090
- CTM188—Level 6 Electronic Fuel Systems With Delphi/Lucas EUIs, Section 02, Group 090 (Dual Rail System) and Group 091 (Single Rail System)

Later Tier II 12.5 L engines with dual- or single-rail fuel systems are covered in CTM188.

SECTION 02—GROUP 100 (Starting and Charging Systems)

- Updated torque specifications for alternator mounting hardware.

SECTION 02—GROUP 110 (Electrical Engine Control)

NOTE: Repair procedures for electrical engine control components has been moved to section 02, group 110 of the following manuals:

- CTM115—Delphi/Lucas Electronic Fuel Systems With Delphi/Lucas EUIs
- CTM188—Level 6 Electronic Fuel Systems With Delphi/Lucas EUIs

SECTION 03—GROUP 120 (Base Engine Operation)

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

NOTE: Fuel system theory of operation has been moved to Section 03, Group 130 of the following manuals:

- *CTM115—Delphi/Lucas Electronic Fuel Systems With Delphi/Lucas EUIs*
- *CTM188—Level 6 Electronic Fuel Systems With Delphi/Lucas EUIs*

SECTION 04—GROUP 150 (Observable Diagnostics and Tests)

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

NOTE: Fuel system testing and diagnostics has been moved to Section 04, Group 150 in two other technical manuals: CTM115—Delphi/Lucas Electronic Fuel Systems With Delphi/Lucas EUIs and CTM188—Level 6 Electronic Fuel Systems With Delphi/Lucas EUIs.

SECTION 5 (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 6 (Specifications)

- All repair, test and diagnostic specifications listed throughout this manual are consolidated in this section for ease of reference.
- Updated dynamometer test specifications.
- Updated intake manifold pressure specifications.

OUO1004,0000BBC –19–11OCT00–2/2

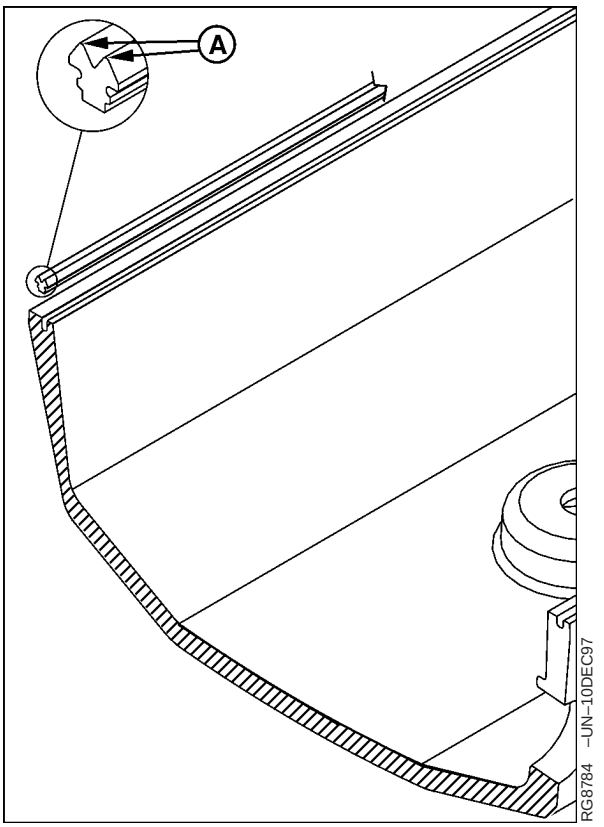
Replace Rocker Arm Cover Gasket

1. Remove rocker arm cover. (See REMOVE AND INSTALL ROCKER ARM COVER earlier in this group.)
2. Remove existing gasket from cover and discard. Clean gasket groove as needed.
3. Position new gasket at two front corners of cover with double lips (A) of gasket facing up.

IMPORTANT: DO NOT stretch gasket while seating in groove of cover.

4. Seat gasket on front side of cover and proceed around entire cover gasket groove using a deep-well socket.
5. Re-seat gasket again (especially in corners) after entire gasket is installed in groove.

A—Gasket Double Lips



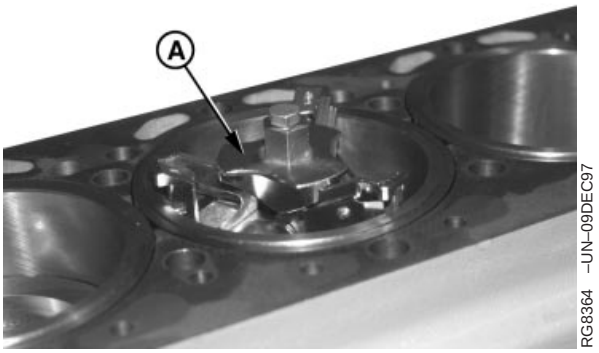
Replacing Rocker Arm Cover Gasket

RG,RG34710,62 –19–30SEP97–1/1

NOTE: Always follow manufacturer's directions provided with ridge reamer.

7. Remove carbon ridge from liner bore with a scraper or JT07277 Ridge Reamer (A). Use compressed air to remove loose carbon from cylinders.

A—JT07277 Ridge Reamer



Using Liner Ridge Reamer

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RG,RG34710,107 –19–01NOV00–3/4

Inspect Thrust Bearings

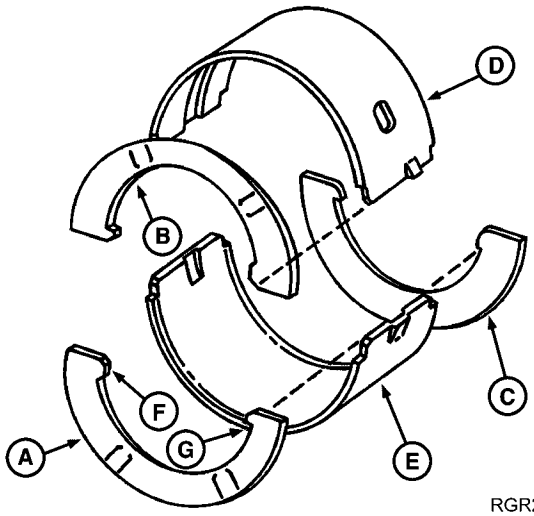
Check thrust surfaces of the thrust bearing and the thrust bearing journal on crankshaft and replace as necessary.

Thrust bearings are available in each of the previously mentioned insert undersizes. An oversize thrust washer set containing one regular size washer and two 0.18 mm (0.007 in.) oversize washers is also available.

Specification

Oversize Thrust Washers Available—Thickness	0.18 mm (0.007 in.)

NOTE: Thrust bearing must be installed with slots facing crankshaft flange. Two halves (A) and (C) go on cap side, not block.



Thrust Bearing Assembly

A—Lower Rear Thrust Washer
B—Upper Rear Thrust Washer
C—Lower Front Thrust Washer
D—Main Bearing Block Thrust Bearing
E—Main Bearing Cap Thrust Bearing
F—Large Tang
G—Small Tang

RG,RG34710,173 –19–13AUG99–1/1

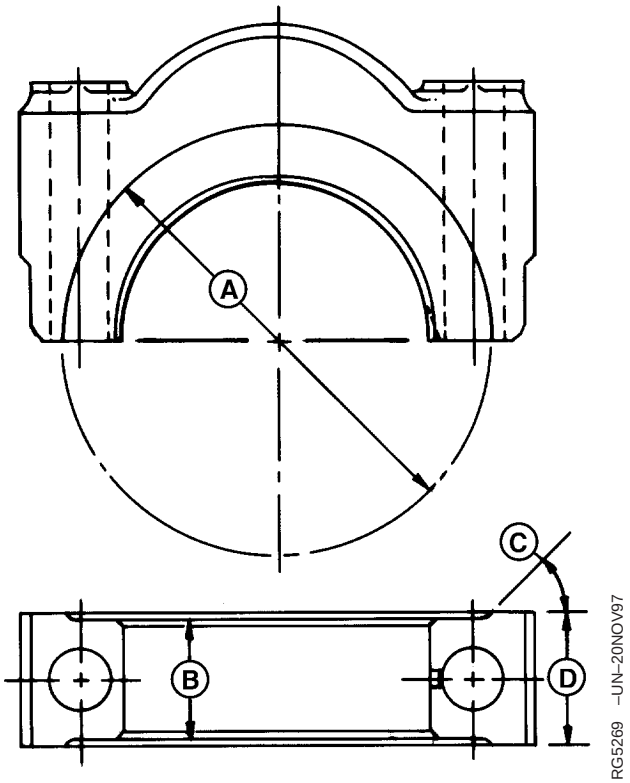
Thrust Bearing New Part Specifications

IMPORTANT: Install thrust bearing in cylinder block and tighten to specification before regrinding or polishing thrust surfaces to ensure that all surfaces on bearing and on block web are correctly aligned.

Specification

Thrust Bearing New Part Specifications—Thrust Washer	
Clearance Base Circle (A)	162.24—163.76 mm (6.387—6.447 in.)
Thrust Surface Width (B)	42.05—42.12 mm (1.656—1.658 in.)
Relief Angle (C)	45°
Bearing Cap Overall Width (D)	43.46 mm (1.711 in.)
Thrust Surface Maximum Runout	0.025 mm (0.0010 in.)

A—Thrust Washer Clearance Base Circle
B—Thrust Surface Width
C—Relief Angle
D—Bearing Cap Overall Width



Thrust Bearing Clearance

RG,RG34710,174 –19–13AUG99–1/1

Test Thermostat Opening Temperature

1. Remove thermostats. (See REMOVE THERMOSTATS earlier in this group.)

CAUTION: DO NOT allow thermostat or thermometer to rest against the side or bottom of container when heating water. Either may rupture if overheated.

2. Visually inspect thermostats for corrosion or damage. Replace thermostats as a matched set as necessary.

3. Suspend thermostats and a thermometer in a container of water.

4. Stir the water as it heats. Observe opening action of thermostat and compare temperatures with specification given in chart below.

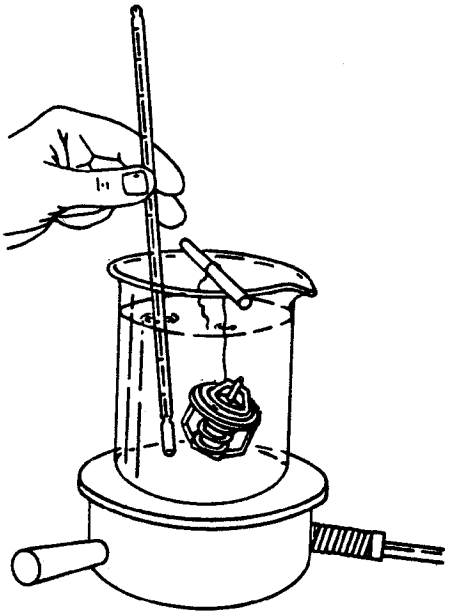
Specification

Thermostat Test—Rating	82°C (180°F)
Initial Opening (Range) Temperature	80—84°C (175—182°F)
Full Open (Nominal) Temperature	94°C (202°F)

NOTE: Due to varying tolerances of different supplies, initial opening and full open temperatures may vary slightly from specified temperatures.

5. Remove thermostat and observe its closing action as it cools. In ambient air the thermostat should close completely. Closing action should be smooth and slow.

6. If any one thermostat is defective, replace both thermostats.



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Testing Thermostats

RG,RG34710,234 –19–30SEP97–1/1

02
070
13

Check Camshaft-to-Crankshaft Timing

Check Camshaft-to-Crankshaft Timing

1. Remove rocker arm cover. See (REMOVE AND INSTALL ROCKER ARM COVER in Group 020.)

2. Remove plug from cylinder block and install JDG820 Flywheel Turning Tool (B).

IMPORTANT: JDG971 Timing Pin MUST BE installed into camshaft timing slot (A) first before attempting to install second timing pin into crankshaft timing slot (C).

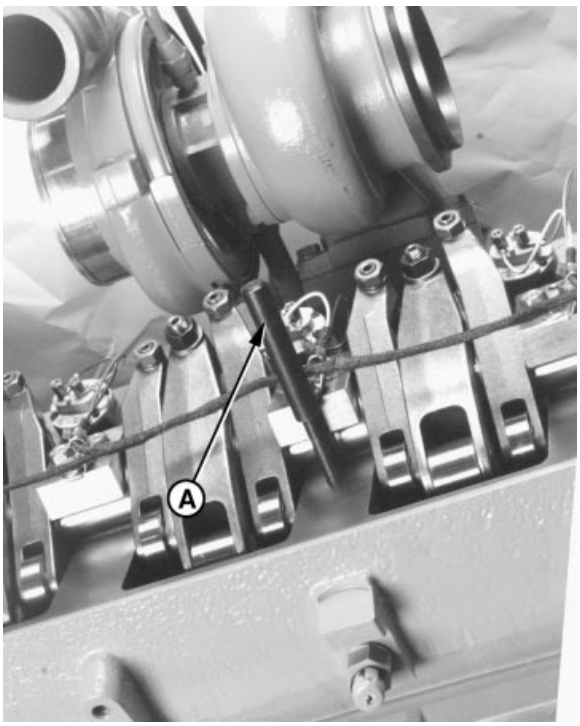
3. Rotate engine flywheel in running direction (Counter-clockwise as viewed from rear) until JDG971 Timing Pin (A) engages single timing slot (D) in camshaft. The proper timing slot can be found by viewing camshaft timing lobe through camshaft timing pin bore while rotating engine. The double timing slot (E) will be at approximately 11 o'clock (viewed from rear of engine) when pin is installed in slot (D). This ensures that engine is locked at TDC of No. 1 cylinder's compression stoke. Intake and exhaust rocker arms on No. 1 cylinder should be loose.

4. Remove threaded plug from crankshaft timing hole below oil cooler and filter housing assembly.

IMPORTANT: DO NOT insert timing pin full depth into cylinder block crankshaft timing hole when rotating engine flywheel until double slot on camshaft timing lobe is at approximately 11 o'clock (viewed from rear of engine) to avoid crankshaft counterweight bending timing pin.

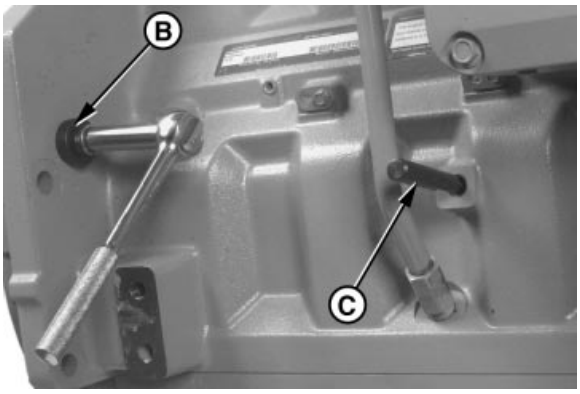
5. Slightly move engine flywheel back and forth with turning tool until a second JDG971 Timing Pin (C) can be installed in slot in crankshaft. This ensures that camshaft and crankshaft are in sync (properly timed).

A—Timing Pin
B—Flywheel Turning Tool
C—Timing Pin
D—Single Timing Slot
E—Double Timing Slot



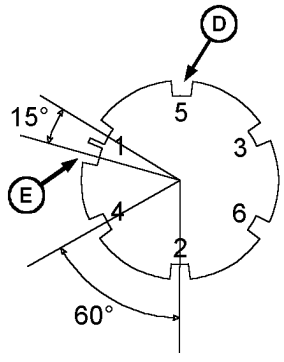
RG8228A –UN–05DEC97

JDG971 Timing Pin in Camshaft



RG8227D –UN–05DEC97

JDG971 Timing Pin in Crankshaft



RG11165 –UN–30OCT00

Camshaft Timing Slot

04
150
23

Continued on next page

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