PowerTech™ 4.5 L and 6.8 L Diesel Engines Base Engine

COMPONENT TECHNICAL MANUAL

PowerTech™ 4.5L and 6.8L Diesel Engines— Base Engine

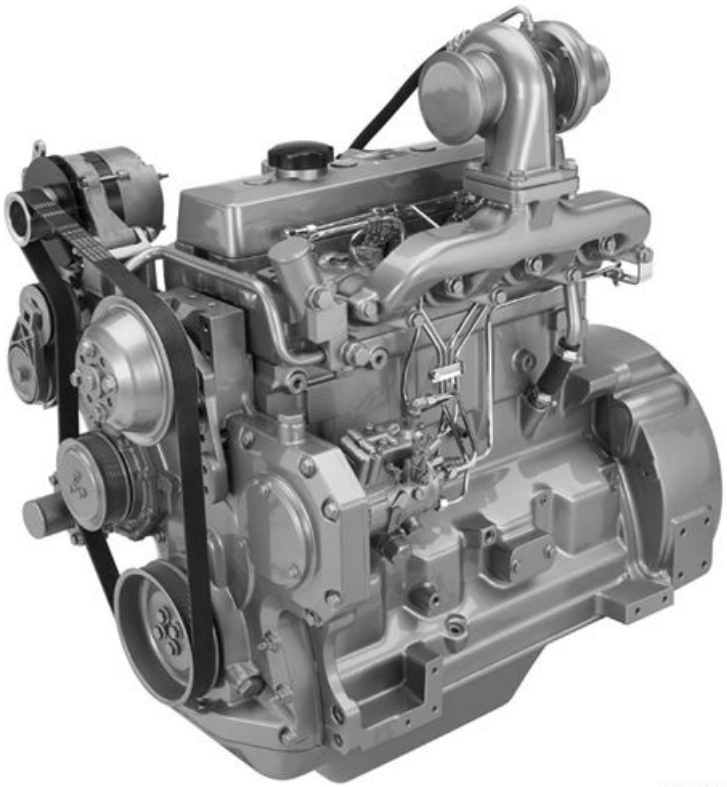
CTM104 19JAN12 (ENGLISH)

For complete service information also see:

PowerTech™ Diesel Engines—Mechanical Fuel Systems	CTM207
PowerTech™ Diesel Engines—Level 4 Electronic Fuel Systems with Bosch VP44 Pump	CTM170
PowerTech™ Diesel Engines—Level 12 Electronic Fuel Systems with Stanadyne DE10 Pump	CTM331
PowerTech™ Diesel Engines—Level 1 Electronic Fuel Systems with Delphi/Lucas DP201 Pump	CTM284
PowerTech™ Diesel Engines—Level 11 Electronic Fuel Systems with Denso HPCR	CTM220
PowerTech™ Diesel Engines and PowerTech™ Plus—Level 14 Electronic Fuel Systems with Denso HPCR	CTM320
PowerTech™ Diesel Engines and PowerTech™ E—Level 16 Electronic Fuel Systems with Denso HPCR	CTM502
Alternators and Starter Motors	CTM77
OEM Engine Accessories	CTM67
Application List	CTM106819
JDPS Master Tool Manual	TM111119

John Deere Power Systems
LITHO IN U.S.A.

PowerTech™ M 4.5 L Engine with Mechanical Fuel System and 17 mm Injectors



CD31002 —UN—29NOV07

4045HF280 Engine (3/4 Left Front View)

PowerTech is a trademark of Deere & Company

CD03523,00001B4 -19-03DEC07-1/1

Live With Safety

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

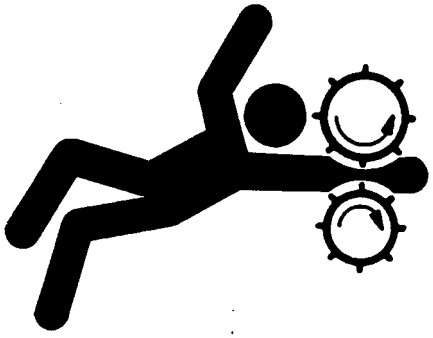
TS231 —19—07OCT88

DX,LIVE -19-25SEP92-1/1

Service Machines Safely

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



TS228 —UN—23AUG88

DX,LOOSE -19-04JUN90-1/1

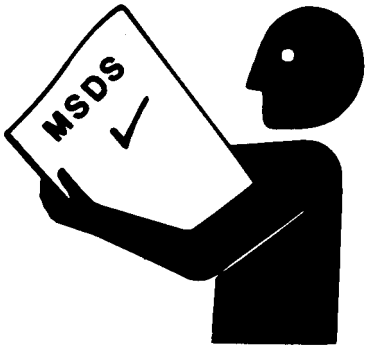
Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)



TS1132 —UN—26NOV90

DX,MSDS,NA -19-03MAR93-1/1

Engine Serial Number Plate Information

IMPORTANT: The engine serial number plate (A) can be easily destroyed. Before "hot tank" cleaning the block, remove the plate.

NOTE: Four-valve head engines have "16V" (for 16 valves total on 4-cylinder engine) or "24V" (for 24 valves total on 6-cylinder engine) printed on a plate located on the rocker arm cover.

Engine Serial Number (B)

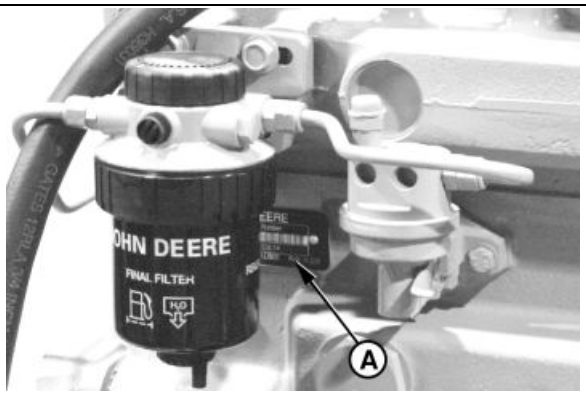
Each engine has a 13-digit John Deere engine serial number identifying the producing factory, engine model designation, and a 6-digit sequential number. The following is an example:

CD4045L123456

CD	**Engine Manufacturing Location**
CD	Saran, France
T0	Dubuque, Iowa
PE	Torreon, Mexico
J0	Rosario, Argentina
4	**Number of Cylinders**
045	**Displacement in Liters** (4.5 Liters)
L	**Aspiration Code** (Early Engines) or **Emission Tier Level** (Later Engines)
D	Naturally aspirated
T	Turbocharged, no aftercooling
A	Turbocharged and air-to-coolant aftercooled
H	Turbocharged and air-to-air aftercooled
S	Turbocharged and air-to sea water aftercooled
B	Non-certified engine
C,E or F.....	Tier 1/Stage I emission certified engine
G, J or K....	Tier 2/Stage II emission certified engine
L, M, N or P	Tier 3/Stage IIIA emission certified engine
123456.....	**6-digit unique sequence number**

Engine Model Designation (C)

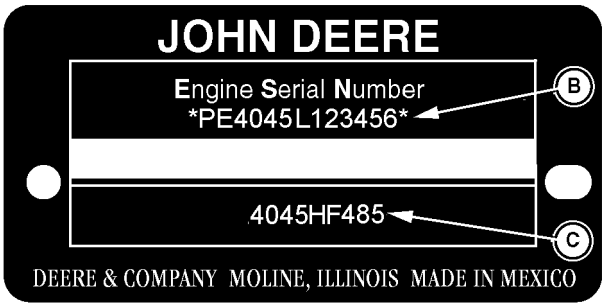
The second line of information on the serial number plate identifies the engine/machine or OEM relationship. See Application manual, CTM106819.



RG7778 —UN—11NOV97

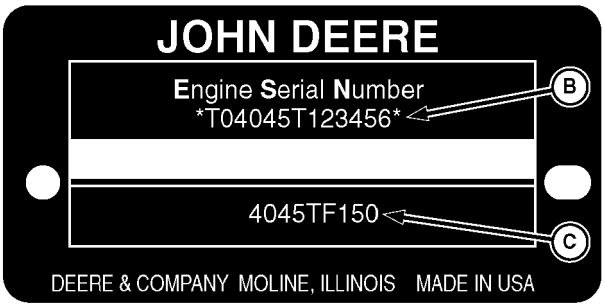
RG13806 —UN—23JAN06

Saran Serial Number Plate



RG13716 —UN—23JAN06

Torreon Serial Number Plate



RG9060A —UN—18MAY09

Dubuque Engine Serial Number Plate

A—Engine Serial Number Plate
B—Engine Serial Number
C—Engine Application Data
D—Empty, Coefficient of Absorption or Saran internal factory identification

Continued on next page

RG19661,0000005 -19-09DEC09-1/2

Diesel Engine Oil

Use oil viscosity based on the expected air temperature range during the period between oil changes.

John Deere Plus-50™ II oil is preferred.

John Deere Plus-50™ is also recommended.

Other oils may be used if they meet one or more of the following:

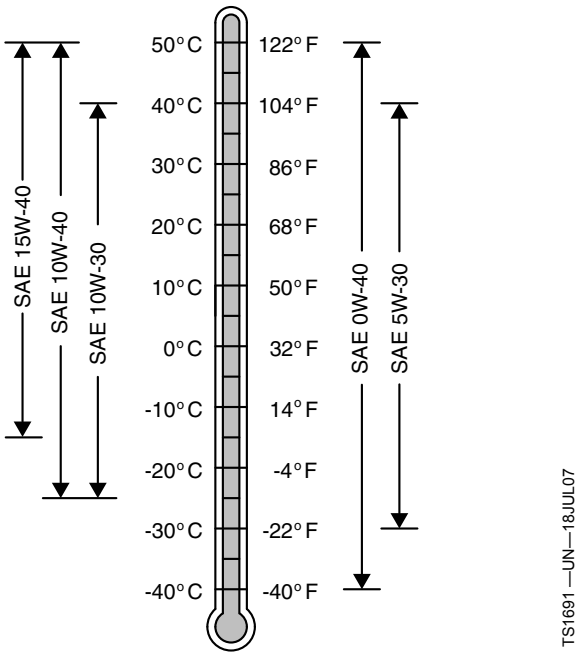
- John Deere Torq-Gard™
- API Service Category CJ-4
- API Service Category CI-4 PLUS
- API Service Category CI-4
- ACEA Oil Sequence E9
- ACEA Oil Sequence E7
- ACEA Oil Sequence E6
- ACEA Oil Sequence E5
- ACEA Oil Sequence E4

Multi-viscosity diesel engine oils are preferred.

Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.

DO NOT use diesel fuel with sulfur content greater than 10 000 mg/kg (10 000 ppm).

Plus-50 is a trademark of Deere & Company
Torq-Gard is a trademark of Deere & Company



Oil Viscosities for Air Temperature Ranges

DX,ENOIL11 -19-11APR11-1/1

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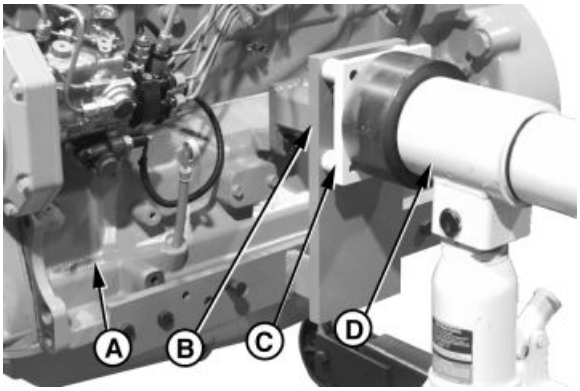
Engine Mounted on Repair Stand

A—Engine
B—62835 Engine Adapter
C—D05226ST Special Adapter
D—Engine Repair Stand



RG7780 —UN—11NOV97

6068 Engine

RG,03,DT7334 -19-11NOV97-1/1

General Information

NOTE: Engines with four-valve head design are covered in Group 021.

OUO1089,0000236 -19-12JUN02-1/1

Check and Adjust Valve Clearance

CAUTION: To prevent accidental starting of engine while performing valve adjustments, always disconnect NEGATIVE (—) battery terminal.

IMPORTANT: Valve clearance MUST BE checked and adjusted with engine COLD.

1. Remove rocker arm cover and crankcase ventilator tube.

NOTE: On HPCR/2-valve head engines, it is not necessary to remove the injector wiring harness (C) for the valve clearance adjustment.

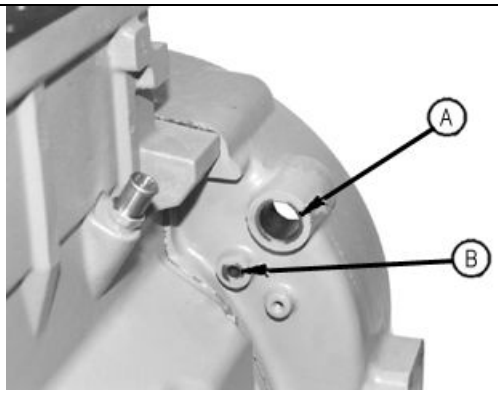
IMPORTANT: Visually inspect contact surfaces of valve tips and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage.

Rocker arms that exhibit excessive valve clearance should be inspected more thoroughly to identify damaged parts.

2. Remove plastic plugs or cover plate from engine timing/rotation hole (A) and timing pin hole (B).

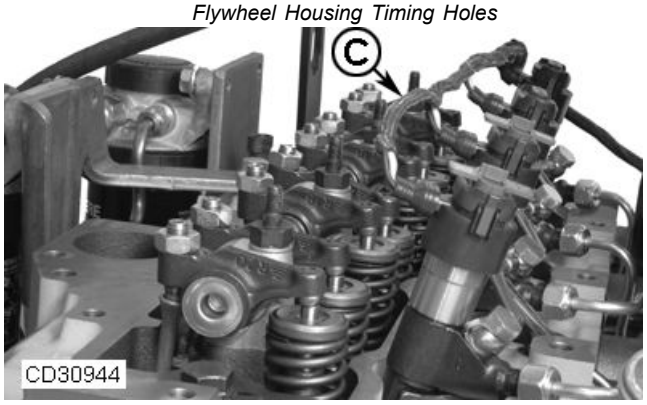
NOTE: Some engines are equipped with flywheel housings which do not allow use of an engine flywheel rotation tool. These engines with straight nose crankshafts may be rotated from front nose of engine, using JDG966 Crankshaft Front/Rear Rotation Adapter.

3. Using JDE83, JDG820 (formely JDE81-1) or JDG10576 Flywheel Turning Tool, rotate engine flywheel in running direction (clockwise viewed from front) until No. 1 cylinder is at TDC compression stroke. Insert JDG1571 or JDE81-4 Timing Pin in flywheel.



RG7408 —UN—06AUG96

Flywheel Housing Timing Holes



CD30944 —UN—19JUL07

Injector wiring harness on HPCR/2-valve head engine

A—Timing/Rotation Hole
B—Timing Pin Hole
C—Injector wiring harness on HPCR/2-valve head engine

NOTE: When No. 1 piston is at TDC on compression stroke, No. 1 cylinder rocker arms are loose. Otherwise, rotate engine one full revolution (360°).

Continued on next page

RG,05,DT7375 -19-06SEP07-1/4

2. Measure camshaft follower OD. If camshaft follower OD is less than specified, install a new follower.

Specification

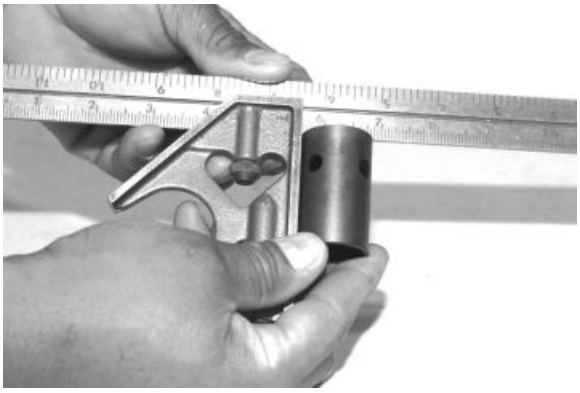
Camshaft
Follower—OD.....31.61—31.64 mm
(1.245—1.246 in.)

RG7422 —UN—23NOV97

Camshaft Follower Wear

RG,05,DT7369 -19-11NOV97-2/3

3. Check crown on follower face. If flat or concave, replace follower and check camshaft lobes for wear. (See VISUALLY INSPECT CAMSHAFT in Group 050.)
4. Measure camshaft follower bore in block and determine if clearance is within specification. (See MEASURE CAMSHAFT FOLLOWER MACHINED BORE IN BLOCK in Group 030.)
5. Lubricate camshaft followers in clean engine oil and install in same bore from which removed.



RG7423 —UN—23NOV97

Camshaft Follower and Crown Wear

RG,05,DT7369 -19-11NOV97-3/3

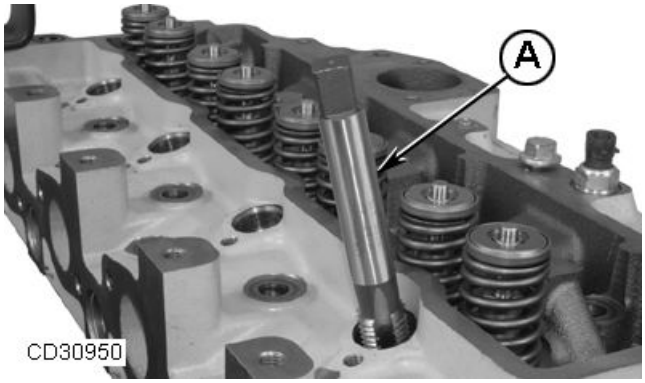
Remove Fuel Injector Sleeves (2-Valve Head Engines with HPCR Fuel System)

NOTE: Different methods can be used to extract the injector sleeve depending on space above engine. Below is a method for restricted area but the threaded rod can be replaced by an appropriate blind-hole bearing puller. See also REMOVE FUEL INJECTOR SLEEVES USING JDG10631 TOOL.

IMPORTANT: If removing the sleeve with cylinder head on engine, coat a piece of rag with a large amount of grease and put it inside the sleeve to prevent metal chips to enter the cylinder. Apply grease onto the tap end.

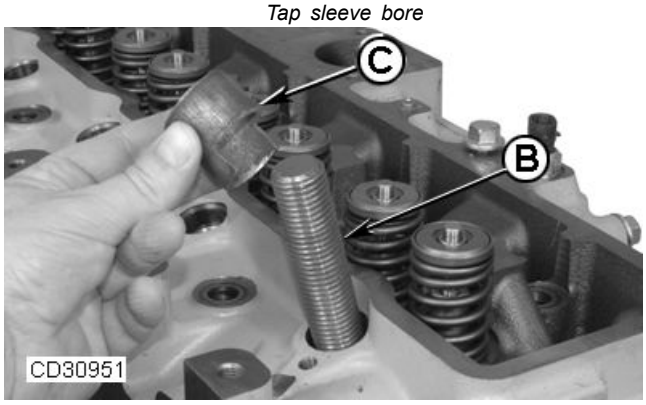
1. Tap three to four threads into the inner diameter of the sleeve with a M22 (or 7/8 in.) tap (A).
2. Screw a threaded rod (B) corresponding to the tap size.
3. Slide a self-made spacer (C) over the threaded rod.
4. Install appropriate size nut and washer (D), then tighten nut until sleeve (E) is extracted.

A—Tap (M22 or 7/8 in.)
B—Threaded rod
C—Self-made spacer
D—Nut and washer
E—Injector sleeve



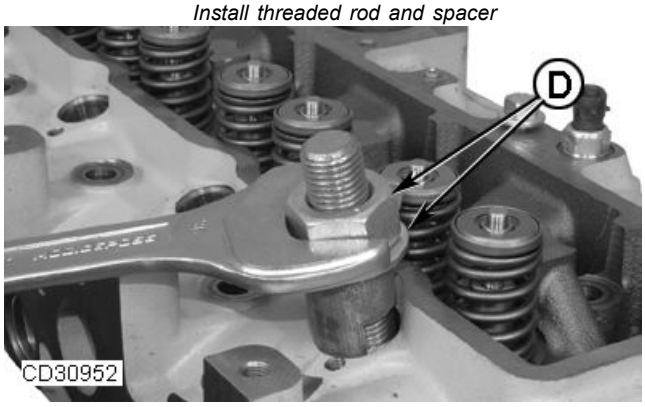
CD30950 —UN—25JUL07

Tap sleeve bore



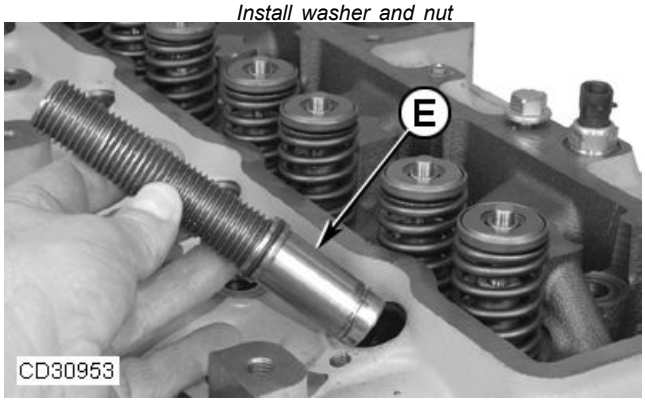
CD30951 —UN—25JUL07

Install threaded rod and spacer



CD30952 —UN—25JUL07

Install washer and nut



CD30953 —UN—25JUL07

Injector sleeve removed

CD03523,000019B -19-13MAY08-1/1

Inspect and Clean Exhaust Manifold

1. Thoroughly clean all passages and gasket surfaces in exhaust manifold and exhaust elbow.
2. Inspect entire exhaust manifold for cracks or damage. Replace parts as necessary.

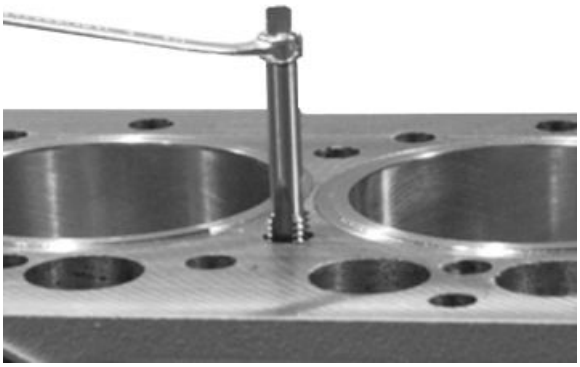
RG,05,DT7347 -19-11NOV97-1/1

Clean and Inspect Top Deck of Cylinder Block

1. Remove gasket material, rust, carbon, and other foreign material from top deck. Gasket surface must be clean.
2. Clean threaded holes in cylinder block using JDG680 Tap or any 1/2-13 UNC-2A tap about 76 mm (3.0 in.) long. Use compressed air to remove debris and fluids from the cap screw holes. Replace block if there is evidence of damage.
3. Use compressed air to remove all loose foreign material from cylinders and top deck.

IMPORTANT: All debris must be cleaned from the camshaft followers before assembling the engine.

4. If not previously done, remove camshaft followers from block and wash in solvent. Lubricate with clean engine oil and install in the same bore.
5. Inspect top deck for flatness and serviceability. (See MEASURE CYLINDER BLOCK TOP DECK FLATNESS in Group 030.)



RG7444 —UN—23NOV97

Cleaning Threaded Holes in Cylinder Block

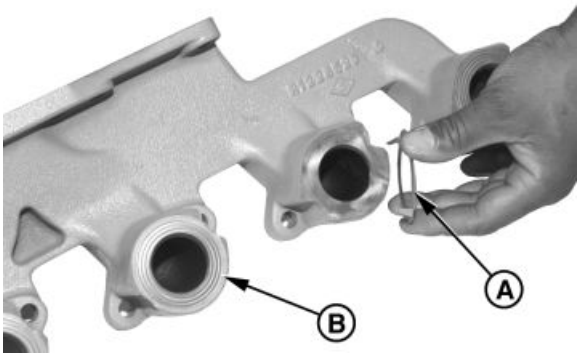
RG7421 —UN—23NOV97

Clean and Lube Camshaft Followers

RG,05,DT7346 -19-11NOV97-1/1

5. Using guide studs, install exhaust manifold (B) with gasket(s) (A). (See REMOVE, INSPECT, AND INSTALL EXHAUST MANIFOLD in Group 080.)

A—Stainless Steel Gasket Shown
B—Exhaust Manifold

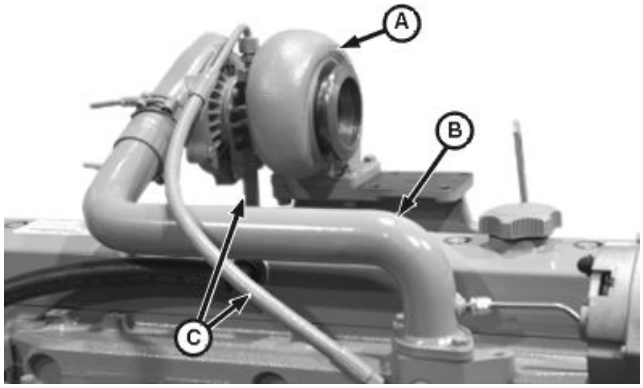


RG7625A —UN—06NOV97

Exhaust Manifold Steel Gaskets

CD03523,000019E -19-21AUG07-4/5

6. If equipped, install turbocharger (A), exhaust elbow (shown removed) and turbocharger oil inlet and drain lines (C). (See INSTALL TURBOCHARGER in Group 080.). Install air intake tube (B). (See REMOVE AND INSTALL AIR INTAKE TUBE in Group 080.)
7. Install alternator if removed. (See REMOVE AND INSTALL ALTERNATOR in Group 100.)
8. If engine oil was drained from crankcase, install new oil filter and fill engine with clean oil of correct grade and viscosity. (See Section 01, Group 002.)
9. Fill cooling system with clean coolant. (See Section 01, Group 002.)
10. Perform engine break-in. (See PERFORM ENGINE BREAK-IN in Group 010.)



RG10376 —UN—26JUN02

Turbocharger

A—Turbocharger
B—Air Intake Tube
C—Turbocharger Oil Inlet and Oil Drain Lines

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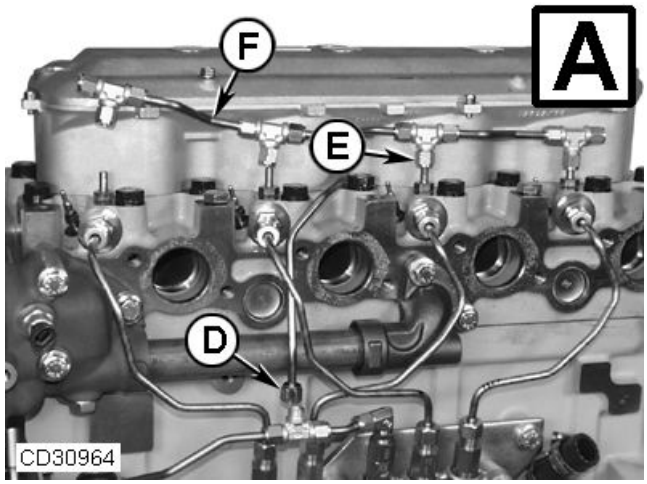
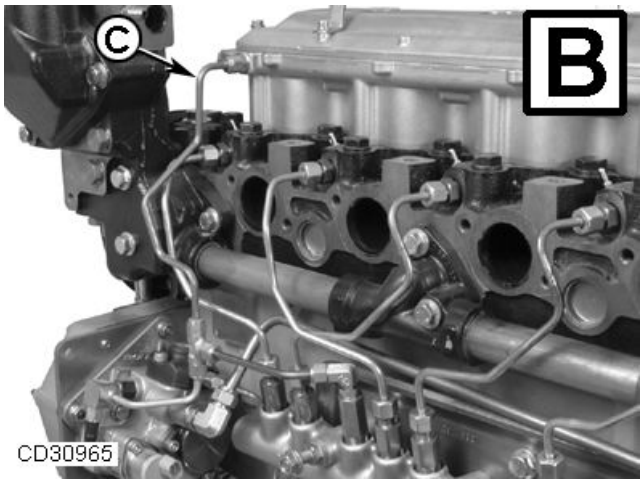


External fuel leak-off system



Internal fuel leak-off system

A—External fuel leak-off system
B—Internal fuel leak-off system
C—Fuel leak-off line
D—Fuel leak-off line nut
E—Fuel leak-off fitting nut
F—Fuel leak-off line assembly

15.

NOTE: The fuel leak-off system can be external (A) or internal (B).

- On internal fuel leak-off system (B), disconnect the fuel leak-off line (C).
- On external fuel leak-off system (A), disconnect fuel leak-off line nut (D) and the fitting nut (E) at each tee fitting. Then remove the complete fuel leak-off line assembly (F).

NOTE: For other fuel system components (fuel filters, fuel injectors...), refer to appropriate manual as listed below:

- *CTM220 — Level 11 Electronic Fuel System (HPCR/4-Valve Head)*
- *CTM320 — Level 14 Electronic Fuel System (HPCR/4-Valve Head)*

Continued on next page

CD03523,000019F -19-27AUG07-6/14

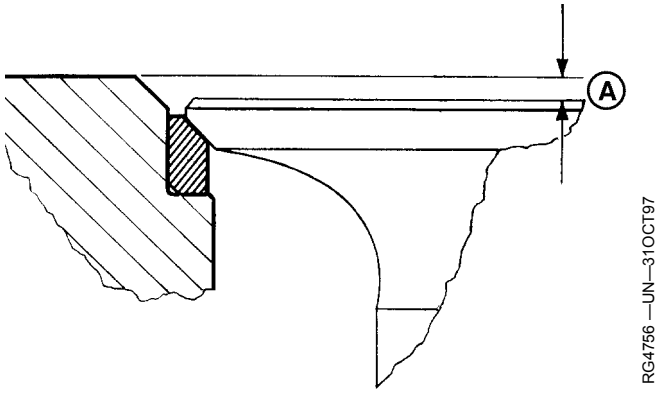
Measure Valve Recess in Cylinder Head

1. Measure and record valve recess (A) using a depth micrometer, magnetic base dial indicator or a dial indicator with JDG451 Height Gauge (B). Measurements must be made a maximum of 3.0 mm (0.12 in.) from edge of valve head.
2. Compare measurements between both intake valves for each cylinder and make sure difference is less than maximum variation allowed. Repeat step for both exhaust valves at each cylinder.
3. If there is uneven valve wear per cylinder, check valve bridge pocket-to-pocket variation. (See INSPECT AND MEASURE VALVE BRIDGES earlier in this group.)

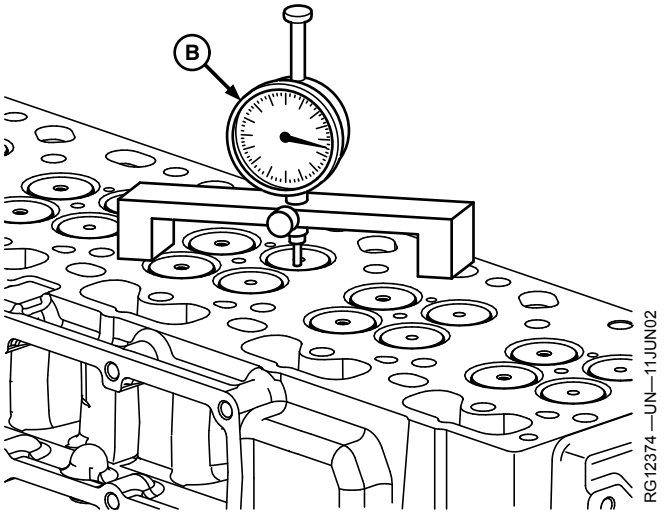
Specification	
Intake Valves—Recess in Cylinder Head	0.77—1.27 mm (0.030—0.050 in.)
Wear Limit	1.77 mm (0.070 in.)
Exhaust Valve—Recess in Cylinder Head	0.81—1.31 mm (0.032—0.052 in.)
Wear Limit	1.81 mm (0.071 in.)
Intake and Exhaust Valves—Maximum Variation for a Pair of Valves (Per Cylinder)	0.3 mm (0.012 in.)

IMPORTANT: Intake valves, exhaust valves, valve seat inserts, springs and retainers must be replaced in pairs to maintain proper valve bridge alignment. Also, replace bridge if any of these parts are replaced.

Install new valves and/or valve seat inserts, as necessary, to obtain proper valve recess.



Valve Recess Measurement



Measuring Valve Recess

A—Valve Recess **B—Dial Indicator**

OUO1089,000020D -19-28JAN04-1/1

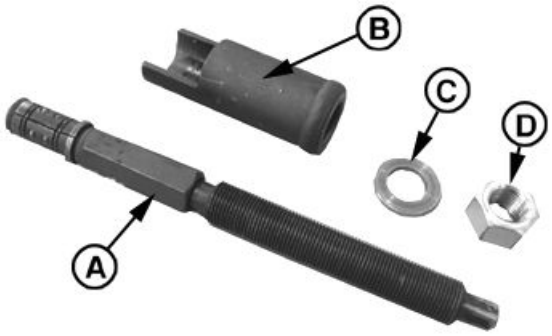
Remove Fuel Injector Sleeve with JDG10631 Tool

IMPORTANT: If removing the sleeve with cylinder head on engine, insure area around the sleeve is clean and free of debris that could enter the fuel system or cylinder.

1. Place forcing screw (A) into the injection nozzle sleeve. Insure the expander portion of the tool is installed so that the expander will locate securely on the sleeve inner diameter. Using a backup wrench, tighten the forcing screw.
2. Install spacer (B) on the forcing screw. Position the spacer with the cut-out facing into the cylinder head.
3. Install flat washer (C) and hex nut (D).

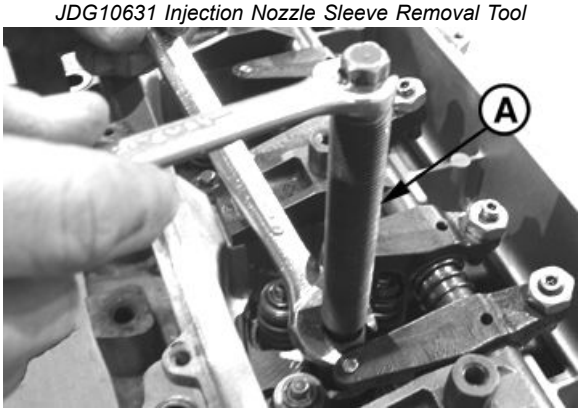
   Turn hex nut until sleeve is loose.
4. Remove tool with sleeve.

A—Forcing Screw
B—Spacer
C—Flat Washer
D—Hex Nut



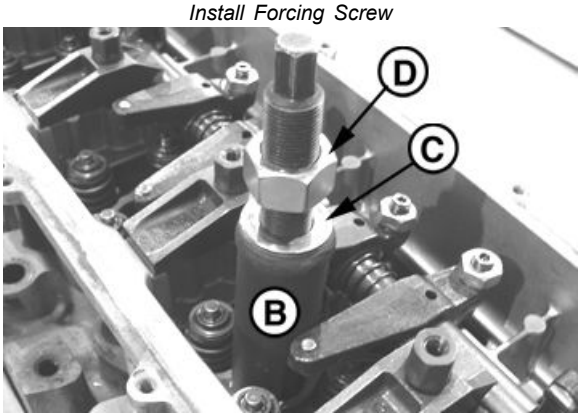
RG15754 —UN—09MAY08

JDG10631 Injection Nozzle Sleeve Removal Tool



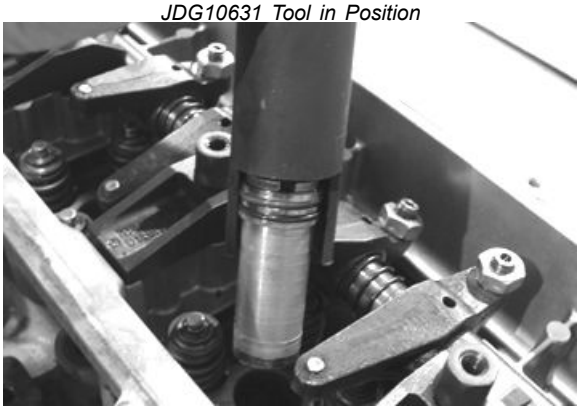
RG15758 —UN—09MAY08

Install Forcing Screw



RG15759 —UN—09MAY08

JDG10631 Tool in Position



RG15760 —UN—09MAY08

Remove Injection Sleeve

OUO1089,0000234 -19-13MAY08-2/2

Install Cylinder Head

1. Dip fuel supply pump push rod (A) in clean engine oil and carefully install in cylinder block before installing cylinder head.

A—Fuel Supply Pump Push Rod

RG7447 —UN—04NOV97

Fuel Supply Pump Push Rod

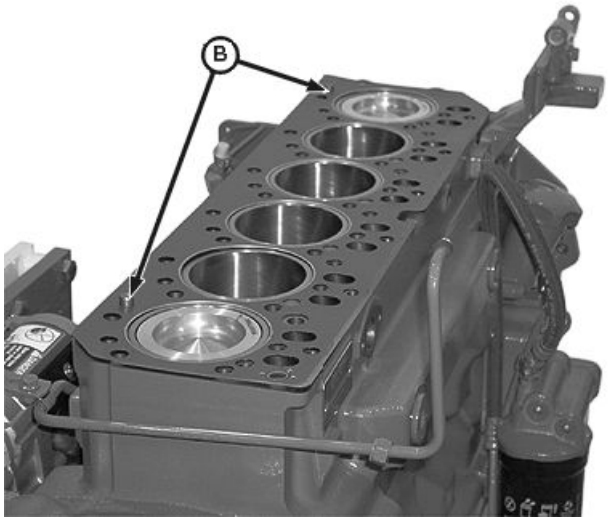
OUO1089,0000228 -19-05SEP11-1/5

2. Reinstall two dowel pins (B) in cylinder block at locating holes, if removed.

IMPORTANT: ALWAYS thoroughly inspect cylinder head gasket for possible manufacturing imperfections. Return any gasket that does not pass inspection.

3. Place new head gasket on cylinder block. Do not use sealant; install dry.

B—Dowel Pins



RG12389A —UN—03JUL02

Cylinder Head Dowel Pins

Continued on next page

OUO1089,0000228 -19-05SEP11-2/5

Remove, Inspect, and Install Closed Crankcase Ventilation System (If Equipped)

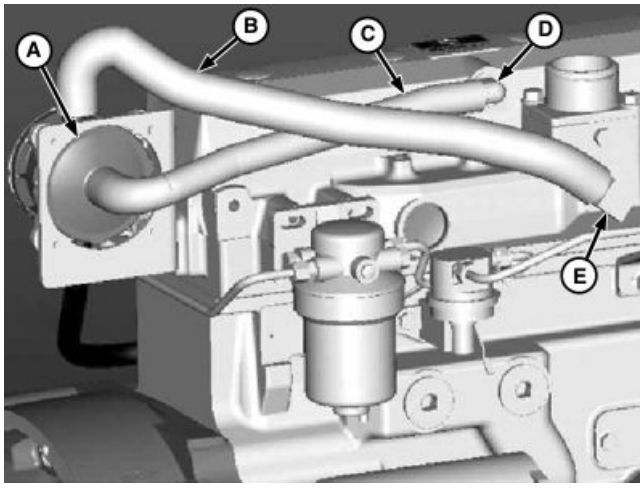
NOTE: CCV valve may be mounted to engine (as shown) or remotely mounted. Verify that centerline of mounted CCV valve is between 350 mm-450 mm (13.78-17.72 in.) above centerline of crankshaft. On engines with dual dipstick option, the CCV valve must be mounted at a minimum height of 420 mm (16.54 in.). Correct the mounting location if it is not correct.

1. Remove parts (A-H).
2. Inspect hoses (C, D and G) for kinks, blockage, or other damage.
3. With check valve (H) connected to hose (G), hold hose from end opposite check valve, letting check valve hang.
4. Pour oil into open end of hose. Oil should pass through check valve before hose is full. If it does not, verify the following:
   - Hose length is at least 275 mm (10.83 in.).
   - Hose is not plugged.
   - Check valve is installed with black end towards crankcase.
   - Check valve functions correctly.
5. Verify that crankcase oil drain tube (I) is not plugged.

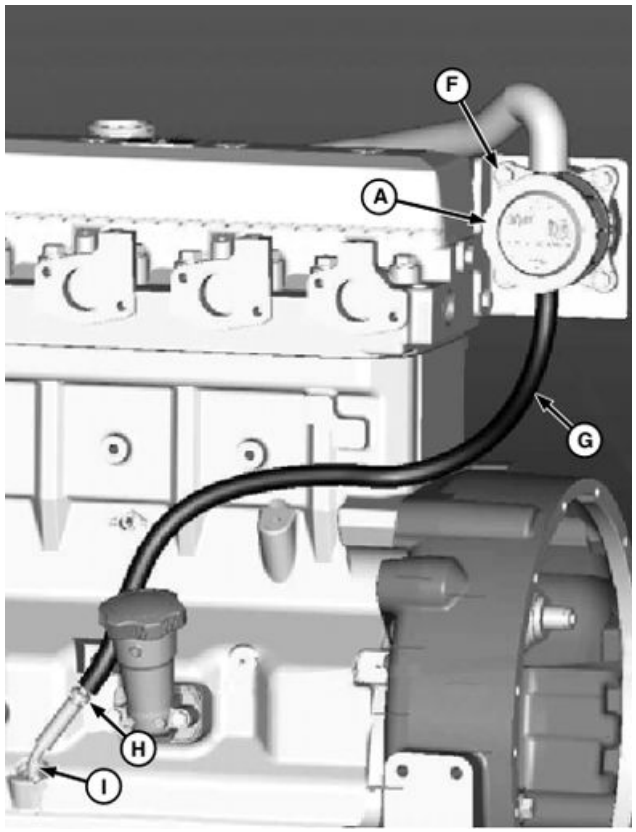
   NOTE: CCV valve has no serviceable internal parts.

6. Inspect CCV valve (A) for cracks or other damage.
7. Replace parts as necessary.
8. Install parts (A—H).

A—Closed Crancase Ventilation (CCV) Valve
B—Hose, CCV Valve to Intake Manifold
C—Hose, Valve Cover to CCV Valve
D—Valve Cover Vent Fitting
E—Intake Manifold Fitting
F—Cap Screw, CCV Valve to Bracket
G—Oil Drain Hose
H—Check Valve
I— Crankcase Oil Drain Tube



RG12426 —UN—20NOV03



RG12427 —UN—03FEB04

OUO1082,00002AD -19-01JUL04-1/1

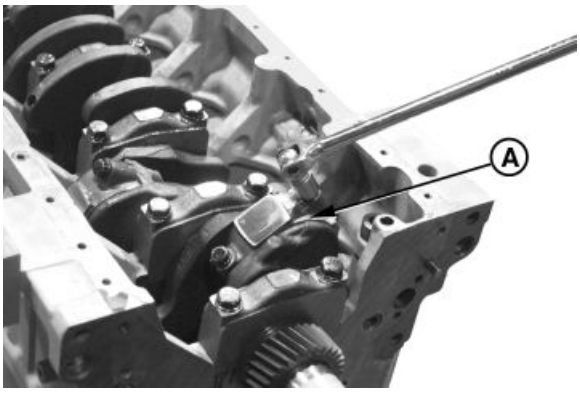
7. Remove oil pan, oil pump, and pick-up tube. (See REMOVE, INSPECT AND INSTALL OIL PUMP PICK-UP TUBE ASSEMBLY in Group 060.) (See REMOVE ENGINE OIL PUMP in Group 060.)
8. Mark rods, pistons, and caps to ensure correct assembly in same location.

IMPORTANT: Keep inserts with their respective caps for rod and main bearings.

9. Remove all rod caps (A) with bearings.
10. Measure rod bearing-to-journal oil clearance with PLASTIGAGE ® before removing piston and rod assembly. Record measurements. (See INSPECT AND MEASURE CONNECTING ROD BEARINGS, later in this group.)

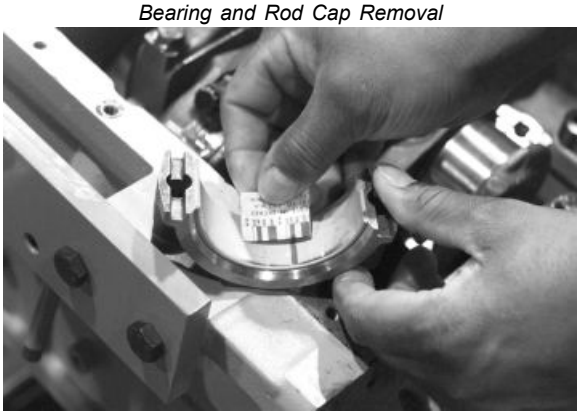
NOTE: Use PLASTIGAGE ® as directed by the manufacturer. PLASTIGAGE ® will determine bearing-to-journal oil clearance, but will not indicate the condition of either surface.

A—Rod Caps



RG7457 —UN—04NOV97

Bearing and Rod Cap Removal



RG7459 —UN—23NOV97

Measure Bearing Clearance

PLASTIGAGE is a registered trademark of the DANA Corp.

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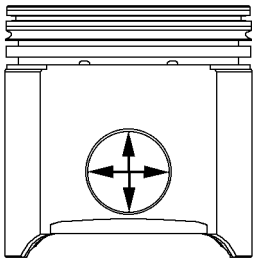
RG,10,DT7421 -19-06JUN02-3/4

Measure Piston Pin Bore

Measure piston pin bore. If bore is not within specification, replace piston and liner set.

Specification

Piston Pin Bore (Small Pin)—ID	34.935—34.945 mm (1.3754—1.3758 in.)
Piston Pin Bore (Large Pin)—ID	41.285—41.295 mm (1.6254—1.6258 in.)



RG7402 —UN—23NOV97

Piston Pin Bore

RG,10,DT7413 -19-12NOV97-1/1

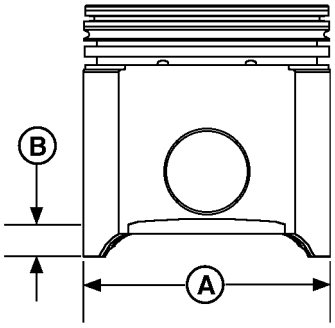
Measure Piston Skirt

1. Measure piston skirt (A) 90° to piston pin bore and 28 mm (1.1 in.) from bottom of piston (B). Record measurement.

Specification

Piston Skirt (Measurement Taken at Bottom of Skirt 28 mm [1.1 in.] from Bottom of Piston)—Diameter	106.38—106.40 mm (4.188—4.189 in.)

2. Measure cylinder liner as directed later in this group and compare with piston measurement.



RG7403 —UN—03NOV97

Piston Skirt Wear

A—Piston Skirt **B—Measurement Area**

RG,10,DT7412 -19-12NOV97-1/1

Measure Piston Height

Measure piston height from center of piston pin bore-to-top of piston.

Piston (Two Valve Head Engines)—Specification

Piston—Height (Measured from Center of Pin Bore to Top of Piston)	71.64—71.70 mm (2.820—2.823 in.)

Piston (Four Valve Head Engines)—Specification

Piston—Height (Measured from Center of Pin Bore to Top of Piston)	71.60—71.65 mm (2.819—2.820 in.)

DPSG,OUO1004,212 -19-04JUN02-1/1

Inspect and Clean Cylinder Block

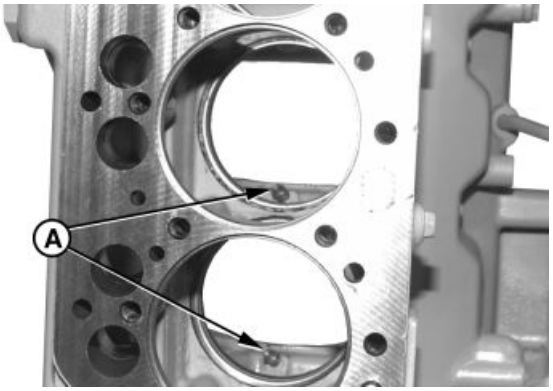
Before inspecting and cleaning cylinder block, remove all of the following:

- piston cooling orifices (A) (see REMOVE, INSPECT AND INSTALL PISTON COOLING ORIFICES later in this group)
- soft plugs (B)
- oil gallery plugs (C) (using JDG782A Oil Gallery Plug Tool)
- all external and internal mounted components (refer to the proper group for removal procedures)

IMPORTANT: If block is cleaned in a hot tank, be sure to remove any aluminum parts such as nameplates (D). Aluminum parts can be damaged or destroyed by hot tank solutions.

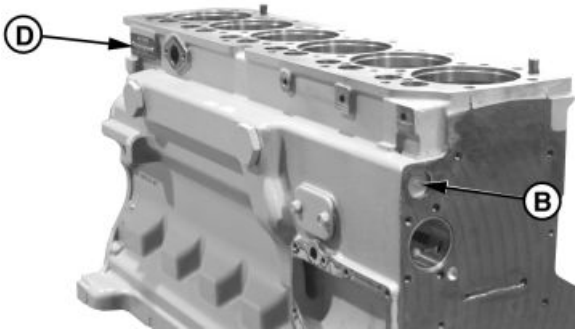
1. Clean block thoroughly using cleaning solvent, pressure steam, or a hot tank.
2. All passages and crevices must be clear of sludge, and grease.
3. All coolant passages must be clear of lime deposits and scale.

A—Piston Cooling Orifice
B—Soft Plug
C—Oil Gallery Plug
D—Nameplate



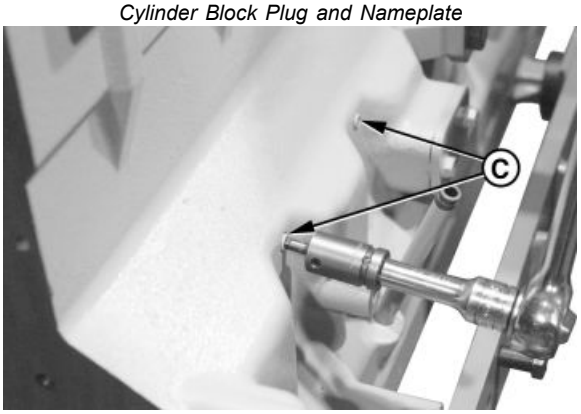
RG7796 —UN—11NOV97

Cylinder Block Piston Cooling Orifice



RG7483 —UN—04NOV97

Cylinder Block Plug and Nameplate



RG7484A —UN—04NOV97

Cylinder Block Oil Gallery Plug

Continued on next page

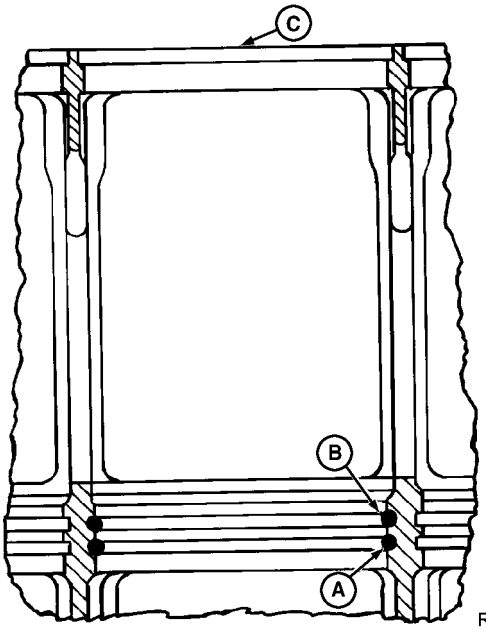
RG,10,DT7402 -19-29NOV99-1/3

Install Packing on Cylinder Liner and O-Rings in Block

IMPORTANT: DO NOT use oil or hand cleaner soap on cylinder liner packing or O-rings. Petroleum products will cause the red (or white) O-ring to swell, which may result in O-ring damage during liner installation.

1. Pour AR54749 Soap Lubricant into a suitable container.
2. Dip O-rings in AR54749 Soap Lubricant.
3. Install the black O-ring (A) in the lower O-ring groove in the cylinder block (C).
4. Install the red (or white) O-ring (B) in the upper O-ring groove in the cylinder block.

A—Black O-Ring
B—Red or White O-Ring
C—Cylinder Block

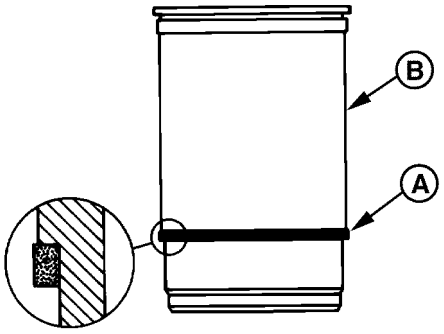


Cylinder Liner Packing and Block O-Rings

RG,10,DT7391 -19-11NOV97-1/2

5. Turn cylinder liner (B) upside-down. Dip square packing (A) in soap lubricant and install over outside of liner.
6. Slide packing down firmly against shoulder on liner. Make sure packing is not twisted.
7. Coat the liner packing sealing area of the cylinder liner and block O-rings with soap lubricant.

A—Square Packing
B—Cylinder Liner



Cylinder Liner Packings and O-Rings

RG,10,DT7391 -19-11NOV97-2/2

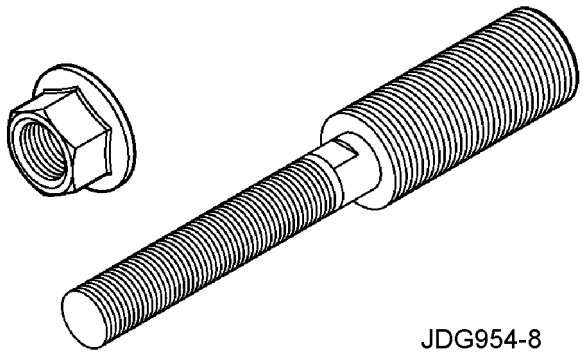
Complete Final Assembly

1. Install oil pump outlet tube O-ring in cylinder block. Install oil pump and outlet tube. (See INSTALL ENGINE OIL PUMP in Group 060.)
2. Install balancer shaft bushings (4-cylinder engines). (See REMOVE AND INSTALL BALANCER SHAFT BUSHINGS in Group 050.)
3. Install camshaft bushings. (See REMOVE AND INSTALL CAMSHAFT BUSHINGS in Group 050.)
4. Install oil bypass valve (in front of block) and front plate. (See INSTALL CYLINDER BLOCK FRONT PLATE in Group 050.)
5. Install balancer shafts (if equipped). (See INSTALL AND TIME BALANCER SHAFTS in Group 050.)
6. Install camshaft and timing gears. (See INSTALL CAMSHAFT in Group 050.)
7. If equipped with cartridge type oil pressure regulating valve, install valve. (See REMOVE AND INSTALL OIL PRESSURE REGULATING VALVE in Group 060.)
8. Install timing gear cover. (See INSTALL TIMING GEAR COVER in Group 050.)
9. If equipped with spring, plunger and seat type oil pressure regulating valve, install valve assembly. (See REMOVE AND INSTALL OIL PRESSURE REGULATING VALVE in Group 060.)
10. Install oil pan. (See INSTALL OIL PAN in Group 060.)
11. Install crankshaft pulley. (See INSTALL PULLEY OR VIBRATION DAMPER PULLEY in Group 040.)
12. Install camshaft followers. (See INSPECT, MEASURE AND ASSEMBLE CAMSHAFT FOLLOWERS in Group 050.)
13. Install cylinder head with new gasket. (See INSTALL CYLINDER HEAD in Group 020 for two valve head or INSTALL CYLINDER HEAD in Group 021 for four valve head.)
14. Fill engine with clean oil and proper coolant.
15. Perform engine break-in. (See PERFORM ENGINE BREAK-IN in Group 010.)

RG,10,DT7383 -19-05JUN02-1/1

Forcing Screw and Nut..... JDG954-8

To install the unitized front oil seal on conical nose crankshaft.



RG19661,0000171 -19-26MAY09-6/17

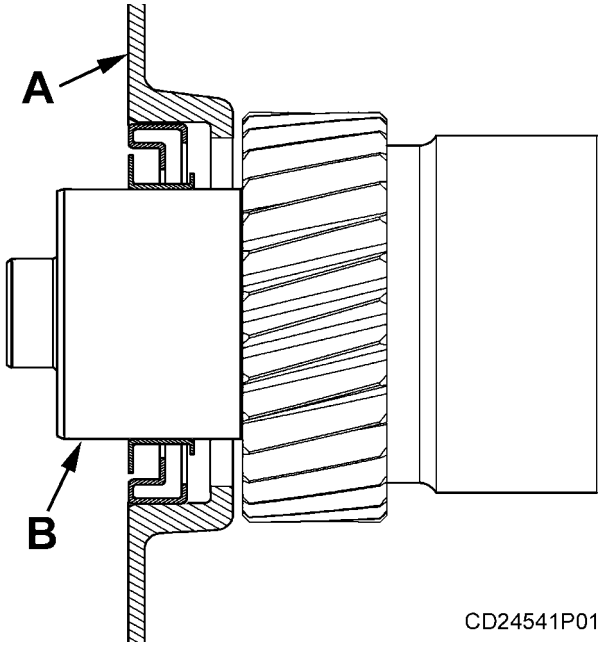
Straight-Nose Crankshaft without Timing Wheel - Assembly No. 1

Install seal flush with timing gear cover, using the following tools:

- JDG954-2
- JDG954-5
- JDG954-6

A—Timing gear cover without timing wheel clearance

B—Straight-nose crankshaft without machining for timing wheel



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RG19661,0000171 -19-26MAY09-7/17

Check Crankshaft End Play

Measure end play prior to removing crankshaft to determine condition of thrust bearings.

1. Position dial indicator on contact face of flywheel, on front crankshaft nose, on damper, or front pulley assembly, if installed.

T88331 —UN—14OCT88

Check Crankshaft End Play w/Dial Indicator

RG,15,DT7454 -19-15OCT01-1/2

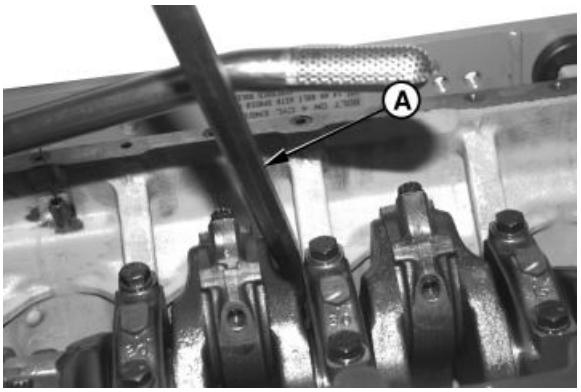
IMPORTANT: Do not apply too much pressure with pry bar (A), as this could damage bearings.

2. Using a pry bar, gently push crankshaft as far to rear of engine as possible.
3. Zero the dial indicator.
4. Gently pry the crankshaft as far forward as possible. Note indicator reading. If end play is not within specifications, install new thrust bearing.

Specification

Crankshaft—End Play.....0.029—0.357 mm (0.001—0.014 in.)

A—Pry Bar



RG7517 —UN—05NOV97

Prying Crankshaft Toward Rear of Engine

RG,15,DT7454 -19-15OCT01-2/2

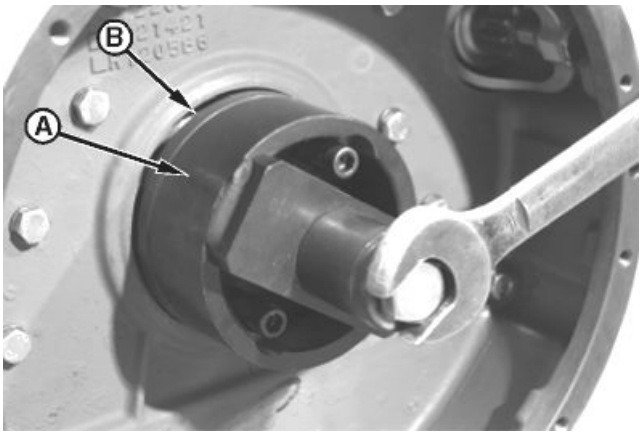
Inspect Flywheel

1. Inspect the clutch contact face for scoring, overheating, or cracks. Replace or resurface flywheel if defective.
2. Examine flywheel ring gear for worn or broken teeth. Replace ring gear if defective, as described later in this group.

RG,15,DT7465 -19-14NOV97-1/1

IMPORTANT: Handle the rear oil seal and sleeve assembly carefully. If wear sleeve surface is scratched, gouged or any sealant (liquid) is present, order a new seal assembly.

4. Carefully start oil seal (B) and wear sleeve over pilot and crankshaft flange with open side of seal toward engine.
5. Attach JT30042 Driver (A) and thrust washer to the guide plate with cap screw. Tighten the cap screw until driver bottoms on pilot.
6. Remove seal driver and pilot plate. Check that seal and wear sleeve assembly is properly positioned on crankshaft flange and installed square in flywheel housing bore.



RG9443 —UN—07JUL98

Rear Oil Seal/Sleeve Driver Tool

A—Driver **B—Seal**

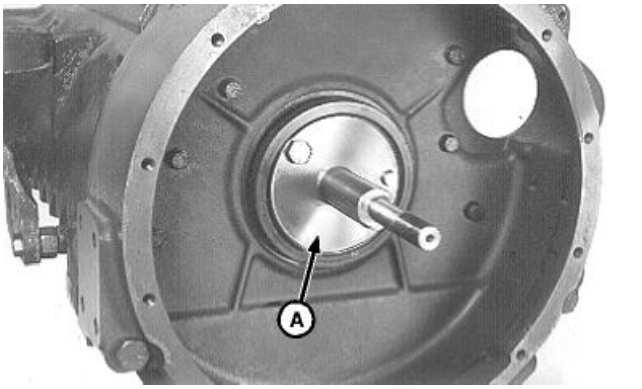
RG,15,DT7446 -19-09DEC11-3/4

Install Rear Oil Seal/Wear Sleeve Using KCD10002A

NOTE: Due to a diameter change of the crankshaft bore, it may be necessary to suppress the pilot pin from KCD10002. With this modification, KCD10002 becomes KCD10002A

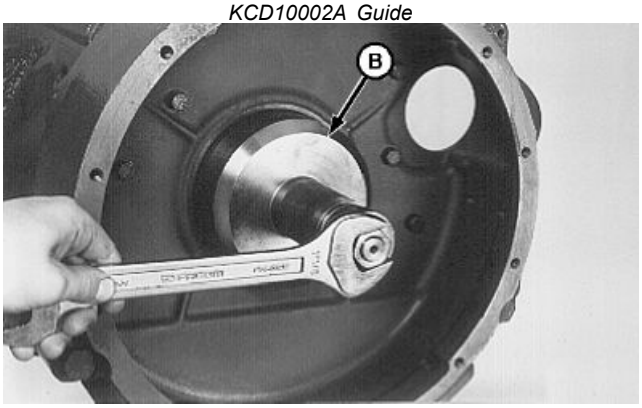
1. Position guide (A) from KCD10002A Rear Oil Seal/Wear Sleeve Installer Set on crankshaft end with two cap screws finger tight.
2. Install new oil seal/wear sleeve assembly on guide with open side of seal toward engine. Center the guide and tighten cap screws.
3. Slide driver (B) onto guide (A) and gradually tighten hex nut until driver bottoms on guide.
4. Remove seal driver and guide. Check that seal and wear sleeve assembly is properly positioned on crankshaft flange and installed square in flywheel housing bore.

A—Guide **B—Driver**



RG9136 —UN—18MAY98

KCD10002A Guide



RG9137 —UN—18MAY98

KCD10002A Driver

RG,15,DT7446 -19-09DEC11-4/4

Crankshaft Grinding Specifications

Bearing Size	Crankshaft Main Journal OD	Crankshaft Rod Journal OD
Standard	79.324—79.350 mm (3.1229—3.1240 in.)	77.800—77.826 mm (3.0629—3.0640 in.)
0.25 mm (0.010 in.) Undersize	79.074—79.100 mm (3.1131—3.1141 in.)	77.550—77.576 mm (3.0531—3.0541 in.)

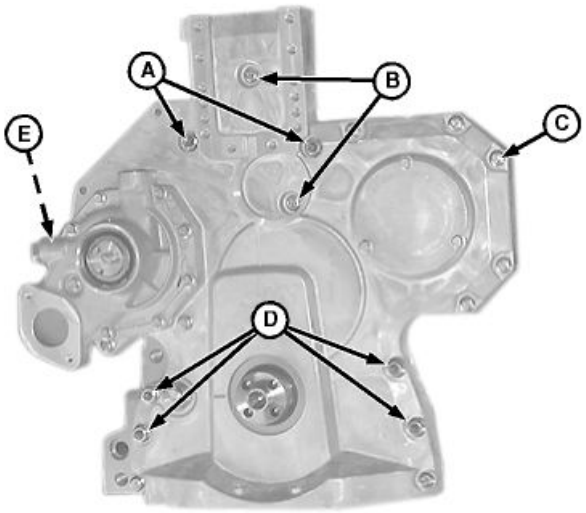
Main and Connecting Rod Journal Surface Finish (AA)	Lap 0.20 µm (8 AA)
Thrust Surface Finish (AA)	Lap 0.40 µm (16 AA)
Thrust Bearing Journal Width	38.952—39.028 mm (1.5335—1.5365 in.)
Direction of Crankshaft Rotation (viewed from flywheel end):	
Grinding	Clockwise
Lapping	Counterclockwise
Engine Stroke	127 mm (5.00 in.)
Main Journal Maximum Runout (Concentricity) Relative to No. 1 and No.7 (6.8 L) or No. 1 and No. 5 (4.5 L) Journals	0.05 mm (0.0019 in.)
Main Journal Maximum Runout (Concentricity) Between Adjacent Journals	0.025 mm (0.0009 in.)

RG,15,DT7435 -19-14NOV97-1/1

NOTE: Mark and identify location of timing gear cover hardware before removal to aid in reassembly.

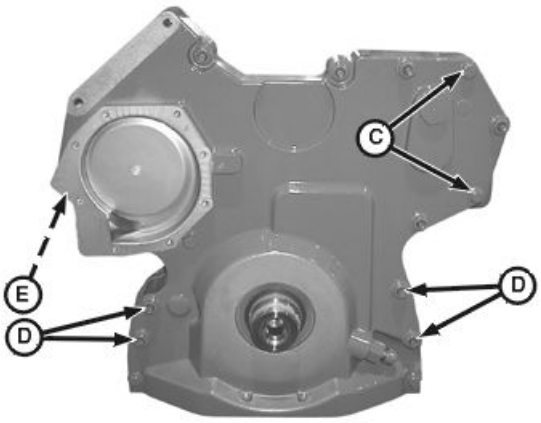
15. **On Later, Two-Valve Head Engines:**[1] remove timing gear cover-to-cylinder block stud nuts and washers (A).
16. **On All Engines:** remove timing gear cover-to-cylinder block stud nuts and washers or flange nuts (D).
17. **On Two-Valve Head Engines:** remove cap screws (B).
18. Remove cap screws (C) bordering timing cover and cap screw (E) on back of engine front plate. Remove cover.
19. Remove two piece oil seal/wear sleeve, if equipped. (See REPLACE FRONT CRANKSHAFT OIL SEAL AND WEAR SLEEVE in Group 040.)

A—Stud Nuts and Washers
B—Cap Screws
C—Cap Screws
D—Stud Nuts and Washers or Flange Nuts (9 used)
E—Cap Screw (Behind Engine Front Plate)



RG9105 —UN—01APR98

Two-Valve Head Engine Shown (Except HPCR/2-Valve Head Engine)



RG12353A —UN—03JUL02

Four-Valve Head and HPCR/2-Valve Head Engine Shown

[1]Serial Numbers: Dubuque-built engines (703905—), Saran-built engines (516218—), Torreon-built engines (001000—).

RG,16,DT7506 -19-13SEP07-4/4

Inspect and Measure Camshaft Bushing ID and Journal OD

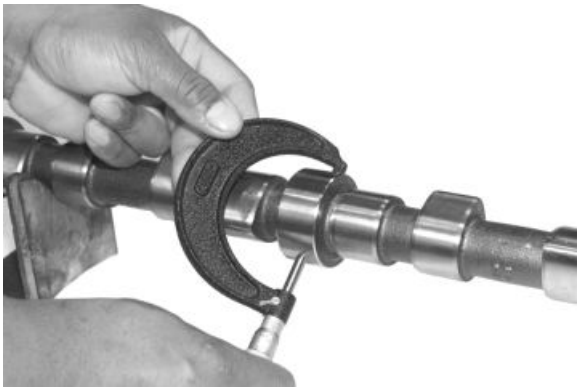
All engine camshafts have a (replaceable) bushing installed in No. 1 (front) camshaft bore.

1. Measure camshaft journals. If a camshaft journal is damaged or does not meet specification, install a new camshaft.
2. Measure camshaft bushing ID and remaining bores in cylinder block. If camshaft bore is damaged or is not within specification, have a qualified machine shop install new bushings.

   If No. 1 camshaft bushing ID does not meet specifications, replace camshaft bushing. (See REMOVE AND INSTALL CAMSHAFT BUSHING earlier in this group.)

Camshaft Bearing Bores and Journals—Specification

Camshaft Journal—OD	55.872—55.898 mm (2.1997—2.2007 in.)
Camshaft Bore, Front No. 1 in Block (Without Bushing)—ID	59.961—59.987 mm (2.3607—2.3617 in.)
Camshaft Bore, Front No. 1 in Block (With Bushing)—ID	55.961—55.987 mm (2.2031—2.2042 in.)
Camshaft Bore, All Except No. 1—ID	55.986—56.012 mm (2.2042—2.2052 in.)
Camshaft Journal-to-Bushing, No. 1 Bore (With Bushing)—Oil Clearance	0.063—0.115 mm (0.0025—0.0045 in.)
Camshaft Journal-to-Bushing, All Except No. 1 Bore—Oil Clearance	0.088—0.140 mm (0.0035—0.0055 in.)



RG7566 —UN—23NOV97

Measuring Camshaft Journal OD

RG,16,DT7497 -19-14NOV97-1/1

Measure Idler Gear Bushing and Shaft

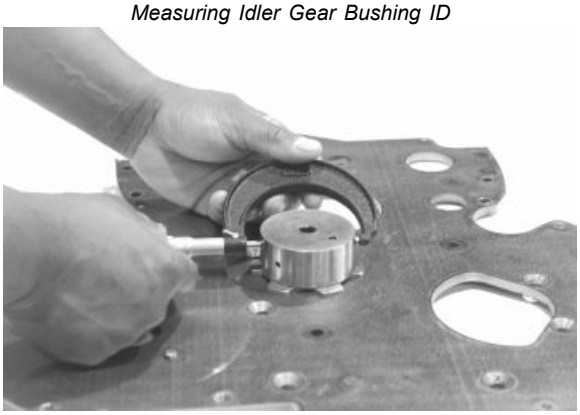
1. Measure idler gear bushing ID and shaft OD to determine oil clearance. If oil clearance exceeds specification, replace worn parts.

Specification

Upper Idler Gear Bushing (Two-Valve Head non-HPCR Engine) (30 mm Wide Gear)—ID.....69.802—69.832 mm (2.7481—2.7493 in.)
Upper Idler Gear Bushing (Two-Valve Head non HPCR Engine) (22 mm Wide Gear)—ID.....44.49—44.54 mm (1.751-1.753 in.)
Upper Idler Gear Bushing (Four-Valve and HPCR/2Valve Head Engine)—ID.....92.732—92.762 mm (3.6509—3.6520 in.)
Lower Idler Gear Bushing—ID.....44.489—44.539 mm (1.7515—1.7535 in.)
Upper Idler Gear Shaft (Two-Valve Head non-HPCR Engine) (30 mm Wide Gear)—OD.....69.757—69.777 mm (2.7463—2.7471 in.)
Upper Idler Gear Shaft (Two-Valve Head non-HPCR Engine) (22 mm Wide Gear)—OD.....44.43—44.46 mm (1.749-1.750 in.)
Upper Idler Gear Shaft (Four-Valve and HPCR/2Valve Head Engine)—OD.....92.687—92.707 mm (3.6491—3.6499 in.)
Lower Idler Gear Shaft—OD.....44.437—44.463 mm (1.7495—1.7505 in.)
Upper Idler Gear Bushing-to-Shaft (Two-Valve Head non-HPCR Engine)—Oil Clearance.....0.075—0.125 mm (0.0030—0.0049 in.)
Upper Idler Gear Bushing-to-Shaft (Four-Valve and HPCR/2Valve Head Engine)—Oil Clearance.....0.0025—0.075 mm (0.0010—0.0030 in.)

RG7573 —UN—23NOV97

Measuring Idler Gear Bushing ID



RG7574 —UN—23NOV97

Measuring Idler Shaft Journal OD

Lower Idler Gear Bushing-to-Shaft—Oil Clearance.....0.026—0.102 mm (0.0010—0.0040 in.)
Upper Idler Gear—End Play.....0.070—0.170 mm (0.0027—0.0066 in.)
Lower Idler Gear—End Play.....0.070—0.330 mm (0.0027—0.0129 in.)

2. If idler gear end play, measured earlier in this group, was out of specification, remove idler shaft and thrust washer from front plate. (See REMOVE LOWER AND UPPER IDLER SHAFTS, later in this group.)
3. Check thrust washer for wear.
4. Measure idler gear hub width and shaft width. Replace worn parts that are out of specification.

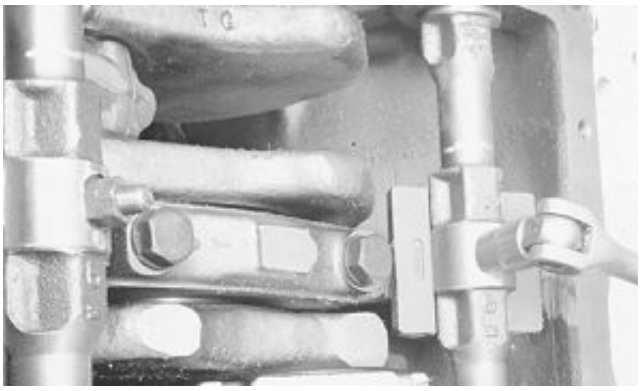
RG,16,DT7484 -19-14SEP07-1/1

IMPORTANT: Ensure weights are installed to shaft side opposite key (C).

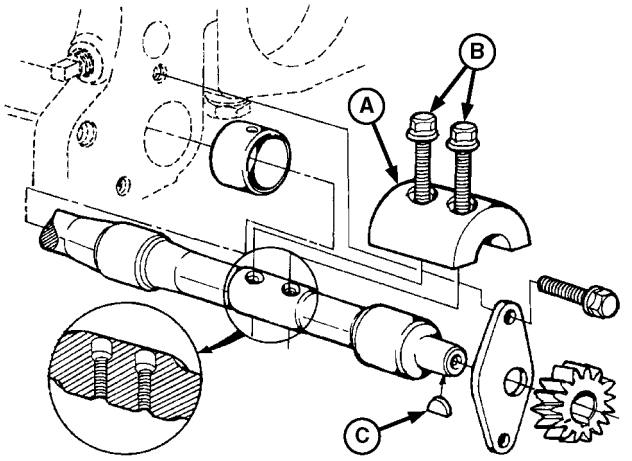
5. Later engines[1] have balancer shafts with removable weights. Install weights to balancer shafts using new cap screws and nuts. Tighten to specifications.

Specification	
Balancer Shaft Removable Weights (Single Cap Screw Weights)—Torque	58 N·m (43 lb-ft)
Balancer Shaft Removable Weights (Dual Cap Screw Weights)—Torque	40 N·m (30 lb-ft)

A—Weight
B—Screw (1 or 2 used)
C—Key
D—Nut

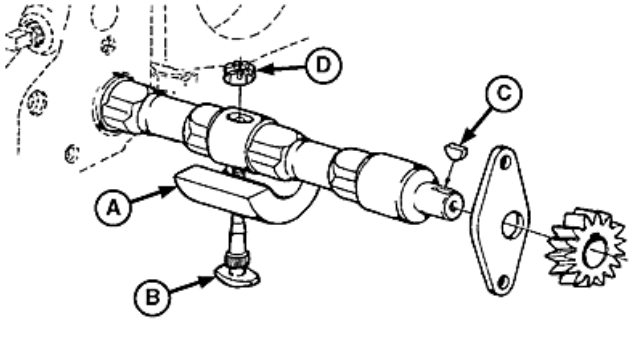

T91157 —UN—09NOV88

Balancer Shaft Removable Weights



RG12432 —UN—02DEC03

Dual Cap Screw Weight



RG13388 —UN—10MAY10

Single Cap Screw Weight

[1]Serial Numbers: Dubuque-built engines (700877—), Saran-built engines (500212—), Torreon-built engines (001000—).

Continued on next page

RG,16,DT7475 -19-17SEP07-4/8

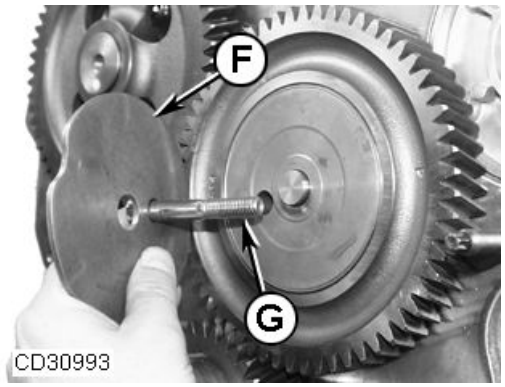
8. Install upper idler gear front thrust washer (F) with lubrication grooves facing toward gear.

IMPORTANT: DO NOT use zinc coated hardware to retain idler gear. If cap screw is zinc coated, replace with new phosphate coated cap screw. See parts catalog for appropriate part number.

9. Lubricate upper idler gear cap screw (G) threads with oil then tighten to specifications.

	Specification
Upper Idler Gear Cap Screw—Torque	70 N·m (53 lb-ft)

F—Front thrust washer **G—Cap screw**



CD30993 —UN—18SEP07

Install upper front thrust washer and cap screw

CD03523,00001AC -19-13JAN10-2/2

Clean and Inspect Timing Gear Cover

1. Drive crankshaft front oil seal out of cover on engines not using a unitized front seal.
2. Remove material and sealant from cylinder block and timing gear cover gasket surfaces. If necessary, remove oil filler neck and gasket and injection pump drive gear nut cover plate and gasket.

CAUTION: Do not spin bearings when drying with compressed air.

3. If engine is equipped with the auxiliary drive, remove auxiliary drive as described earlier in this group.
4. If engine is equipped with electronic tachometer (magnetic pick-up) sensor, remove sensor and O-ring. (See REMOVE AND INSTALL MAGNETIC PICK-UP SENSOR, as described in this group.)
5. Clean timing gear cover in solvent. Dry with compressed air.
6. Inspect cover for cracks or damage. Make sure seal bore is clean and free of nicks.

RG,16,DT7472 -19-14NOV97-1/1

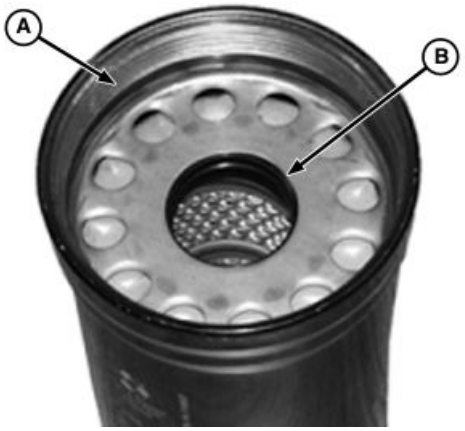
15. **On engines with standard filter option:** Spread a layer of clean engine oil on new filter seal. Install filter and tighten until packing contacts filter base. Tighten an additional 1/2—3/4 turn after packing contacts base. DO NOT overtighten oil filter.

IMPORTANT: DO NOT use filter wrench to install filter. Install filter by hand only.

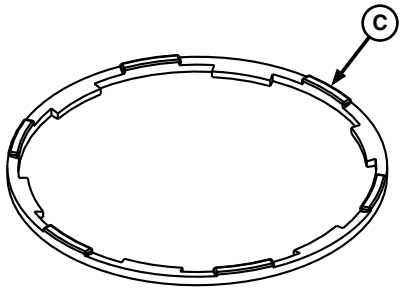
On extended life oil filters, ensure that tabs (C) of dust seal are properly installed in the slots of housing before installing filter.

On engines with extended-life filter option: Apply clean engine oil to the inner (B) and outer (A) seal and filter threads. Wipe both sealing surfaces (D and E) of the header with a clean rag. *Ensure that dust seal (C) is in place on header, and that tabs on seal are in line with slots on header.* Replace seal if damaged. Install and tighten oil filter by hand until firmly against dust seal. DO NOT apply an extra 1/2—3/4 turn after seal contact as done with other filters.

A—Outer Seal
B—Inner Seal
C—Dust Seal
D—Outer Seal Surface
E—Inner Seal Surface

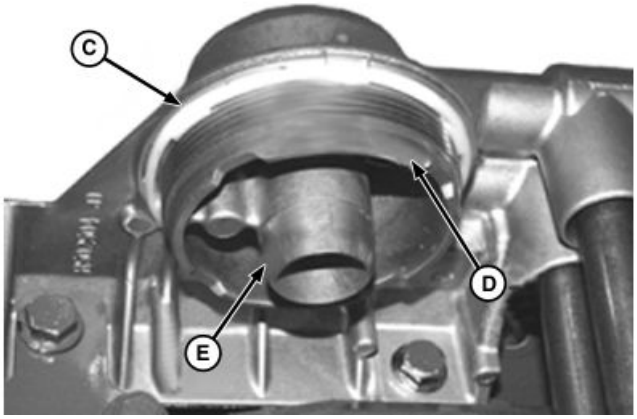


RG13381 —UN—12DEC03



RG12425 —UN—12DEC03

Oil Filter Dust Seal



RG13382 —UN—12DEC03

RG19661,0000010 -19-16JUN05-6/6

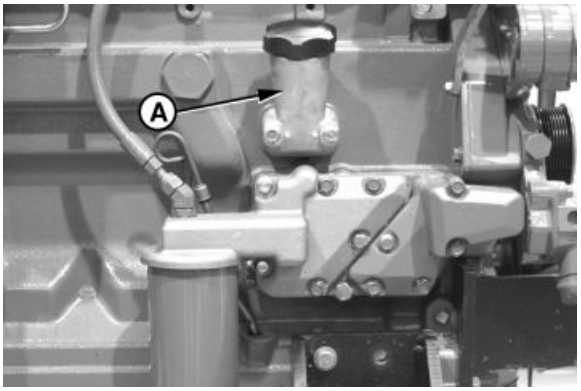
Remove and Install Oil Fill Adapter

NOTE: Some engines have a timing gear cover mounted oil filler. (See INSTALL TIMING GEAR COVER in Group 050.)

1. Remove oil fill tube (A).

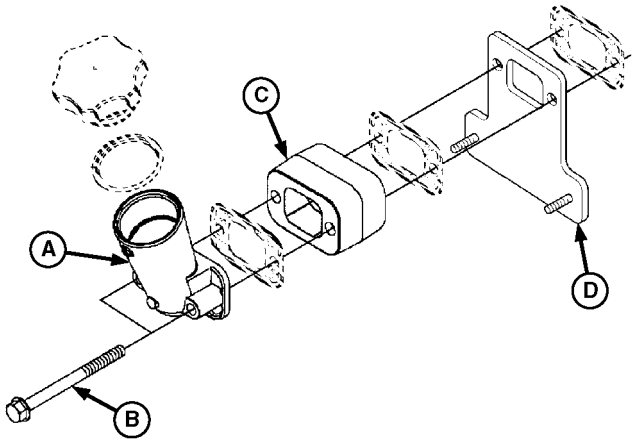
IMPORTANT: Engine damage and/or failure can result if the wrong cap screws are used in assembly of oil fill adapter. The oil fill adapter is used in multiple oil fill option codes. Regardless of the engine, cap screws used to attach the oil fill adapter to the engine must never thread into the cylinder block deeper than 14 mm (0.551 in.). When all required components are considered (plates, spacers, gaskets, etc.), installing a cap screw that threads into the cylinder block deeper than 14 mm (0.551 in.) could cause the camshaft to be side-loaded, resulting in engine damage during start-up.

2. Inspect and replace adapter as needed.
3. If replacing with a new RE501377 Oil Fill Adapter, refer to the engine option code label on the rocker arm cover for the correct oil fill option code. Then refer to the following table to select the proper length cap screws listed in the table.



RG7964 —UN—13NOV97

Oil Fill Adapter



RG13383 —UN—12DEC03

A—Oil Fill Adapter
B—Cap Screw
C—Spacer
D—Bracket

Option Code*	Cap Screw (B) with Pre-Applied Thread Locker and Sealant**	Cap Screw (B) without Pre-Applied Thread Locker and Sealant**	Cap Screw (B) Specifications	Spacer (C)	Bracket (D)
1201, 1202, 1212, 1214, 1215, 1235	RE67239	19M7799	M8x1.25x45	None	None
1203, 1210	RE71526	19M7979	M8x1.2x55	None	None
1204, 1209	RE503609	19M7970	M8x1.25x100	R136514	None
1211	RE71527	19M7873	M8x1.25x110	R136514	RE70063
1234	RE534333	19M7766	M8x1.25x20	None	None

* This option code should be used for reference only to identify ALL parts that are needed in the oil fill adapter assembly (gaskets, spacer, mounting plate, etc.). As previously stated, cap screw length should be chosen to meet the 14 mm (0.551 in.) maximum thread engagement depth requirement.

** If the 19M type cap screws are used, apply LOCTITE® 242 Thread Lock and Sealer (Medium Strength) to threads of cap screws to prevent oil leaks. If the RE type are used, new cap screws with pre-applied sealant must be used.

4. Using a new gasket, install oil fill adapter.
5. Tighten cap screws to specifications.

Specification

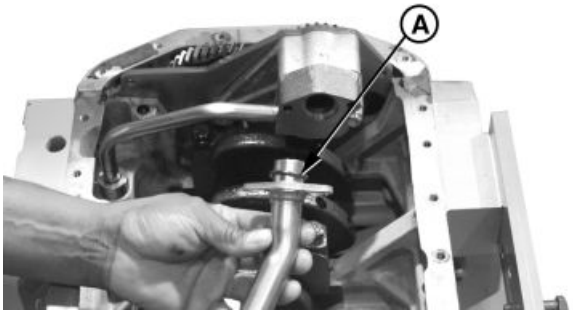
Oil Fill Tube Cap Screws—Torque..... 35 N·m (26 lb-ft)

LOCTITE is a registered trademark of the Loctite Corp.

RG,20,DT7528 -19-29AUG11-1/1

9. Install new O-ring (A) on neck of pick-up tube. Install pick-up tube. (See REMOVE, INSPECT, AND INSTALL OIL PUMP PICK-UP TUBE ASSEMBLY in this group.)

A—O-Ring



RG7599 —UN—06NOV97

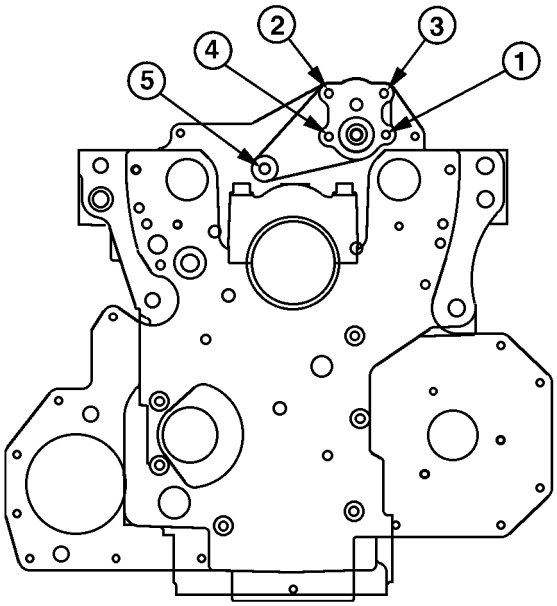
O-Ring on Pick-Up Tube Neck

RG,20,DT7520 -19-17NOV97-2/3

NOTE: Idler gear cap screw threads (5) must be lubricated.

10. Tighten four cap screws and lower idler gear cap screw to specified torque according to sequence shown.

Specification	
Oil Pump-to-Front Plate and Oil Pump Pick-Up Tube Cap Screws —Torque	35 N·m (26 lb-ft)
Oil Pump Lower Idler Gear Cap Screw (Lubricated Threads) —Torque	70 N·m (53 lb-ft)



RG8090 —UN—05JAN98

Viewed from Rear of Engine

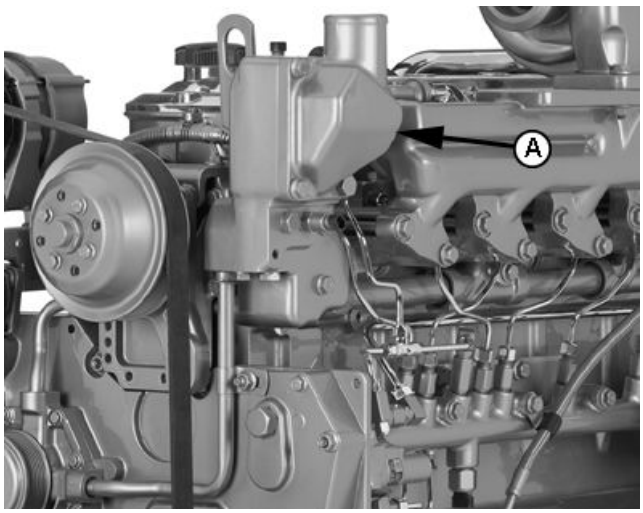
RG,20,DT7520 -19-17NOV97-3/3

IMPORTANT: Air must be expelled from cooling system when filling. Loosen temperature sending unit fitting in thermostat housing or plug at rear of cylinder head to allow air to escape when filling system. Tighten fitting or plug when all air has been expelled.

OUO1080,0000236 -19-17MAY02-2/2

Remove and Install Thermostat Cover and Thermostats (Engines with EGR Cooler)

1. Remove thermostat cover (A). Clean and check cover for cracks or damage.



RG13737 —UN—11NOV04

Thermostat Cover

RG19661,0000046 -19-21SEP07-1/2

IMPORTANT: Thermostat type and location may vary. Carefully note the location and position of each thermostat before removing it from the housing for installation purposes.

NOTE: Thermostat housing shown has one non-blocking thermostat (B) and two blocking thermostats (C). Thermostats on your engine may be different.

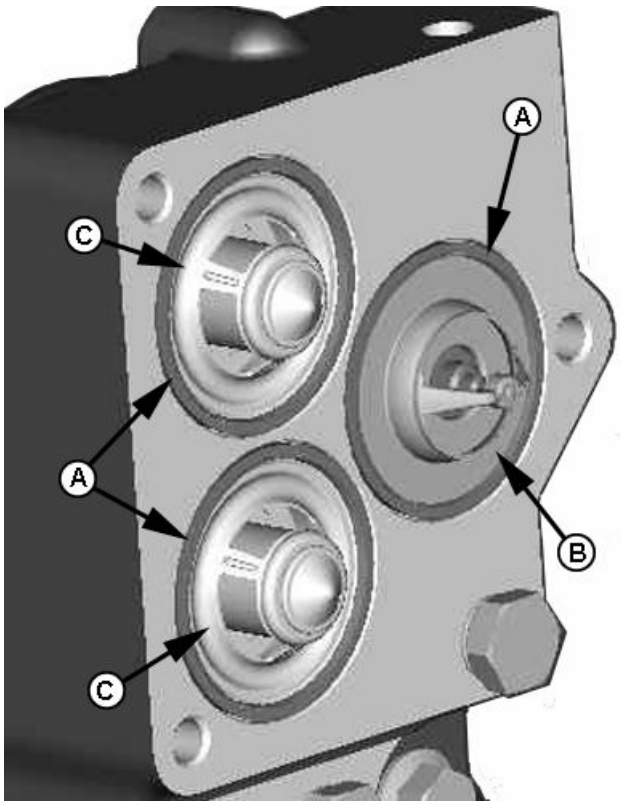
2. Remove all three thermostats from the housing.

NOTE: Install rubber seal (A) on thermostat with the lip toward thermostat cover.

3. Remove and discard rubber seal (A) from each of the three thermostats.
4. Install thermostats with new rubber seals in thermostat housing.
5. Install thermostat cover and tighten cap screws to specifications.

	Specification
Thermostat Cover Cap Screws—Torque	47 N·m (35 lb-ft)

A—Rubber Seal
B—Non-Blocking Thermostat
C—Blocking Thermostat



RG13729 —UN—11NOV04

Thermostats

RG19661,0000046 -19-21SEP07-2/2

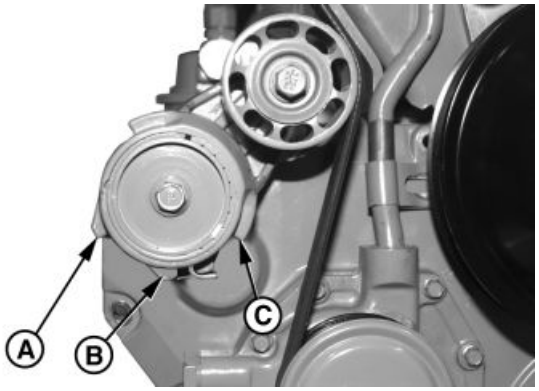
Checking Belt Tensioner Spring Tension and Belt Wear

Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner.

Checking Belt Wear

The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops (A and B) when correct belt length and geometry are used.

1. Visually inspect cast stops (A and B) on belt tensioner assembly.
2. If the tensioner stop on swing arm (C) is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, etc.) and the belt length. Replace belt as needed.
3. If the belt shows abnormal side wear, sheaves may be out of alignment. Verify that correct spacer is installed between tensioner mount and timing gear cover.



Check Belt Wear

A—Cast Stop
B—Cast Stop
C—Swing Arm

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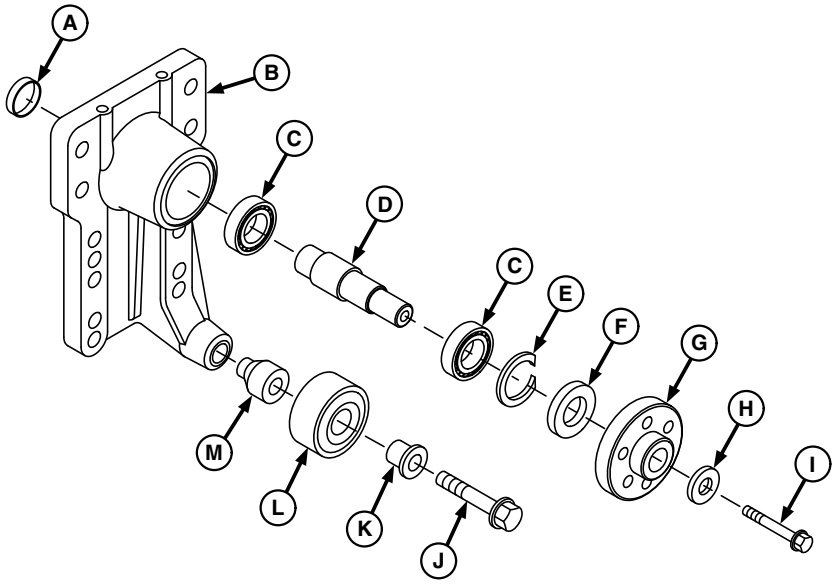
RG,25,JW7551 -19-20NOV03-1/2



RG12162 —UN—10MAY02

Adjustable Fan Drive Assembly

A—Plug
B—Bearing Housing
C—Bearing
D—Shaft
E—Snap Ring
F—Seal
G—Hub
H—Washer
I— Cap Screw
J— Cap Screw
K—Sleeve
L—Idler Pulley
M—Spacer

Assemble Fan Drive Assembly

1. Pack inner and outer bearings (C) with TY6333 or TY6347 High Temperature Grease. Apply clean engine oil to bearing I.D. and shaft O.D.

   IMPORTANT: Apply force to bearing inner race only.

2. Support end of shaft (D) and install bearings against shoulder.
3. Support bearing housing (B) on a firm flat surface with bearing bore in the upward position.
4. Install bearing and shaft assembly into housing.
5. Determine proper snap ring (E) thickness needed to obtain specified end play.

Specification

Fan Drive Shaft—Max. End Play..... 0.25 mm (0.0098 in.)

6. Install snap ring in housing groove. Visually inspect snap ring installation for proper seating in housing groove.
7. Apply a thin coat of clean engine oil to O.D. of seal (F) and to seal lips. Install seal in housing bore until flush with housing.
8. Install plug (A) in rear of housing to specified height above housing face.

Specification

Fan Drive Housing Plug—Height..... 5.9—6.5 mm (0.2323—0.2559 in.)

9. Apply clean engine oil to I.D. of fan hub (G) and push onto shaft until it bottoms against shoulder.
10. Install washer (H) and cap screw (I). Tighten cap screw to specifications.

Specification

Fan Hub-to-Fan Shaft—Torque..... 125 N·m (92 lb-ft)

11. Install idler pulley if removed. Torque idler retaining cap screw to specification.

Specification

Fan Drive Idler Cap Screw—Torque..... 50 N·m (37 lb-ft)

OUO1080,0000234 -19-08MAY02-2/2

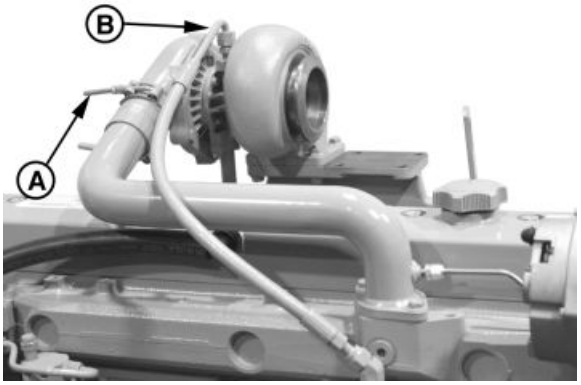
Remove Turbocharger

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

IMPORTANT: When cleaning turbocharger, do not spray directly into compressor cover or turbine housing. If turbocharger inspection is required, do not clean exterior prior to removal. Doing so may wash away evidence of a potential failure mode. See TURBOCHARGER INSPECTION later in this group.)

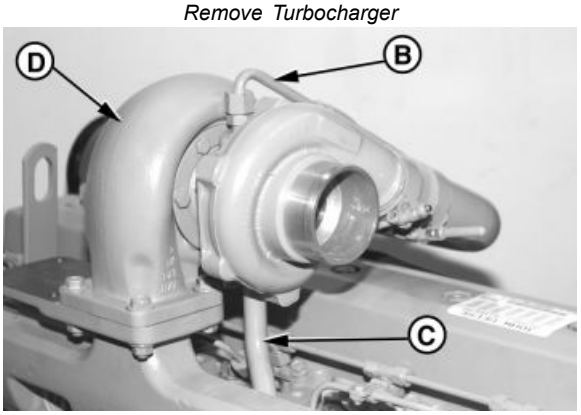
1. Thoroughly clean exterior of turbocharger and surrounding area to prevent entry of dirt into the air intake system during removal.
2. Remove air intake hose and exhaust elbow (shown removed). Loosen hose clamp (A).
3. Disconnect oil inlet line (B) and oil return pipe (C) from turbocharger (D).

A—Hose Clamp
B—Oil Inlet Line
C—Oil Return Pipe
D—Turbocharger
E—Actuator
F—Actuator Coolant Inlet
G—Actuator Coolant Outlet



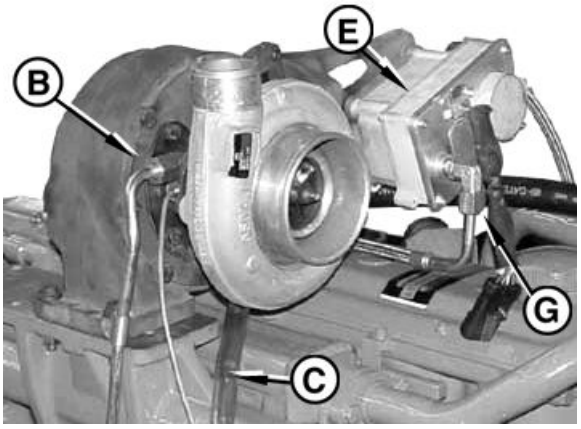
RG7618A —UN—06NOV97

Remove Turbocharger



RG7619A —UN—06NOV97

Disconnect Turbocharger Lines



RG14104 —UN—24MAR05

Remove VG Turbocharger

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RG19661,0000003 -19-15JUN05-1/2

Remove and Install Variable Geometry Turbocharger Actuator (4-Cylinder Engine - If Equipped)

RG15257 —UN—09APR07

Actuator Linkage (Earlier design)

CD31005 —UN—30JAN08

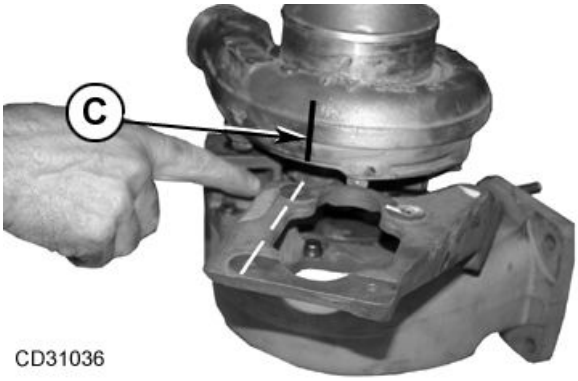
Actuator Linkage (Later design)

NOTE: Actuator linkage on earlier engines has a splined ball-joint design while later engines feature a threaded ball-joint design.

Continued on next page

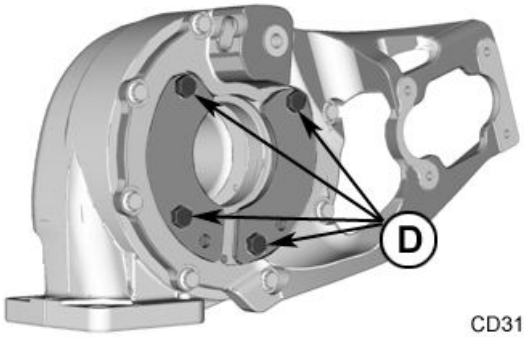
RG19661,000022A -19-09APR08-1/7

Install Turbocharger Turbine Housing



CD31036 —UN—16JUN09

Assemble center housing into turbine housing



CD31037 —UN—16JUN09

Install the 2 quarter moon shaped clamp plates

C—Alignment mark **D—Clamp plate cap screws**

1. Carefully assemble the center housing into the new turbine housing while respecting the alignment mark previously done (C).
2. Reinstall the 2 quarter moon shaped clamp plates and the 4 cap screws (D). Verify alignment and tighten to specification.

Specification	
Clamp plates to turbine housing—Torque	25 N·m (19 lb-ft)

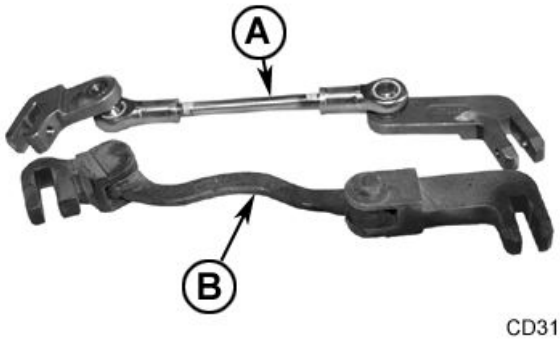
3. Spin turbocharger shaft to be certain it spins free with no interference.
4. Assemble actuator to new turbine housing bracket (see **Remove and Install Variable Geometry Turbocharger Actuator (6-Cylinder Engine - If Equipped)**.

CD03523,00001D1 -19-16JUN09-3/4

NOTE: The new turbine housing requires the use of the ball-type linkage (A) instead of the previous linkage design (B).

IMPORTANT: The ball-type linkage is adjusted by the manufacturer then endpoints are crimped in place. DO NOT attempt to modify the length of the linkage.

5. Install VGT actuator linkage (see **Remove and Install Turbocharger Actuator Linkage (6-Cylinder Engine)**.
6. Reinstall turbocharger on engine (See **Install Turbocharger**).



CD31039 —UN—16JUN09

A—New linkage (Ball-type) **B—Previous linkage**

CD03523,00001D1 -19-16JUN09-4/4

Repair Turbocharger

Turbochargers for service may be designed for a specific application. When installing turbochager on engine, it can be necessary to re-orient the center and compressor housings.

On engines equipped with the variable geometry turbocharger, an engine re-learn procedure is required to enable the engine to reset it's operating paramaters. During this process, the engine may momentary increase in speed.

RG,30,JW7571 -19-15JUN09-1/1

Remove, Inspect, and Install EGR Valve (Tier 3/Stage IIIA)

1. Disconnect wiring lead and remove two attaching screws (A). Place JDG10194 EGR removal tool at the base of the EGR valve and install tool forcing screws into the intake manifold. Carefully remove the valve without binding by alternately turning the two forcing screws until the valve lands are past the intake manifold port.
2. Remove gasket and clean mating surfaces. Vacuum debris and loose carbon deposits from intake housing.
3. Replace EGR O-rings (B) each time valve is removed.
4. Inspect valve lands (C) for wear and damage. Remove carbon deposits and debris.
5. Lubricate O-rings with clean engine oil. Carefully install EGR valve and new gasket with the motor pointing away from the engine. Tighten attaching screws (A) to initial specifications.

Specification	
EGR Valve - Initial —Torque	5 N·m (4 lb-ft)

6. Tighten EGR attaching screws (A) to final specifications. Connect wiring lead.

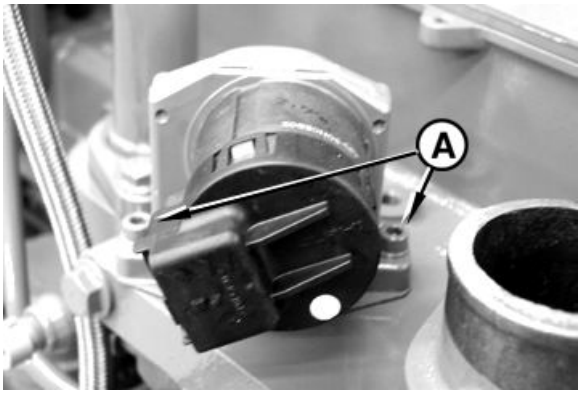
Specification	
EGR Valve - Final—Torque	15 N·m (11 lb-ft)

IMPORTANT: If installing a new EGR valve, recalibrate using Service Advisor™, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION under the Interactive Test tab - RETEST.

If reusing the EGR valve, recalibrate using Service Advisor™, see HARNESS DIAGNOSTIC MODE TEST under the interactive test tab - RETEST.

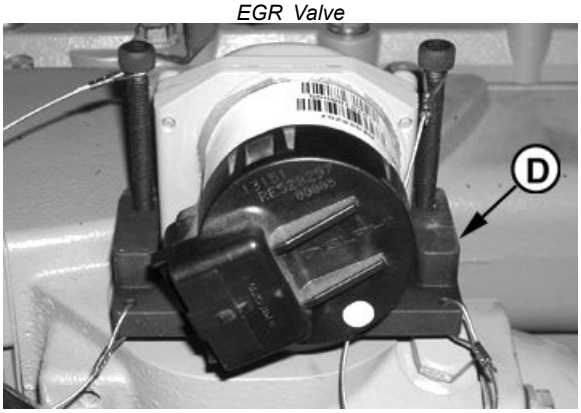
NOTE: On certain applications, the EGR valve has a vent hole, obturated with a plug (E), to prevent contamination during storage and painting operations. Once EGR valve is installed on engine, this plug MUST be removed.

A—Attaching Screws
B—O-Rings
C—EGR Valve Lands
D—JDG10194 EGR Removal Tool with Screws
E—Vent plug (to be removed)



EGR Valve

RG14089 —UN—22MAR05

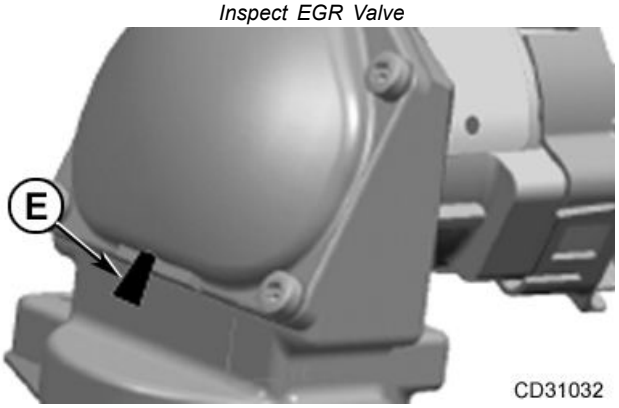


JDG10194 EGR Removal Tool

RG14881 —UN—26MAY06

Inspect EGR Valve

RG14076 —UN—01APR05



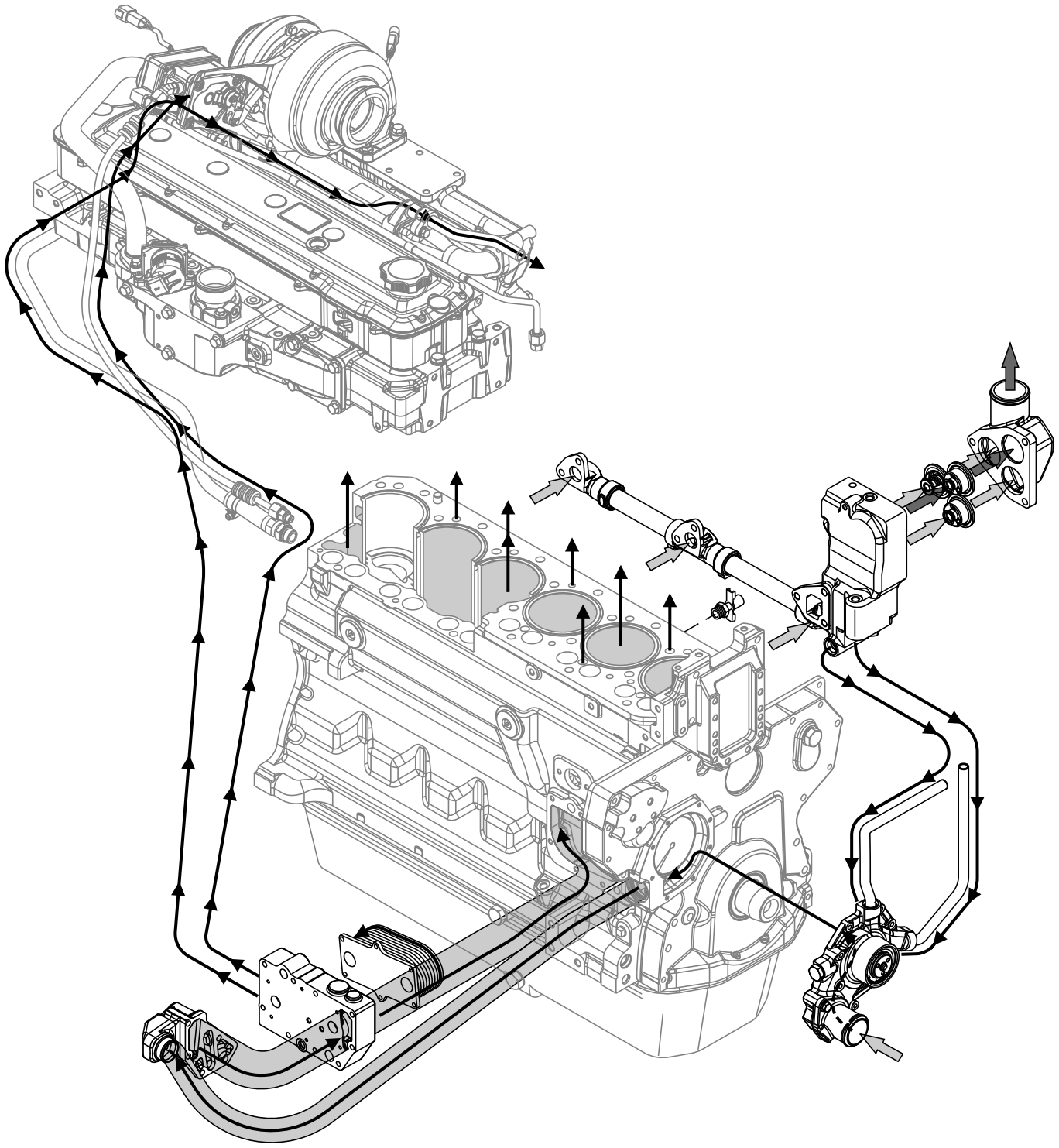
EGR Valve with vent plug

CD31032 —UN—20MAY09

RG19661,0000040 -19-20MAY09-1/1

Section 03
Theory of Operation

Contents



RG13957 —UN—14JUN05

Engine Coolant Flow with EGR Cooler
(Tier 3/Stage IIIA Engines)

The cooling system includes the radiator, coolant pump (A), and thermostat(s) (I).

Coolant is circulated from the coolant pump into the coolant passage adapter (B) and circulates around the oil cooler plates (D). From the oil cooler, coolant flows into the main coolant gallery (E). From the gallery coolant flows into the coolant jacket (F), around the cylinder liners, up through the block deck passages (G), and into the cylinder head. In the cylinder head, the coolant flows through passages (H) around the intake and exhaust ports, valve seats, and injection nozzles. Coolant flows toward the front end of the cylinder head and exits through the coolant manifold/thermostat housing (J). Engines may be equipped with a dual thermostat assembly (K).

Continued on next page

RG19661,000000E -19-15JUN05-2/3

About This Section of the Manual

This section of the manual contains necessary information to diagnose some base engine, all lubrication system and all cooling system problems. This section is divided into two areas: diagnosing malfunctions and testing procedures. The diagnosing malfunction areas are further divided into the following headings, containing the following symptoms:

- **(L)** Diagnosing Lubrication System Malfunctions:
  - L1 - Excessive Oil Consumption
  - L2 - Engine Oil Pressure Low
  - L3 - Engine Oil Pressure High
- **(C)** Diagnosing Cooling System Malfunctions:
  - C1 - Coolant Temperature Above Normal
  - C2 - Coolant Temperature Below Normal
  - C3 - Coolant in Oil or Oil in Coolant

Procedures for diagnosing some of the above symptoms are formatted such that a test or repair is recommended, then, based on the results, another test or repair is recommended. Other symptoms are formatted in a symptom - problem - solution format. In these symptoms, the problems are arranged in the most likely or easiest to check first. Symptoms arranged in both formats refer to testing procedures in the second part of this section. The second part of this section contains the following testing procedures:

- Base Engine Testing Procedures:
  - Test Engine Compression Pressure
  - Test Engine Cranking Speed
  - Dynamometer Test
- Lubrications System Testing Procedures:
  - Engine Oil Consumption
  - Check Engine Oil Pressure
  - Check for Excessive Crankcase Pressure (Blow-By)
  - Check for Turbocharger Oil Seal Leak
- Cooling System Testing Procedures:
  - Inspect Thermostat and Test Opening Temperature
  - Pressure Test Cooling System and Radiator Cap
  - Check for Head Gasket Failures
  - Check and Service Cooling System
- Air Supply and Exhaust Systems Testing Procedures:
  - Check Air Intake System
  - Measure Intake Manifold Pressure (Turbo Boost)
  - Check for Intake and Exhaust Restrictions
  - Test for Intake Air Leaks
  - Check for Exhaust Leaks (Turbocharger Engines)
  - Test Turbocharger Wastegate
  - Test Air Filter Restriction Indicator Switch

DPSG,RG40854,512 -19-06MAR00-1/1

2. Attach JT07042[1] 600 psi gauge or JT01682A[2] 400 psi gauge (except for PowerTech “E” engine) to adapter.

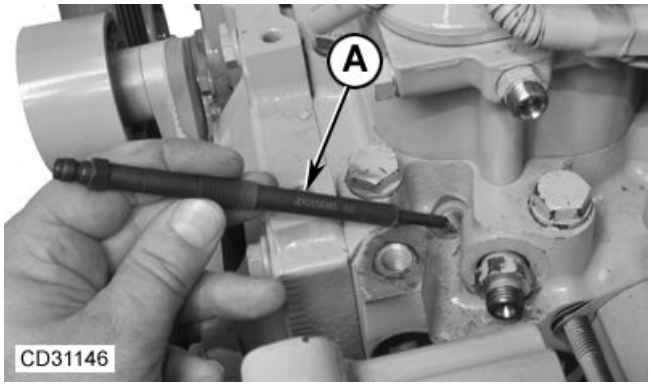
RG5646 —UN—02APR90

Attach compression test gauge

[1]Part of JT01674A Compression test kit, but can be ordered separately.
[2]JT01682A 400 psi gauge has been replaced by JT07042 600 psi gauge in JT01674A kit.

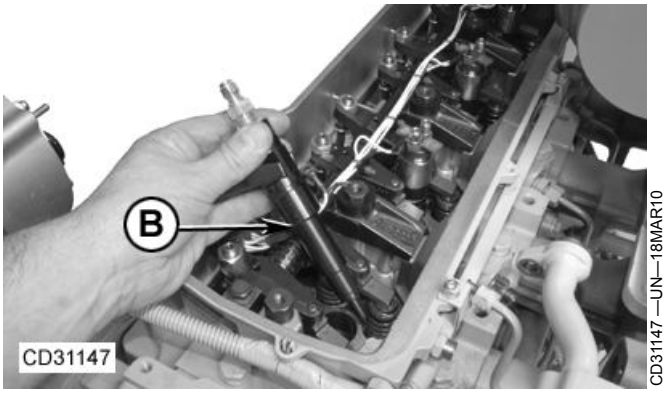
RG,105,JW7652 -19-19MAR10-4/6

Four-Valve Head Engines



CD31146 —UN—18MAR10

Install JDG11065 adapter in glow plug hole



CD31147 —UN—18MAR10

Install JDG2047A adapter in injector hole

A—JDG11065 Compression test adapter (in glow plug hole)

B—JDG2047A Compression test adapter (in injector hole)

NOTE: Engine compression pressure can be tested either through glow plug hole or through injector hole.

1. Remove glow plug then install JDG11065 adapter (A) or remove injector then install JDG2047A adapter (B).

Continued on next page

RG,105,JW7652 -19-19MAR10-5/6

Check for Head Gasket Failures

NOTE: Booklet DB1119—CYLINDER HEAD GASKET FAILURES for 6466 and 6076 Engines can be used as a guide for diagnosing head gasket failures on POWERTECH® 4.5 L and 6.8 L Engines. However, use specifications provided in this manual (CTM104).

Head gasket failures generally fall into three categories:

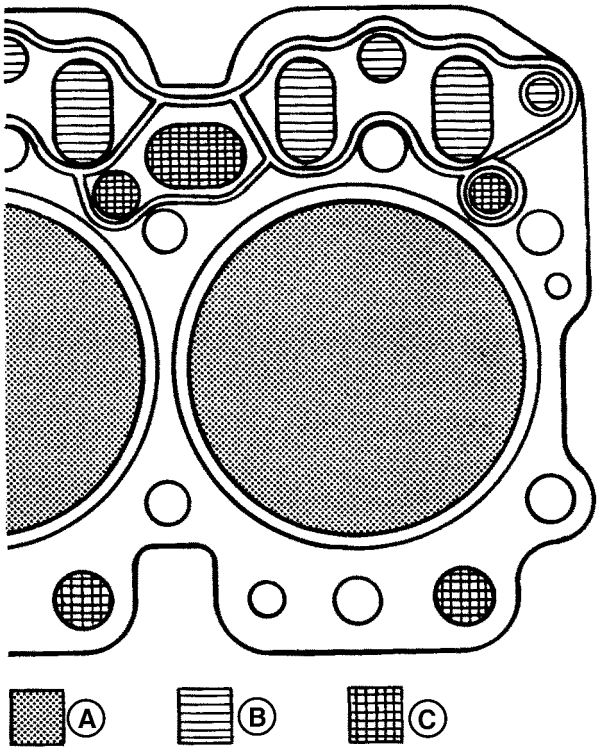
- Combustion seal failures.
- Coolant seal failures.
- Oil seal failures.

Combustion seal failures occur when combustion gases escape between cylinder head and head gasket combustion flange, or between combustion flange and cylinder liner. Leaking combustion gases may vent to an adjacent cylinder, to a coolant or oil passage, or externally.

Coolant or oil seal failures occur when oil or coolant escapes between cylinder head and gasket body, or between cylinder block and gasket body. The oil or coolant may leak to an adjacent coolant or oil passage, or externally. Since oil and coolant passages are primarily on right-hand (camshaft) side of engine, fluid leaks are most likely to occur in that area.

Follow these diagnostic procedures when a head gasket joint failure occurs or is suspected.

1. Before starting or disassembling engine, conduct a visual inspection of machine and note any of the following:
   - Oil or coolant in head gasket seam, or on adjacent surfaces. Especially right rear corner of gasket joint.
   - Displacement of gasket from normal position.
   - Discoloration or soot from combustion gas leakage.
   - Leaking radiator, overflow tank, or hoses.
   - Leaking coolant from coolant pump weep hole.
   - Damaged or incorrect radiator, fan, or shroud.
   - Obstructed air flow or coolant flow.
   - Worn or slipping belts.
   - Damaged or incorrect pressure cap.
   - Presence of oil in coolant.
   - Low coolant levels or Improper coolant.
   - Unusually high or low oil levels.
   - Oil degradation, dilution, or contamination.
   - Incorrectly specified injection pump.
   - Indications of fuel or timing adjustments.
   - Unburned fuel or coolant in exhaust system.
2. Obtain coolant and oil samples for further analysis.
3. Start and warm up engine if it can be safely operated. Examine all potential leakage areas again as outlined previously. Using appropriate test and measurement equipment, check for the following:
   - White smoke, excessive raw fuel, or moisture in exhaust system.
   - Rough, irregular exhaust sound, or misfiring.
   - Air bubbles, gas trapped in radiator/overflow tank.
   - Loss of coolant from overflow.



RG6432 —UN—03NOV97

Diagnosing Head Gasket Joint Failures

A—Combustion Sealing Area
B—Oil Sealing Areas
C—Coolant Sealing Areas

   - Excessive cooling system pressure.
   - Coolant overheating.
   - Low coolant flow.
   - Loss of cab heating (air lock).
4. Shut engine down. Recheck crankcase, radiator, and overflow tank for any significant differences in fluid levels, viscosity, or appearance.
5. Compare your observations from above steps with the diagnostic charts earlier in this group. If diagnostic evaluations provide conclusive evidence of combustion gas, coolant, or oil leakage from head gasket joint, the cylinder head must be removed for inspection and repair of gasket joint components.

COMBUSTION SEAL LEAKAGE

Symptoms:

- Exhaust from head gasket crevice
- Air bubbles in radiator/overflow tank
- Coolant discharge from overflow tube
- Engine overheating
- Power loss
- Engine runs rough
- White exhaust smoke
- Loss of cab heat
- Gasket section dislodged, missing (blown)

Continued on next page

RG,105,JW7657 -19-23MAY00-1/2

Section 05
Tools and Other Materials

Contents

Other Material (Two-Valve Head)

Number	Name	Use
Clean Engine Oil (U.S.)	Lubricant	Lubricate head bolt before installation.

OUO1082,000029C -19-26MAY06-1/1

Flexible Cylinder Hone D17004BR

Hone cylinder liners.

RG5074

RG5074 —UN—07NOV97

D17004BR

DPSG,OUO1004,2711 -19-24SEP07-8/14

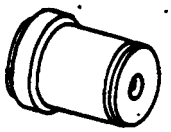
Piston Pin Bushing Remover and Installer ..... JD286 (JD-286)[1]

Remove and install large 41 mm (1.6 in.) piston pin bushings.

Piston Pin Bushing Remover and Installer JDE88

Remove and install small 35 mm (1.3 in.) piston pin bushings.

[1]*Order JD-286 when tool is ordered from European Parts Distribution Center (EPDC)*



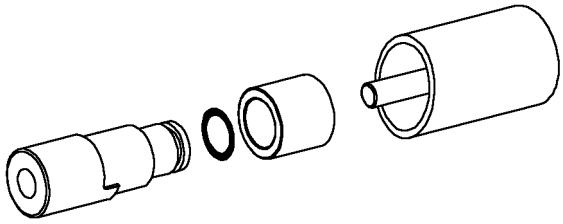
RG5107 —UN—23AUG88

JD286 (JD-286)

DPSG,OUO1004,2711 -19-24SEP07-9/14

Connecting Rod Bushing Service Set JDG953

Replace pin bushing in connecting rods with tapered pin-end.



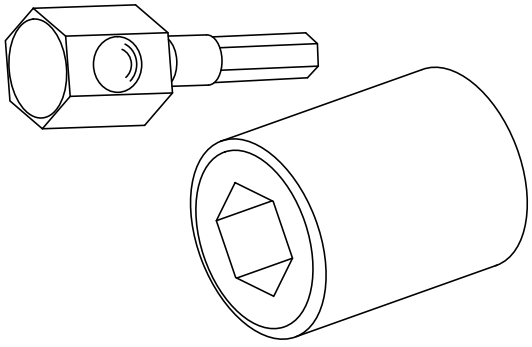
RG9126 —UN—22APR98

JDG953

DPSG,OUO1004,2711 -19-24SEP07-10/14

Oil Gallery Plug Tool JDG782A

Used to remove and install oil gallery plug.



RG11804 —UN—25OCT01

JDG782A

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DPSG,OUO1004,2711 -19-24SEP07-11/14

Crankshaft, Main Bearings and Flywheel Other Materials

Number	Name	Use
TY16285 (U.S.) CXTY16285 (Canadian) 7649 (LOCTITE®)	Cure Primer	Used to clean nose of crankshaft for damper installation.
TY15969 (U.S.) TY9479 (Canadian) 680 (LOCTITE®)	Retaining Compound (Maximum Strength)	Used to retain vibration damper to crankshaft.
	Brake Kleen or Ignition Cleaner	Remove sealant from crankshaft flange.
TY15969 (U.S.) TY9479 (Canadian) 680 (LOCTITE®)	Retaining Compound (Maximum Strength)	Apply to crankshaft front wear sleeve.
T43513 (U.S.) TY9474 (Canadian) 271 (LOCTITE®)	Thread Lock and Sealer (High Strength)	Apply to threaded studs of flywheel (option code 1557).
	PLASTIGAGE®	Check main bearing-to-crankshaft journal oil clearance.
PM38655 (U.S.) TY9484 (Canadian) LOCTITE® 515 (LOCTITE)	Flexible Form-In-Place Gasket	Apply to cylinder block front plate, crankshaft flywheel hub (1568 flywheel option code), rear face of cylinder block prior to installing flywheel housing and Merit tractor flywheel housing M20 cap screw surface.
T43514 (U.S.) TY9475 (Canadian) 277 (LOCTITE®)	Plastic Gasket	Apply to torque converter access hole plug.

LOCTITE is a trademark of Loctite Corp.
PLASTIGAGE is a registered trademark of DANA Corp.

DPSG,OUO1004,2717 -19-24MAY02-1/1

Lubrication System Service Equipment and Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

SERVICEGARD is a trademark of Deere & Company

Some of the SERVICEGARD™ tools listed in this manual may no longer be available for purchase. If you do not have the referenced tool, a suitable substitute may be available from a local supplier.

DPSG,OUO1004,2728 -19-26APR00-1/5

Blind-Hole Puller Set D01061AA	Remove oil filter bypass valve (extended-life filter), oil pressure regulating valve seat and dipstick tube from block.

DPSG,OUO1004,2728 -19-26APR00-2/5

Collet (5/16 in.) JT01724 (33856)	Used with JT01720 Actuator Pin and 1156 Slide Hammer to remove dipstick tube from cylinder block.

DPSG,OUO1004,2728 -19-26APR00-3/5

Actuator Pin JT01720 (28250)	Used with JT01724 Collet and 1156 Slide Hammer to remove dipstick tube from cylinder block.

DPSG,OUO1004,2728 -19-26APR00-4/5

Slide Hammer..... 1156 (Formerly D01299AA) Used with JDG1517 Pressure Regulating Valve Installer and Remover Tool Set to remove oil pressure regulating	valve. Used with JT01724 Collet and JT01720 Actuator Pin to remove dipstick tube from cylinder block.

DPSG,OUO1004,2728 -19-26APR00-5/5

Diagnostic Service Equipment and Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

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Some of the SERVICEGARD™ tools listed in this manual may no longer be available for purchase. If you do not have the referenced tool, a suitable substitute may be available from a local supplier.

DPSG,OUO1004,2739 -19-26APR00-1/4

Water Vacuum Gauge Kit D05022ST	Used to test air filter restriction indicator switch.

DPSG,OUO1004,2739 -19-26APR00-2/4

Turbocharger Shield JDG576	Cover turbocharger inlet when testing engine with air filter system removed.

DPSG,OUO1004,2739 -19-26APR00-3/4

Air Regulator with Gauge	Pressurize wastegate actuator to test operation of wastegate.

DPSG,OUO1004,2739 -19-26APR00-4/4

ITEM	Engine		
Oil Pressure At Rated Speed, Full Load (± 15 psi)	400 kPa (58 psi)	400 kPa (58 psi)	375 kPa (54 psi)
Oil Pressure At Low Idle (Minimum)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)
Length	867 mm (34.1 in.)	860 mm (33.9 in.)	1123 mm (44.2 in.)
Width	680 mm (26.8 in.)	612 mm (24.1 in.)	657 mm (25.9 in.)
Height	1055 mm (41.5 in.)	1039 mm (40.9 in.)	1036 mm (40.8 in.)
Weight	491 kg (1083 lb)	491 kg (1083 lb)	608 kg (1340 lb)

Tier 3 Engines (2-Valve Head Design - Non-HPCR)

ITEM	Engine	
	4045TF280	4045HF280
Number of Cylinders	4	4
Bore	106 mm (4.19 in.)	106 mm (4.19 in.)
Stroke	127 mm (5.0 in.)	127 mm (5.0 in.)
Displacement	4.5 L (276 cu in.)	4.5 L (276 cu in.)
Compression Ratio	19.0:1	19.0:1
Max. Crank Pressure	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)
Fuel System description	Stanadyne DB4	Stanadyne DB4
Governor Regulation (Industrial)	7—10 %	7—10 %
Governor Regulation (Generator)	3—5%	3—5 %
Oil Pressure At Rated Speed, Full Load (± 15 psi)	345 kPa (50 psi)	345 kPa (50 psi)
Oil Pressure At Low Idle (Minimum)	105 kPa (15 psi)	105 kPa (15 psi)
Length	860 mm (33.9 in.)	860 mm (33.9 in.)
Width	612 mm (24.1 in.)	612 mm (24.1 in.)
Height	994 mm (39.1 in.)	994 mm (39.1 in.)
Weight	396 kg (872 lb)	396 kg (872 lb)

DPSG,OUO1004,102 -19-25SEP07-3/3

Engine Rebuild Specifications

Item	Measurement	Specification
D05226ST Special Adapter-to-Mounting Hub SAE Grade 8 Socket Head Cap Screws	Torque	600 N·m (450 lb-ft).
62835[1] Engine Adapter-to-Special Adapter SAE Grade 8 Cap Screws	Torque	135 N·m (100 lb-ft).
Engine Lift Strap Cap Screws	Torque	170 N·m (125 lb-ft)
Engine Repair Stand M12 Cap Screws	Torque	140 N·m (105 lb-ft)
Engine Repair Stand M14 Cap Screws	Torque	225 N·m (165 lb-ft)

[1]Part of JT07268 Engine Repair Stand Adapter Kit

DPSG,OUO1004,2706 -19-07NOV03-1/1

Item	Measurement	Specification
Balancer Shaft Journal-to-Bushing	Clearance	0.016—0.102 mm (0.0006—0.0040 in.)
Lower Block Bore for Seating Liner	ID	115.75—115.80 mm (4.557—4.559 in.)
Upper Block Bore for Seating Liner	ID	120.70—120.75 mm (4.752—4.754 in.)
Liner Flange in Block	ID	126.33—126.35 mm (4.973—4.974 in.)
Liner at Upper Bore	OD	120.61—120.69 mm (4.7484—4.7516 in.)
Liner-to-Cylinder Block	Clearance at Lower Bore	0.035—0.100 mm (0.001—0.004 in.)
Liner-to-Cylinder Block	Clearance at Upper Bore	0.10—0.14 mm (0.004—0.005 in.)
Cylinder Liner	ID	106.48—106.52 mm (4.192—4.194 in.)
Cylinder	Maximum Wear	0.10 mm (0.004 in.)
Cylinder	Maximum Taper	0.05 mm (0.002 in.)
Cylinder	Maximum Out-of-Round	0.05 mm (0.002 in.)
Cylinder Liner Flange Counterbore	Depth in Block	5.952—5.988 mm (0.2343—0.2357 in.)
Cylinder Liner Flange	Thickness	6.022—6.058 mm (0.2371—0.2385 in.)
Cylinder Block Top Deck		
Maximum Acceptable Out-of-Flat, Entire Length or Width (Used)	Measurement	0.08 mm (0.003 in.)
Maximum Acceptable Out-of-Flat (Any 150 mm [5.90 in.] Length)	Measurement	0.025 mm (0.001 in.)
Top Deck (Surface Grind Only) (AA)	Surface Finish	0.8—3.2 micrometers (32—125 micro-in.)
Top Deck Surface Finish	Maximum Wave Depth	0.012 mm (0.0005 in.)
Main Bearing Bore Centerline-to-Cylinder Block Top Deck	Distance	337.896—337.972 mm (13.3029—13.3059 in.)
Piston Cooling Orifice Jet	Diameter	1.4 mm (0.055 in.)
Piston Cooling Orifice	Torque	11 ± 1.5 N·m (96 ± 13 lb-in.)
Push Rod	OD	9.891—9.917 mm (0.3894—0.3904 in.)
Push Rod Bore in Block	ID	10.00—10.05 mm (0.3937—0.3957 in.)
Cylinder Liner	Height above Block	0.030—0.100 mm (0.001—0.004 in.)
	Maximum Permissible Height Difference at Nearest Point of Two Adjacent Liners, or Within a Single Liner	0.05 mm (0.002 in.)
Connecting Rod Cap Screws	Initial Torque	58 N·m (43 lb-ft)

Continued on next page

DPSG,OUO1004,2714 -19-18JUN02-4/5

Cooling System Specifications

Item	Measurement	Specification
Coolant Manifold/Thermostat Cover Cap Screws (Single Thermostat)	Torque	70 N·m (52 lb-ft)
Air Bleed Port Plug	Torque	6 N·m (53 lb-in.)
Thermostat Cover-to-Coolant Manifold Cap Screws (6010 Series Tractors with Single Thermostat)	Torque	30 N·m (22 lb-ft)
Coolant Manifold-to-Cylinder Head Cap Screws (6010 Series Tractors with Single Thermostat)	Torque	35 N·m (26 lb-ft)
Coolant Pump Impeller Bore	ID	11.973—11.999 mm (0.4714—0.4724 in.)
Coolant Pump Bearing Shaft (Impeller End)	OD	12.025—12.038 mm (0.4734—0.4739 in.)
Coolant Pump Bearing Shaft (Pulley End)	OD	39.997—40.013 mm (1.5747—1.5753 in.)
Coolant Pump Housing Bearing Bore	ID	61.961—61.987 mm (2.4394—2.4404 in.)
Coolant Pump Impeller (Standard Flow)	Position	2.46—2.58 mm (0.096—0.102 in.) below end of shaft
Coolant Pump Impeller (High Flow)	Position	Flush ± 0.13 mm (0.005 in.) with end of shaft
Coolant Pump Housing-to-Impeller	Minimum Clearance	0.27 mm (0.010 in.)
Coolant Pump Pulley Cap Screws	Torque	15 N·m (133 lb-in.)
Coolant Pump-to-Timing Cover Cap Screws	Torque	16 N·m (142 lb-in.)
Coolant Pump Inlet Elbow Cap Screws	Torque	35 N·m (26 lb-ft)
Fan-to-Pulley Hub M8 Cap Screws	Torque	35 N·m (26 lb-ft)
Fan-to-Pulley Hub M10 Cap Screws	Torque	70 N·m (52 lb-ft)
Fan Drive Hub	Radial Runout	0.038 mm (0.0015 in.)
Belt Tensioner-to-Timing Cover and Engine Cap Screws	Torque	50 N·m (37 lb-ft)
Belt Tensioner Pulley Cap Screw	Torque	40 N·m (29 lb-ft)
Belt Tensioner	Spring Tension	18—22 N·m (13—16 lb-ft)
8-Rib Poly-Vee Belt		
New Belt[1]	Tension	535—715 N (120—160 lb-force)
Used Belt	Tension	400—580 N (90—130 lb-force)
Fan Drive (Option Codes 2301 and 2302)		
Bearing Housing	ID	38.018—38.038 mm (1.4968—1.4976 in.)
Bearing	OD	38.087—38.100 mm (1.4995—1.5000 in.)

Continued on next page

DPSG,OUO1004,2734 -19-21NOV03-1/2

POWER RATINGS ON DYNAMOMETER FOR OEM ENGINES (4 Cyl.)[a]								
Engine Model (Emission Certification)	**Fuel System Option Code**	**Electronic Software Option Codes**	**Original Injection Pump (Part No.)**	**Replaced By Injection Pump (Part No.)**	**Governor Regulation**	**Rated Speed at Full Load (rpm)[a]**	**Fast Idle (rpm)[a]**	**Power Rating kW (HP)[b]**
	16MA		RE504696	RE504931	3—5%	1800	1870	82 (110)
	16MA		RE504931		3—5%	1800	1870	82 (110)
	16MT		RE503733	RE505050	3—5%	1500	1560	70 (94)
	16MT		RE505050		3—5%	1500	1560	70 (94)
	16MU		RE504695	RE505050	3—5%	1500	1560	70 (94)
	16MU		RE505050	RE506990	3—5%	1500	1560	70 (94)
	16MU		RE506990		3—5%	1500	1560	70 (94)
	16TG		RE507941		STD	2000	2185	77 (103)
	16YG		RE508834		STD	2000	2185	77 (103)
	16YU		RE508754		3—5%	1800	1870	75 (101)
4045TF151 (Tier 1)	1677		RE60096	RE67563	3—5%	1800	1870	75 (101)
	1677		RE67563		3—5%	1800	1870	75 (101)
	16CU		RE501192		STD	2200	2400	79 (107)
	16NH		RE505411		3—5%	1800	2240	75 (101)
4045TF152 (Tier 1)	16AX		RE500551		STD	2400	2600	76 (102)
4045TF154 (Tier 1)	1605		RE69781		STD	2500	2700	86 (115)
4045TF155 (Tier 1)	16AX		RE500551		STD	2400	2600	76 (102)
	16JT		RE500551		STD	2400	2600	76 (102)
4045TF157 (Tier 1)	16GQ		RE503048		3—5%	1500	1560	83 (111)
	16LV		RE503830		3—5%	1500	1560	83 (111)
4045TF158 (Tier 1)	16GQ		RE503048		3—5%	1500	1560	83 (111)
	16LZ		RE503735		3—5%	1800	1870	82 (110)
	16MA		RE504696		3—5%	1800	1870	82 (110)
	16MT		RE503733	RE506989	3—5%	1500	1560	70 (94)
	16MT		RE506989		3—5%	1500	1560	70 (94)
	16MU		RE504695	RE505050	3—5%	1500	1560	70 (94)
	16MU		RE505050	RE506990	3—5%	1500	1560	70 (94)
	16MU		RE506990		3—5%	1500	1560	70 (94)
4045TF161 (Tier 1)	16PZ		RE500848		STD	2200	2400	73 (98)
4045TF162 (Non—Certified)	16TG		RE507941		STD	2000	2170	77 (103)
4045TF220 (Non—Certified)	16GQ		RE503048	RE506544	3—5%	1500	1560	83 (111)
	16GQ		RE506544		3—5%	1500	1560	83 (111)
	16LV		RE503830	RE506545	3—5%	1500	1560	83 (111)
	16LV		RE506545		3—5%	1500	1560	83 (111)
	16MT		RE503733			1500	1560	70 (94)
	16MV		RE503736		3—5%	1800	1870	100 (134)
	16MW		RE505051		3—5%	1800	1870	100 (134)
	16NT		RE504465		STD	2500	2700	86 (115)
	16NU		RE504466		STD	2500	2700	86 (115)
	16ZZ		RE508613		3—5%	2100	2200	107 (143)
	161A		RE509525		3—5%	2100	2200	107 (143)
	161B		RE509526		3—5%	2100	2200	107 (143)

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RG,100,JW7641 -19-27SEP07-4/10

POWER RATINGS ON DYNAMOMETER FOR OEM ENGINES (6 Cyl.)[a]								
Engine Model (Emission Certification)	**Fuel System Option Code**	**Electronic Software Option Codes**	**Original Injection Pump (Part No.)**	**Replaced By Injection Pump (Part No.)**	**Governor Regulation**	**Rated Speed at Full Load (rpm)[a]**	**Fast Idle (rpm)[a]**	**Power Rating kW (HP)[b]**
	161H, 163F (12V)	7294	RE515679	RE518164	Electronic	2500	2700	116 (155)
			RE518164		Electronic	2500	2700	116 (155)
	161J, 163M (24V)	7295	RE515679	RE518164	Electronic	2500	2700	116 (155)
			RE518164		Electronic	2500	2700	116 (155)
	161H, 163F (12V)	7296	RE515679	RE518164	Electronic	2500	2700	127 (170)
			RE518164		Electronic	2500	2700	127 (170)
	161J, 163M (24V)	7297	RE515679	RE518164	Electronic	2500	2700	127 (170)
			RE518164		Electronic	2500	2700	127 (170)
	161H, 163F (12V)	7298	RE515679	RE518164	Electronic	2400	2600	123 (165)
			RE518164		Electronic	2400	2600	123 (165)
	161H, 163F (12V)		RE515679	RE518164	Electronic	1500	1560	105 (141)
			RE518164		Electronic	1500	1560	105 (141)
	161J, 163M (24V)		RE515679	RE518164	Electronic	1500	1560	105 (141)
			RE518164		Electronic	1500	1560	105 (141)
6068TFM50 (Tier 1 Marine)	16FA (12V)		RE502619		STD	2600	2800	168 (225)
	16FB (24V)		RE502620		STD	2600	2800	168 (225)
	16FC (12V)		RE502621		STD	2400	2600	130 (175)
	16FD (24V)		RE502622		STD	2400	2600	130 (175)
	16FE (12V)		RE502623		3—5%	1800	1870	115 (154)
	16FF (24V)		RE502624		3—5%	1800	1870	115 (154)
6068TFM75 (Tier 2 Marine)	167Q (12V)	72GD	RE515887		Electronic	2400		118 (158)
	167R (24V)	72GE	RE515888		Electronic	2400		118 (158)
	167Q (12V)	72GF	RE515887		Electronic	2500		133 (178)
	167R (24V)	72GG	RE515888		Electronic	2500		133 (178)
	161E, 167Q (12V)	72EP	RE515887		Electronic	2600		150 (200)
	162K, 167R (24V)	72EQ	RE515888		Electronic	2600		150 (200)
6068TFM76 (Tier 2 Marine Gen Set)	167S	72ER	RE518165		Electronic	1500	1560	98 (131)
	167T	72ES	RE518165		Electronic	1500	1560	98 (131)
	167L	72ET	RE518164		Electronic	1800	1890	121 (162)
	167M	72EU	RE518164		Electronic	1800	1890	121 (162)
6068SFM50 (Tier 2 Marine)	161E 162K	7238, 7247			Electronic	2600	2700	224 (300)
	161E 162K	7248, 7249			Electronic	2500	2600	198 (266)
	161E 162K	7250, 7251			Electronic	2400	2500	175 (235)
	161E 162K	7252, 7253			Electronic	2300	2400	153 (205)

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CD03523,00001B3 -19-30AUG10-4/8

TURBO BOOST PRESSURES (JOHN DEERE AGRICULTURAL EQUIPMENT)				
Machine Model	**Engine Model**	**Rated Power at Full Load Rated Speed kW (hp)**	**Full Load Rated Speed rpm**	**Turbo Boost Pressure at Full Load Rated Speed kPa (bar) (psi)**
	CD4045TL071	69 (93) Eng.	2300	67—81 kPa (0.7—0.8 bar) (10—12 psi)
	CD4045TL272 (Tier 2)	69 (93) Eng.	2300	61—75 kPa (0.6—0.7 bar) (9—11 psi)
6215 Tractor (Advantage)	CD4045TL071 (Tier 1)	54 (72) PTO 70 (94) Eng.	2300	61—75 kPa (0.6—0.8 bar) (9—11 psi)
	CD4045TL272 (Tier 2)	54 (72) PTO 70 (94) Eng.	2300	61—75 kPa (0.6—0.8 bar) (9—11 psi)
6220 Tractor (Premium)	CD4045TL272 (Tier 2)	69 (94) Eng.	2300	61—75 kPa (0.6—0.7 bar) (9—11 psi)
6220SE Tractor	CD4045TL272	69 (92) Eng.	2300	61—75 kPa (0.6—0.7 bar) (9—11 psi)
6220 Tractor	CD4045TL071	54 (72) PTO 69 (90) Eng.	2300	69—84 kPa (0.7—0.8 bar) (10—12 psi)
6220/6220L Tractor	CD4045TL272 (Tier 2)	54 (72) PTO 69 (90) Eng.	2300	61—75 kPa (0.6—0.8 bar) (9—11 psi)
6225 Tractor	CD4045HL282	71 (95)	2300	94—114 kPa (0.9—1.1 bar) (14—17 psi)
6230 Tractor (EMEA[a])	CD4045HL280	71 (95)	2300	94—114 kPa (0.9—1.1 bar) (14—17 psi)
	CD4045HL287	71 (95)	2300	72—88 kPa (0.7—0.8 bar) (10—13 psi)
6230 (Premium, EMEA)	CD4045HL480	71 (95)	2300	Not Applicable
	CD4045HL482	74 (99)	2300	Not Applicable
6230 (Advantage, N.A.[b])	CD4045HL282	71 (95)	2300	94—114 kPa (0.9—1.1 bar) (14—17 psi)
	CD4045HL287	71 (95)	2300	72—88 kPa (0.7—0.8 bar) (10—13 psi)
6230 (Premium, N.A. — 2 valve/cyl. engine)	CD4045HL280	71 (95)	2300	94—114 kPa (0.9—1.1 bar) (14—17 psi)
	CD4045HL287	74 (99)	2300	77—94 kPa (0.7—0.9 bar) (11—14 psi)
6230 (Premium, N.A. — 4 valve/cyl. engine)	CD4045HL480	71 (95)	2300	Not Applicable
	CD4045HL482	74 (99)	2300	Not Applicable
6310 Tractor (Direct Fan Drive)	CD4045TL060	73 (99) Eng.	2300	68—83 kPa (0.7—0.8 bar) (10—12 psi)
6310 Tractor (Viscous Fan Drive)	CD4045TL052	74 (100) Eng.	2300	68—83 kPa (0.7—0.8 bar) (10—12 psi)
6310 Tractor (ECU Level 4)	CD4045TLA50	77 (103) Eng.	2300	68—83 kPa (0.7—0.8 bar) (10—12 psi)
6310/6310L/6310S Tractor	CD4045TL055	60 (80) PTO 74 (99) Eng.	2300	72—88 kPa (0.7—0.9 bar) (10—13 psi)
6320 Tractor	CD4045HL072	77 (103) Eng.	2300	65—79 kPa (0.6—0.8 bar) (9—11 psi)
6320 IVT Tractor	CD4045HLA70	77 (103) Eng.	2300	65—79 kPa (0.6—0.8 bar) (9—11 psi)
6320 Tractor (Premium)	CD4045HL472	77 (103) Eng.	2300	63—78 kPa (0.6—0.8 bar) (9—11 psi)
6320SE Tractor	CD4045TL073	77 (103) Eng.	2300	76—92 kPa (0.8—0.9 bar) (11—13 psi)
	CD4045HL270	77 (103) Eng.	2300	63—78 kPa (0.6—0.8 bar) (9—11 psi)
6320 Tractor	CD4045HL073	60 (80) PTO 75 (101) Eng.	2300	64—78 kPa (0.6—0.8 bar) (9—11 psi)
	CD4045TL074	60 (80) PTO 75 (101) Eng.	2300	63—77 kPa (0.6—0.8 bar) (9—11 psi)
6320 IVT Tractor	CD4045HLA71	60 (80) PTO 77 (103) Eng.	2300	60—74 kPa (0.6—0.7 bar) (9—11 psi)
	CD4045HL476 (Tier 2)	60 (80) PTO 77 (103) Eng.	2300	65—79 kPa (0.7—0.8 bar) (9—11 psi)
	CD4045HL472	60 (80) PTO 77 (103) Eng.	2300	63—77 kPa (0.6—0.8 bar) (9—11 psi)
6320/6320L/S Tractor	CD4045HL270 (Tier 2)	60 (80) PTO 77 (103) Eng.	2300	65—79 kPa (0.7—0.8 bar) (9—11 psi)
	CD4045HL470	60 (80) PTO 77 (103) Eng.	2300	63—77 kPa (0.7—0.8 bar) (9—11 psi)
6325 Tractor	CD4045HL283	78 (105)	2300	112—137 kPa (1.1—1.4 bar) (16—20 psi)

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DPSG,OUO1004,2748 -19-29NOV11-6/11

TURBO BOOST PRESSURES JOHN DEERE CONSTRUCTION AND FORESTRY EQUIPMENT				
Machine Model	**Engine Model**	**Rated Power at Full Load Rated Speed kW (hp)**	**Full Load Rated Speed rpm**	**Turbo Boost Pressure at Full Load Rated Speed kPa (bar) (psi)**
650G Crawler Dozer (Direct Drive)	T04045TT007	74 (99)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
	T04045TT063	74 (99)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
	PE4045TT063	74 (99)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
650G Crawler Dozer (Torque Converter)	T04045TT015	74 (99)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
	T04045TT063	74 (99)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
	PE4045TT063	74 (99)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
	T04045TT069	74 (99)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
	PE4045TT069	74 (99)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
650H Crawler Dozer	T04045TT066	73 (98)	2200	51—62 kPa (0.5—0.7 bar) (7—9 psi)
	PE4045TT066	73 (98)	2200	51—62 kPa (0.5—0.7 bar) (7—9 psi)
650H Crawler Dozer	PE4045HT050 (Tier 2)	73 (98)	2200	51—62 kPa (0.5—0.7 bar) (7—9 psi)
650H Forest Fire Plow	PE4045HT051 (Tier 2)	86 (115)	2200	85 —104 kPa (0.9—1.0 bar) (12—15 psi)
650H Forest Fire Plow	T04045TT091	85 (114)	2200	79—97 kPa (0.7—0.9 bar) (10—13 psi)
	PE4045TT091	85 (114)	2200	79—97 kPa (0.7—0.9 bar) (10—13 psi)
700H Crawler Dozer	T06068TT056	92 (123)	2100	46—56 kPa (0.5—0.6 bar) (7—9 psi)
	PE6068TT056	92 (123)	2100	46—56 kPa (0.5—0.6 bar) (7—9 psi)
700H Crawler Dozer	PE6068TT060 (Tier 2)	92 (123)	2100	72— 88 kPa (0.7—0.9 bar) (11—13 psi)
700J Crawler Dozer	PE6068HT066 (Tier 3)	86 (115)	2100	Not Applicable
750C Crawler Dozer (S.N. —831315)	T06068TT007	110 (148)	2100	72—88 kPa (0.7—0.9 bar) (11—13 psi)
750C Crawler Dozer (S.N. 831316—)	T06068TT052	110 (148)	2100	72—88 kPa (0.7—0.9 bar) (11—13 psi)
	PE6068TT052	110 (148)	2100	72—88 kPa (0.7—0.9 bar) (11—13 psi)
750J Standard Crawler Dozer	PE6068HT063		2100	95—115 kPa (14—17 psi)
750J LGP Crawler Dozer	PE6068HT063		2100	103—123 kPa (15—18 psi)
755D Crawler Loader	CD60687HT480	144 (193)	2000	Not Applicable
764 High Speed Dozer	PE6068HT077	187 (251)	2200	Not Applicable
Excavator				
110 Excavator	T04045TT054	63 (84)	2200	50—62 kPa (0.5—0.6 bar) (7—9 psi)
	PE4045TP052	63 (84)	2200	50—62 kPa (0.5—0.6 bar) (7—9 psi)
110C Excavator	PE4045TP058	66 (89)	2200	50—61 kPa (0.5—0.6 bar) (7—9 psi)
110CFX Excavator	PE4045TP058	66 (89)	2200	50—61 kPa (0.5—0.6 bar) (7—9 psi)
HYEX Military Excavator	PE4045TT050	86 (115)	2500	114—140 kPa (1.1—1.4 bar) (17—20 psi)
120 Excavator	T04045TT052	69 (93)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
	PE4045TP051	69 (93)	2100	63—77 kPa (0.6—0.8 bar) (9—11 psi)
120C Excavator	PE4045HP050 (Tier 2)	70 (94)	2200	55—67 kPa (0.5—0.7 bar) (8—10 psi)
120D Excavator	PE4045HT061			Not Applicable
160LC Excavator	T04045TT055	81 (109)	2300	89—109 kPa (0.9—1.1 bar) (13—16 psi)
160C LC Excavator	PE4045HP051 (Tier 2)	85 (114)	2300	85—103 kPa (0.9—1.0 bar) (12—15 psi)
	PE4045TP053	81 (109)	2300	89—109 kPa (0.9—1.1 bar) (13—16 psi)
160D Excavator	PE4045HT056		2200	143—163 kPa (21—24 psi)
200LC Excavator	T06068TT051	110 (148)	2100	69—85 kPa (0.7—0.8 bar) (10—12 psi)
	PE6068TT051	110 (148)	2100	69—85 kPa (0.7—0.8 bar) (10—12 psi)

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OUO1082,00002AA -19-29NOV11-4/8

TURBO BOOST PRESSURES (JOHN DEERE OEM/OUTSIDE EQUIPMENT MANUFACTURERS)							
Engine Model (Emission Certification)	**Fuel System Option Code**	**Electronic Software Code**	**Injection Pump Part No.**	**Replacement Injection Pump**	**Rated Power at Full Load Rated Speed kW (hp)**	**Full Load Rated Speed rpm**	**Turbo Boost Pressure at Full Load Rated Speed kPa (bar) (psi)**
4045TFM50 (Non—Certified Marine)	16HM		RE503163		65 (87)	1800	36—44 kPa (0.4—0.5 bar) (6—7 psi)
	16HN		RE503162		65 (87)	1800	36—44 kPa (0.4—0.5 bar) (6—7 psi)
	16HP		RE503861		101 (135)	2500	95—117 kPa (1.0—1.2 bar) (14—17 psi)
	16HQ		RE503860		101 (135)	2500	95—117 kPa (1.0—1.2 bar) (14—17 psi)
	16LK		RE503160		112 (150)	2600	128—156 kPa (1.3—1.6 bar) (19—23 psi)
	16LL		RE503161		112 (150)	2600	128—156 kPa (1.3—1.6 bar) (19—23 psi)
4045TFM75 (Tier 2 Marine)			RE518167	RE518086	62 (83)	1500	29—35 kPa (0.3—0.4 bar) (4—5 psi)
			RE518086		62 (83)	1500	29—35 kPa (0.3—0.4 bar) (4—5 psi)
			RE518167	RE518086	62 (83)	1500	29—35 kPa (0.3—0.4 bar) (4—5 psi)
			RE518086		62 (83)	1500	29—35 kPa (0.3—0.4 bar) (4—5 psi)
	166M (12V)	72FP	RE518167	RE518086	79 (106)	2400	72—88 kPa (0.7—0.9 bar) (10—13 psi)
			RE518086		79 (106)	2400	72—88 kPa (0.7—0.9 bar) (10—13 psi)
	166N (24V)	72FQ	RE518167	RE518086	79 (106)	2400	72—88 kPa (0.7—0.9 bar) (10—13 psi)
			RE518086		79 (106)	2400	72—88 kPa (0.7—0.9 bar) (10—13 psi)
	166M (12V)	72FR	RE518167	RE518086	90 (121)	2500	97—119 kPa (1.0—1.2 bar) (14—17 psi)
			RE518086		90 (121)	2500	97—119 kPa (1.0—1.2 bar) (14—17 psi)
	166N (24V)	72FS	RE518167	RE518086	90 (121)	2500	97—119 kPa (1.0—1.2 bar) (14—17 psi)
			RE518086		90 (121)	2500	97—119 kPa (1.0—1.2 bar) (14—17 psi)
	161M (12V)	72EF	RE518167	RE518086	101 (135)	2600	128—156 kPa (1.3—1.6 bar) (19—23 psi)
			RE518086		101 (135)	2600	128—156 kPa (1.3—1.6 bar) (19—23 psi)
	166N (24V)	72EG	RE518167	RE518086	101 (135)	2600	128—156 kPa (1.3—1.6 bar) (19—23 psi)
			RE518086		101 (135)	2600	128—156 kPa (1.3—1.6 bar) (19—23 psi)
	168G (12V)	72EH	RE518167	RE518086	56 (75)	1500	28—35 kPa (0.3—0.4 bar) (4—5 psi)
			RE518086		56 (75)	1500	28—35 kPa (0.3—0.4 bar) (4—5 psi)
	168H (24V)	72EJ	RE518167	RE518086	56 (75)	1500	28—35 kPa (0.3—0.4 bar) (4—5 psi)
			RE518086		56 (75)	1500	28—35 kPa (0.3—0.4 bar) (4—5 psi)
	168J (12V)	72EK	RE518167	RE518086	80 (107)	1800	60—74 kPa (0.6—0.7 bar) (9—11 psi)
			RE518086		80 (107)	1800	60—74 kPa (0.6—0.7 bar) (9—11 psi)
	168K (24V)	72EL	RE518167	RE518086	80 (107)	1800	60—74 kPa (0.6—0.7 bar) (9—11 psi)
			RE518086		80 (107)	1800	60—74 kPa (0.6—0.7 bar) (9—11 psi)
4045HF120 (Non—Certified)	16GR		RE503050	RE506965	102 (137)	1500	123—150 kPa (1.2—1.5 bar) (18—22 psi)
	16GR		RE506965		102 (137)	1500	123—150 kPa (1.2—1.5 bar) (18—22 psi)
	16LW		RE503832	RE506966	102 (137)	1500	123—150 kPa (1.2—1.5 bar) (18—22 psi)
	16LW		RE506966		102 (137)	1500	123—150 kPa (1.2—1.5 bar) (18—22 psi)
4045HF150 (Tier 1)	1610		RE68826	RE505928	104 (140)	2400	99—121 kPa (1.0—1.2 bar) (14—18 psi)
	1610		RE505928		104 (140)	2400	99—121 kPa (1.0—1.2 bar) (14—18 psi)

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RG19661,0000001 -19-26SEP11-5/9

TURBO BOOST PRESSURES (JOHN DEERE OEM/OUTSIDE EQUIPMENT MANUFACTURERS)							
Engine Model (Emission Certification)	**Fuel System Option Code**	**Electronic Software Code**	**Injection Pump Part No.**	**Replace-ment Injection Pump**	**Rated Power at Full Load Rated Speed kW (hp)**	**Full Load Rated Speed rpm**	**Turbo Boost Pressure at Full Load Rated Speed kPa (bar) (psi)**
	162K, 167R	72EQ	RE515888		150 (200)	2600	112—137 kPa (1.1—1.4 bar) (16—20 psi)
6068TFM76 (Tier 2 Marine)	167S, 167T	72ER, 72ES	RE518165		98 (131)	1500	70—86 kPa (0.7—0.9 bar) (10—12 psi)
	167L, 167M	72ET, 72EU	RE518164		121 (162)	1800	135—165 kPa (1.3—1.7 bar) (20—24 psi)
6068SFM50 (Non-Certified Marine) (Sea-Water Aftercooled)	161E 162K	7238, 7247			224 (300)	2600	140—170 kPa (1.4—1.6 bar) (20—24 psi)
	161E 162K	7248, 7249			199 (267)	2500	130—160 kPa (1.3—1.6 bar) (19—23 psi)
	161E 162K	7250, 7251			176 (236)	2400	98—120 kPa (1.0—1.2 bar) (14—17 psi)
	161E 162K	7252, 7253			155 (208)	2300	82—100 kPa (0.8—1.0 bar) (12—15 psi)
	161E 162K	7254, 7255			136 (180)	2200	68—82 kPa (0.7—0.8 bar) (10—12 psi)
6068SFM75	16B5 16R6	72KF 72KG			298 (400)	2800	158—186 kPa (1.6—1.9 bar) (23—27 psi)
	16B5 16R6	72QH 72QJ			186 (250)	2400	70—86 kPa (0.7—0.9 bar) (10—12 psi)
	16B5 16R6	72QK 72QL			209 (280)	2500	88—108 kPa (0.9—1.1 bar) (13—16 psi)
	16B5 16R6	72QM 72QN			239 (320)	2600	112—137 kPa (1.1—1.4 bar) (16—20 psi)
	16B5 16R6	72QP 72QQ			265 (355)	2600	129—157 kPa (1.3—1.6 bar) (19—23 psi)
6068HF120 (Non—Certified)	16GT		RE503051		155 (208)	1500	129—157 kPa (1.3—1.6 bar) (19—23 psi)
	16LY		RE503834	RE503836	155 (208)	1500	129—157 kPa (1.3—1.6 bar) (19—23 psi)
			RE503836		155 (208)	1500	129—157 kPa (1.3—1.6 bar) (19—23 psi)
	16RL		RE506085		197 (264)	2100	150—184 kPa (1.5—1.8 bar) (22—27 psi)
	16SJ		RE506627		197 (264)	2100	150—184 kPa (1.5—1.8 bar) (22—27 psi)
	16TP		RE506883		183 (245)	1500	130—158 kPa (1.3—1.6 bar) (19—23 psi)
	16TQ		RE506884		183 (245)	1500	156—190 kPa (1.6—1.9 bar) (23—28 psi)
	16ZQ		RE509288		197 (264)	2100	150—184 kPa (1.5—1.8 bar) (22—27 psi)
	16ZR		RE509289		197 (264)	2100	150—184 kPa (1.5—1.8 bar) (22—27 psi)
6068HF150 (Tier 1)	1621		RE66575	RE505930	157 (210)	2400	108—132 kPa (1.1—1.3 bar) (16—19 psi)
	1621		RE505930		157 (210)	2400	108—132 kPa (1.1—1.3 bar) (16—19 psi)
	160D		RE69589	RE505962	157 (210)	2400	108—132 kPa (1.1—1.3 bar) (16—19 psi)
	160D		RE505962		157 (210)	2400	108—132 kPa (1.1—1.3 bar) (16—19 psi)
	16CY		RE501345		143 (192)	2200	94—116 kPa (0.9—1.2 bar) (14—17 psi)

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