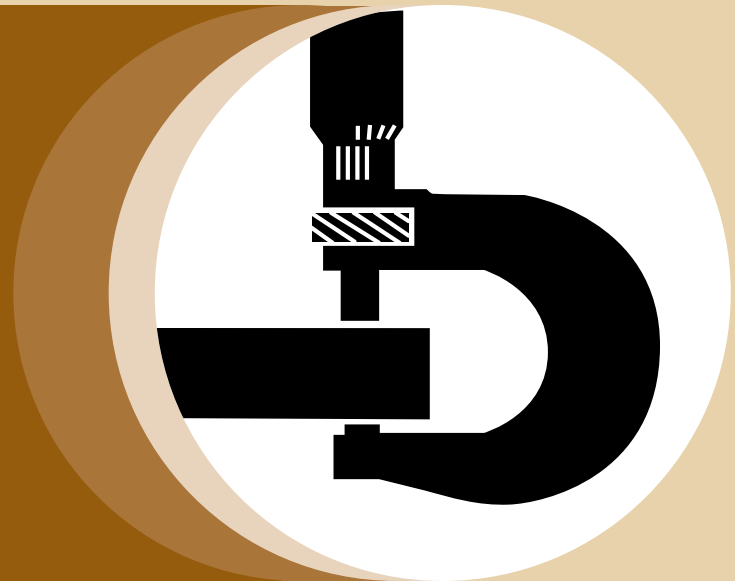


POWERTECH[®] 4.5L & 6.8L Diesel Engines

Base Engine

COMPONENT TECHNICAL MANUAL



For complete service information also see:

- POWERTECH*[®] 4.5 L and 6.8 L Diesel
Engines—Level 4 Electronic Fuel Systems
with Bosch VP44 Pump CTM170
- POWERTECH*[®] 4.5 L and 6.8 L Diesel
Engines—Mechanical Fuel Systems..... CTM207
- Alternators and Starting Motors CTM77
- OEM Engine Accessories..... CTM67 (English Only)

Deere Power Systems Group
CTM104 (19JUN00)

LITHO IN U.S.A.
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Handle Fluids Safely—Avoid Fires

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

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

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

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



Avoid Fires

TS227 -UN-23AUG88

DX,FLAME -19-29SEP98-1/1

Handle Starting Fluid Safely

Starting fluid is highly flammable.

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

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

Do not incinerate or puncture a starting fluid container.



Store Safely

TS1356 -UN-18MAR92

DX,FIRE3 -19-16APR92-1/1

Dispose of Waste Properly

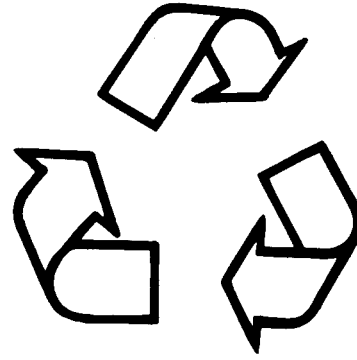
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



Recycle Waste

TSS1133 -UN-26NOV90

DX,DRAIN -19-03MAR93-1/1

Live With Safety

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



Safety Systems

TS231 -19-07OCT88

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

Engine Identification

01
001
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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)

Naturally Aspirated	Turbocharged	Turbocharged, Air-to-Air Aftercooled
	T06068TF250	
	T06068TFM50	

DPSG,OUO1004.2764 -19-18MAY00-6/6

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

Supplemental Coolant Additives (SCAs):

IMPORTANT: DO NOT over-inhibit antifreeze solutions, as this can cause silicate-dropout. When this happens, a gel-type deposit is created which retards heat transfer and coolant flow causing engine to overheat.

NOTE: John Deere Prediluted Antifreeze/Summer Coolant, and John Deere Antifreeze/Summer Coolant Concentrate contain supplemental coolant additives (SCAs). However, as the coolant solution loses its effectiveness, additives will need to be added.

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

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

Inhibit the antifreeze-coolant mix with a non-chromate inhibitor. John Deere Liquid Coolant Conditioner is recommended as a supplemental coolant additive in John Deere engines.



John Deere Liquid Coolant Conditioner

RG7276 -JUN-05DEC97

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Continued on next page

Engine Disassembly Sequence

The following sequence is suggested when complete disassembly for overhaul is required. Refer to the appropriate repair group for removal, inspection and repair of individual engine components.

1. Mount engine on a safety approved repair stand. (See MOUNT ENGINE ON REPAIR STAND in this group.)
2. Drain coolant and oil. Perform John Deere OILSCAN Plus® and COOLSCAN Plus™ analysis. (See OILSCAN Plus® and COOLSCAN Plus™ in Section 01, Group 002.)
3. Remove fan belts, fan, and belt tensioner. (See REMOVE AND INSTALL AUTOMATIC SPRING BELT TENSIONER in Group 070.)
4. Remove alternator. (See REMOVE AND INSTALL ALTERNATOR in Group 100.)
5. Remove turbocharger (if equipped). (See REMOVE TURBOCHARGER in Group 080.) Remove exhaust manifold. (See REMOVE, INSPECT AND INSTALL EXHAUST MANIFOLD in Group 080.)
6. Remove rocker arm cover and vent tube. If option code label is located on rocker arm cover, be careful not to damage label. (See REMOVE CYLINDER HEAD in Group 020.)
7. On applications where the water manifold is not an integral part of cylinder head, remove water manifold or thermostat housing. (See REMOVE AND INSTALL WATER MANIFOLD/THERMOSTAT COVER AND THERMOSTAT in Group 070.)
8. Remove oil cooler piping and water pump. (See REMOVE WATER PUMP in Group 070.)
9. Remove dipstick, oil filter, oil cooler, and adapter housing (if equipped). (See REMOVE, INSPECT AND INSTALL OIL COOLER in Group 060.)
10. Remove oil pressure regulating valve assembly. (See REMOVE AND INSTALL OIL PRESSURE REGULATING VALVE AND SEAT in Group 060.)
11. Remove fuel filter. See REMOVE AND INSTALL FINAL FUEL FILTER AND/OR PRIMARY FUEL FILTER/WATER SEPARATOR BASE in Section 02, Group 090 of CTM207 (Mechanical Fuel Systems) or CTM170 (Electronic Fuel Systems). Remove fuel supply pump. See REMOVE FUEL SUPPLY PUMP in Section 02, Group 090 of CTM207 (Mechanical Fuel Systems) or CTM170 (Electronic Fuel Systems). Remove fuel lines.
12. Remove injection lines and injection pump. Remove injection nozzles. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of CTM207 (Mechanical Fuel Systems) or CTM170 (Electronic Fuel Systems).
13. Remove starter motor. (See REMOVE AND INSTALL STARTER in Group 100.)
14. Remove rocker arm assembly and push rods. Keep rods in order. (See REMOVE CYLINDER HEAD in Group 020.) Check for bent push rods and condition of wear pad contact surfaces on rockers.
15. Remove cylinder head. (See REMOVE CYLINDER HEAD in Group 020.) Check piston protrusion. (See MEASURE PISTON PROTRUSION in Group 030.)
16. Remove camshaft followers. Keep followers in order. (See INSPECT CAMSHAFT FOLLOWERS in Group 050.)
17. Remove flywheel. (See REMOVE FLYWHEEL in Group 040.) Remove flywheel housing. (See REMOVE FLYWHEEL HOUSING in Group 040.)
18. Remove oil pan.

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COOLSCAN is a trademark of Deere & Company.

Continued on next page

RG,04,JW7725 -19-19NOV99-1/2

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.

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.

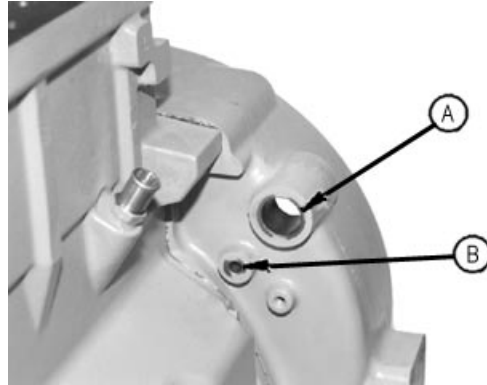
2. Remove plastic plugs or cover plate from engine timing/rotation hole (A) and timing pin hole (B).

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

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

If No.1 cylinder rocker arms are loose, the engine is at No. 1 TDC compression.

If No. 1 cylinder rocker arms are not loose, rotate engine one full revolution (360°) to No. 1 TDC compression.



Flywheel Housing Timing Holes

A—Timing/Rotation Hole
B—Timing Pin Hole

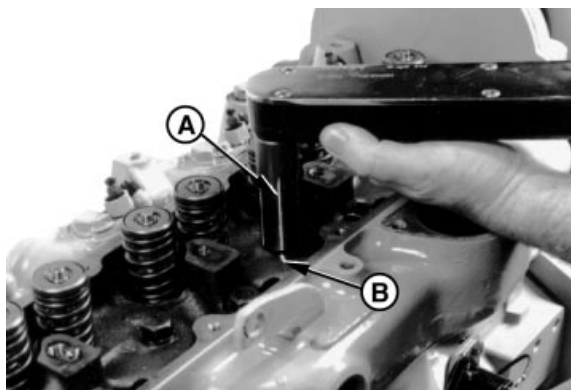
RG7408 -UN-06AUG96

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15. If a cylinder head gasket failure has occurred, check and record torque on each cylinder head cap screw before removing.

To check cylinder head cap screw torque:

- a. Make a reference mark (in-line) on socket (A) and cylinder head surface (B).
- b. Loosen cap screw at least 1/2 turn.
- c. Retighten cap screw (using a torque wrench) until reference marks align and record torque.



RG6310 -UN-03NOV97

Cylinder Head Cap Screws

A—Mark on Socket
B—Mark on Head Surface

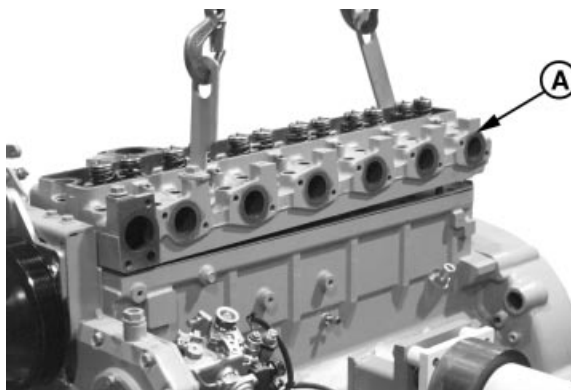
16. Remove all cylinder head cap screws.

RG,05,DT7373 -19-11NOV97-10/12

IMPORTANT: DO NOT use screwdrivers or pry bars between cylinder block and head to loosen head gasket seal. Screwdrivers or pry bars can damage cylinder head and block gasket surfaces.

17. Lift cylinder head (A) from block. If cylinder head sticks, use a soft hammer to tap cylinder head.

A—Cylinder Head



RG7415A -UN-03NOV97

Cylinder Head

Continued on next page

RG,05,DT7373 -19-11NOV97-11/12

Inspect Valve Rotators

Valve rotators cannot be repaired. Replace valve rotators when valves are replaced or reground.

Ensure that valve rotators turn freely in both directions. Replace if defective.



Valve Rotator

RG7428 -UN-23NOV97

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RG,05,DT7364 -19-11NOV97-1/1

Clean Valves

1. Hold each valve firmly against a soft wire wheel on a bench grinder.

IMPORTANT: Any carbon left on the stem will affect alignment in valve refacer. **DO NOT** use a wire wheel on plated portion of valve stem. Polish the valve stem with steel wool or crocus cloth to remove any scratch marks left by the wire brush.

2. Make sure all carbon is removed from valve head, face and unplated portion of stem.

RG,05,DT7363 -19-11NOV97-1/1

Grind Valve Seats

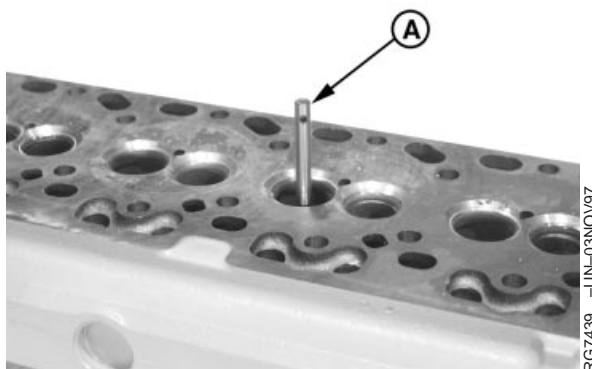
IMPORTANT: Valve seat grinding should only be done by experienced personnel familiar with equipment and capable of maintaining required specifications. **ALWAYS** keep valve guides and work area clean when grinding valve seats to maintain valve guide bore-to-seat runout.

Grinding valve seats increases seat width and valve recess in cylinder head. **DO NOT** grind excessively. Only a few seconds are required to recondition the average valve seat. Dress grinding stone as necessary to maintain specified seat angle.

Support the weight of grinder to avoid excessive pressure on the stone.

Blend or radius all sharp edges after grinding valve seats for a more effective valve face-to-seat seal.

1. Install appropriate pilot (A) in valve guide bore.



Valve Seat Grinding Pilot

A—Pilot

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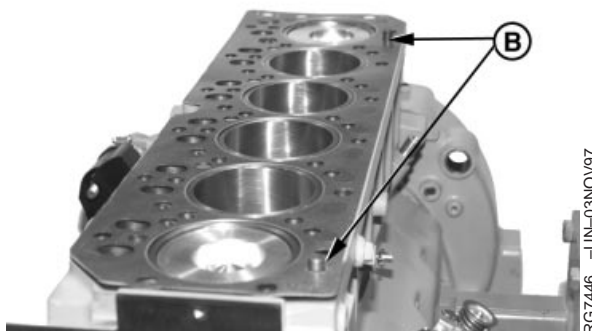
RG.05,DT7353 -19-11NOV97-1/4

IMPORTANT: The O-ring seals in head gasket can be damaged if head is repositioned while resting on engine block. Use guide studs to position cylinder head on block.

2. Install two guide studs (B) in cylinder block at locating holes.

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.

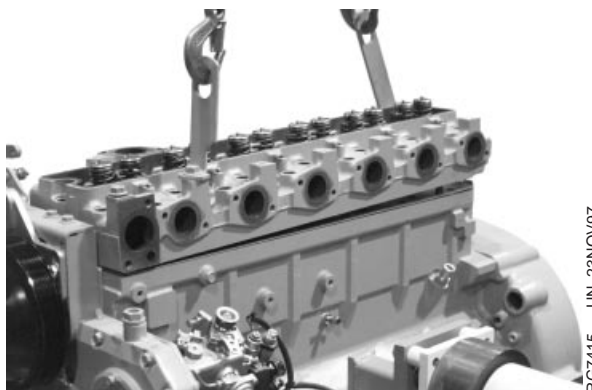


Cylinder Head Guide Studs

B—Guide Studs

RG,05,DT7344 -19-26APR00-2/4

4. Position cylinder head over guide studs and lower onto cylinder block.



Cylinder Head to Block Installation

Continued on next page

RG,05,DT7344 -19-26APR00-3/4

Group 030 Cylinder Block, Liners, Pistons and Rods

Connecting Rods—General Information

Earlier engines have the traditional tongue-and-groove between the connecting rod and cap (A). Later engines have the PRECISION JOINT™ rod and cap (B).

PRECISION JOINT™ rods and caps were introduced as follows:

Dubuque Built

4.5 L Engines	(793938—)
6.8 L Engines	(794055—)

Saran Built

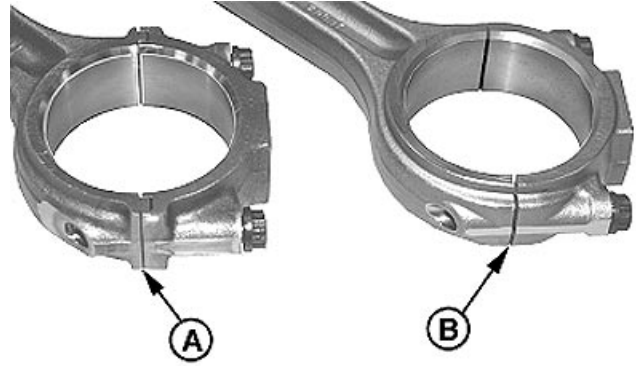
RE500002 Rod	(554036—)
RE500608 Rod	(553937—)

Torreon Built

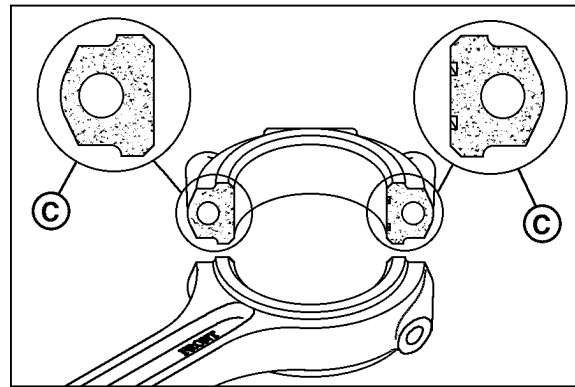
RE500002 Rod	(039708—)
RE500608 Rod	(036628—)

To create the PRECISION JOINT™, the connecting rod is notched with a laser beam. Then a precision mandrel in the rod bore is powered to separate the cap from the rod at the joints (C).

Both types of rods provide a strong joint and torque on cap screws is the same. Removal and installation is similar, with differences noted. See INSPECT ROD AND CAP and INSTALL PISTON AND CONNECTING ROD ASSEMBLY later in this group.



Connecting Rod (Machined)



Connecting Rod (Non-Machined)

- A—Tongue-and-Groove Rod (Early Engines)
- B—PRECISION JOINT™ Rod (Later Engines)
- C—PRECISION JOINT™ Details

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RG9447 -UN-27JUL98

RG9556 -UN-02JUL98

PRECISION JOINT is a trademark of Deere & Company

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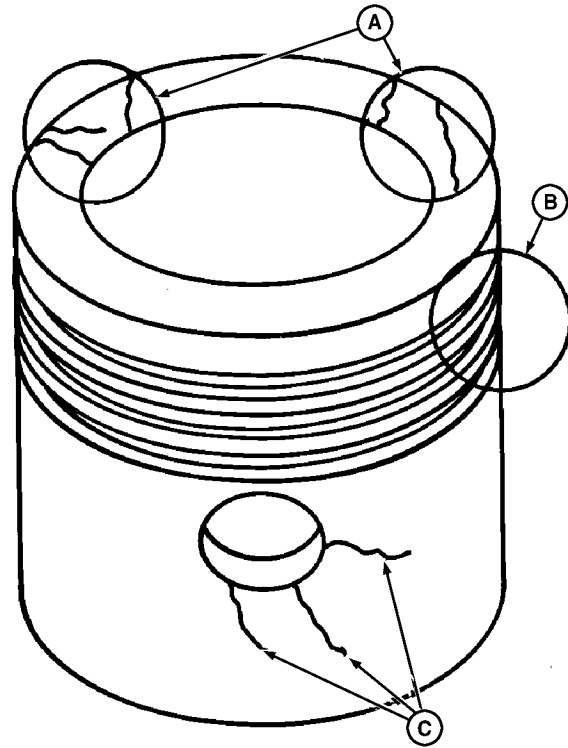
Visually Inspect Pistons

Carefully inspect pistons under magnification. Check for:

- signs of fatigue
- fine cracks in the piston head (A)
- bent or broken ring lands (B)
- cracks in the skirt (C) at inner and outer ends of piston pin bore
- excessive piston skirt wear (original machining marks must be visible)

If any imperfections are found, replace the piston and liner as a set.

A—Piston Head
B—Ring Lands
C—Piston Pin Bore



Piston (Defects Exaggerated)

RG3326
RG3326 -UN-04DEC97

RG,10,DT7416 -19-12NOV97-1/1

Inspect and Measure Connecting Rod Bearings (Rod and Crankshaft in Engine)

IMPORTANT: Use hand wrenches. Pneumatic wrenches may cause thread damage.

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

1. Remove rod cap. Place a piece of PLASTIGAGE® in center of bearing. Install rod cap using OLD cap screws. Tighten cap screws to 58 N•m (43 lb-ft). Tighten cap screw an additional 90—100°. (See TORQUE-TURN CONNECTING ROD CAP SCREWS later in this group.)
2. Remove rod cap. Compare width of PLASTIGAGE® with scale provided on package to determine clearance. Replace bearings if oil clearance is out of specification.



Measure Rod Oil Clearance

RG7459 -UN-23NOV97

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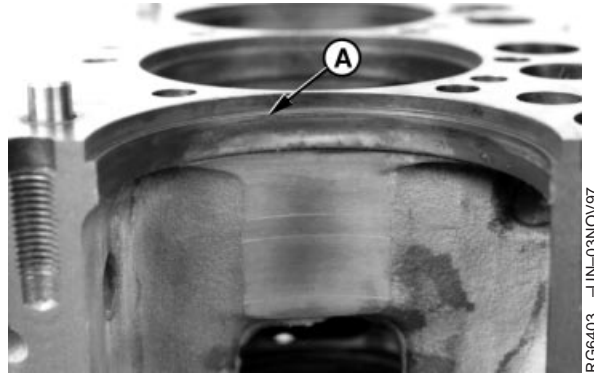
PLASTIGAGE is a registered trademark of the DANA Corp.

DPSG,OUO1004,52 -19-16APR98-1/1

IMPORTANT: DO NOT file liner support flange excessively. Excess filing can damage liner support flange and allow an improper liner fit. Thoroughly clean all filings from cylinder block.

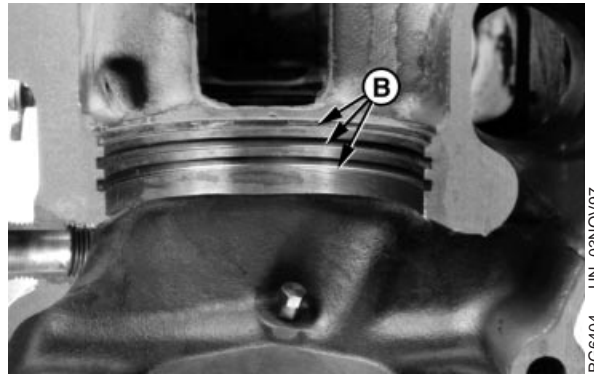
4. Inspect liner support flange (A) for burrs. If burrs are present, use a small half-moon file and LIGHTLY file (in a circular motion) burr off at a 60° angle. DO NOT let file hit top of cylinder block while filing.
5. Carefully inspect block for cracks or damage. If a cracked block is suspected, pressure-test the block. A procedure for pressure testing is outlined in FOS (Fundamentals of Service) Manual—ENGINES. Check for erosion or cracks in the liner O-ring/packing area (B). Replace cracked or damaged blocks.
6. If cylinder block is serviceable, clean out all threaded holes for cylinder head mounting cap screws in top deck of cylinder block, using JDG680 Tap (C) or an equivalent 1/2-13 UNC-2A x 76 mm (3.0 in.) long tap. Remove debris or fluid from tapped holes with compressed air.
7. After service of cylinder block, reinstall piston cooling orifices. (See REMOVE, INSPECT AND INSTALL PISTON COOLING ORIFICES later in this group.)

A—Liner Support Flange
B—O-Ring/Packing Area
C—JDG680 Tap



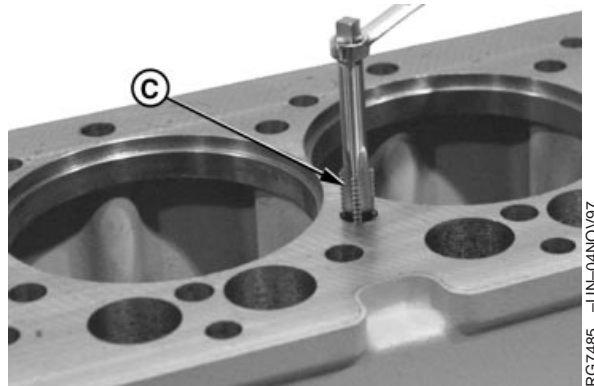
Liner Support Flange

RG6403 -UN-03NOV97



Liner O-Ring/Packing Area

RG6404 -UN-03NOV97



Cleaning Threaded Holes in Cylinder Block

RG7485 -UN-04NOV97

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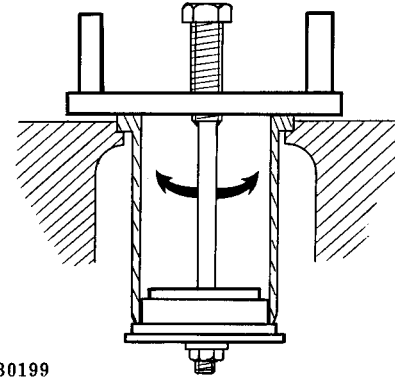
RG,10,DT7402 -19-29NOV99-2/3

- If liner height is above specification, check cylinder block for burrs on liner support flange or incorrect counterbore depth. If burrs are present, apply lapping compound to liner flange shoulder in the block, then install liner and turn to left and right using KCD10001 or JDG1145 Cylinder Liner Puller to rub off enough material to seat liner as necessary.

IMPORTANT: ONE LINER SHIM ONLY may be installed under each liner flange. If liner requires more than one shim, install a new liner or cylinder block.

- If liner height is no more than 0.08 mm (0.003 in.) below top deck of block, install one liner shim under liner flange.

NOTE: Two shim sizes are available; 0.05 mm (0.002 in.) CD15466 liner shim and 0.10 mm (0.004 in.) R65833 liner shim.



CD30199

KCD10001 Shown

CD30199 -UN-07MAR95

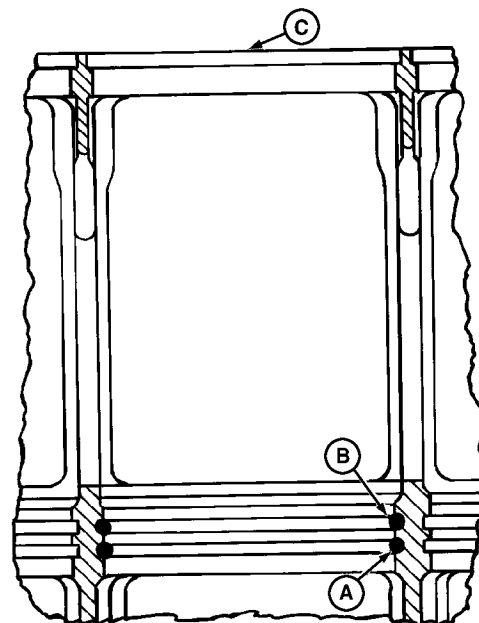
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RG,10,DT7392 -19-11NOV99-2/2

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.

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



RG3826

Cylinder Liner Packing and Block O-Rings

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

RG3826 -UN-04DEC97

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

Torque-Turn Connecting Rod Cap Screws

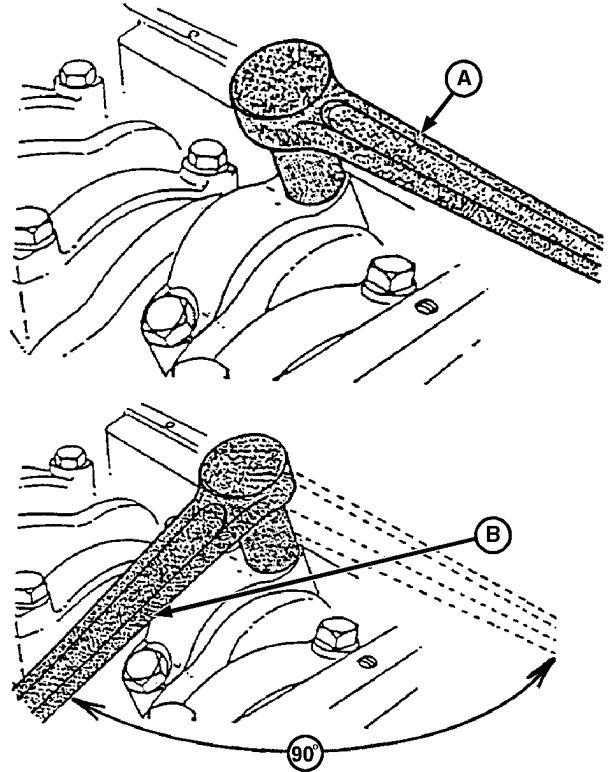
Using Engine Axis Method to Torque-Turn Connecting Rod Cap Screws

1. After tightening cap screws to initial torque values, mark connecting rod cap and socket.
2. Position handle of wrench parallel to centerline of engine crankshaft axis (A).
3. Tighten 1/4 turn (90—100°) clockwise until handle of wrench is perpendicular to centerline of engine crankshaft axis (B) as shown.

Specification

Connecting Rod Cap Screws..... 1/4 Turn (90—100°)
Torque-Turn After Initial Torque

A—Parallel to Centerline Crankshaft
B—Perpendicular to Centerline Crankshaft



Torque-Turn Rod Caps

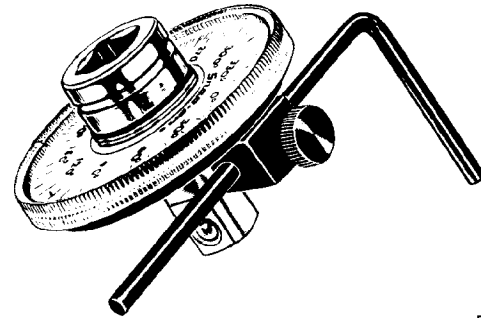
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RG9102 -UN-27MAR98

Using JT05993 Torque Angle Gauge to Torque-Turn Connecting Rod Cap Screws

After tightening cap screws to initial torque values provided earlier, follow directions provided with JT05993 Gauge and torque-turn each cap screw 90°—100°.



Torque Angle Gauge

RG5698

RG5698 -UN-05DEC97

RG,10,DT7386 -19-11NOV97-2/2

Remove Crankshaft Wear Sleeve

1. Rotate crankshaft using JDG820 or JDE83 Flywheel Turning Tool and lock flywheel with JDE81-4 Timing Pin.
2. Back out forcing screw and position collet from JDG992-1 Front Wear Sleeve Puller onto crankshaft flange until threaded ID contacts wear sleeve.

NOTE: You may want to apply inward pressure on collet as it is threaded onto wear sleeve.

3. Thread collet onto wear sleeve and tighten securely. Use a long breaker bar and tighten collet until wear sleeve spins on crank flange.
4. Lubricate threads of forcing screw. Tighten forcing screw until flange on wear sleeve is at least 3.2 mm (0.13 in.) from crankshaft gear.
5. Loosen forcing screw and remove threaded collet from wear sleeve.



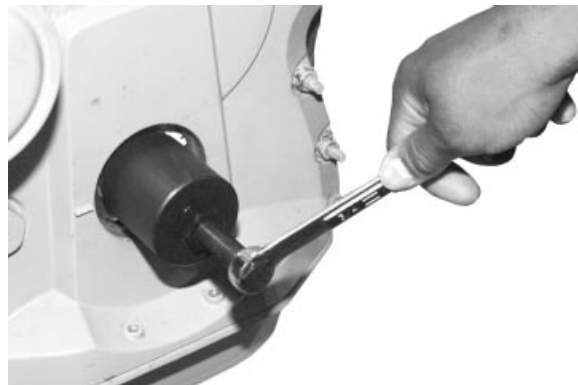
Crankshaft Wear Sleeve Removal Tool

RG8082 -UN-23NOV97



Crankshaft Wear Sleeve Removal Tool

RG8093 -UN-23NOV97



Crankshaft Wear Sleeve Removal Tool

RG8094 -UN-23NOV97

Continued on next page

RG,15,DT7455 -19-15NOV99-4/10

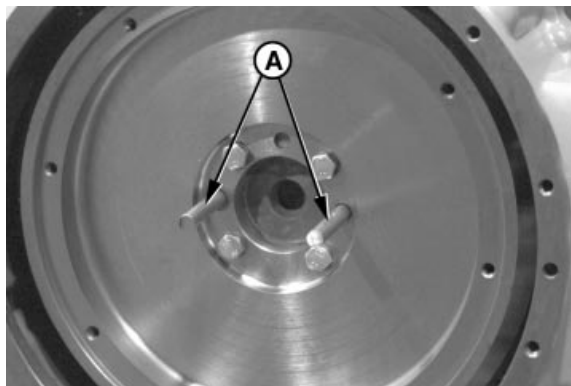
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Install Flywheel

CAUTION: Flywheel is heavy. Plan a proper handling procedure to avoid injuries.

IMPORTANT: Flywheel **MUST BE** clean and free of any oil, grease or debris.

NOTE: Engines with flywheel option code 1557 have threaded studs (B) in flywheel. If studs were removed, apply **LOCTITE® 271 Thread Lock and Sealer** to threads and install studs into flywheel to end of threads.



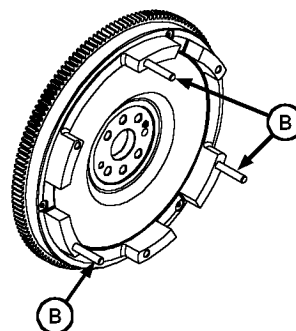
Flywheel and Guide Studs

RG7518A -UN-06NOV97

1. Install two guide studs (A) in crankshaft cap screw threaded holes. Place flywheel on studs and slide into position against crankshaft.

IMPORTANT: **ALWAYS** install new flywheel cap screws when flywheel has been removed.

2. Apply **LOCTITE® 242 Thread Lock and Sealer** to cap screws and start cap screws in crankshaft. Do not tighten until guide studs are removed and all cap screws are started. Tighten cap screws to specifications.



Flywheel (Option 1557)

RG10542 -UN-19NOV99

A—Guide Studs
B—Threaded Studs

Specification

Flywheel Mounting Cap Screws..... 138 N•m (102 lb-ft)
Torque

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RG,15,DT7449 -19-16NOV99-1/1

Remove and Install Crankshaft Timing Wheel (Engines with VP44 Fuel Injection Pump)

Remove Timing Wheel

1. Lock engine at No. 1 TDC.
2. Remove timing gear cover. (See REMOVE TIMING GEAR COVER in Group 050.)
3. Clean crankshaft nose.
4. Remove timing wheel (A) using standard puller as shown.

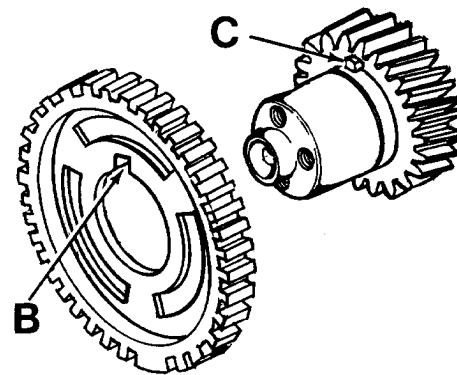


Remove Timing Wheel

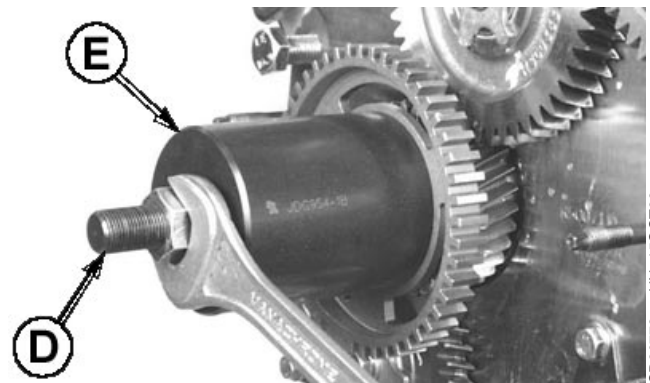
Install Timing Wheel

NOTE: Ensure that the word "FRONT" (stamped on the face of the timing wheel) is facing out from the engine.

1. Slide timing wheel onto crankshaft nose with recess side toward timing gear cover. Be sure keyway (B) in timing wheel is properly aligned with Woodruff key (C).
2. Install JDG954A-2 Adapter (D) on nose of crankshaft. Tighten screws securely.
3. Install JDG954A-1 Installer (E) over adapter.
4. Tighten nut until timing wheel firmly seats against gear face.
5. Remove adapter and installer and install timing gear cover. (See INSTALL TIMING GEAR COVER in Group 050.)



Timing Wheel and Crankshaft Gear



Install Timing Wheel

- A—Timing Wheel
- B—Keyway
- C—Woodruff Key
- D—JDG954A-2 Adapter
- E—JDG954A-1 Installer

DPSG,OUO1004,1126 -19-26OCT99-1/1

5. When finished grinding, inspect the crankshaft by the fluorescent magnetic particle method, or other similar method to determine if cracks have originated due to the grinding operation.
6. De-magnetize the crankshaft after inspection.
7. Thoroughly clean the crankshaft and oil passages with solvent. Dry with compressed air.

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RG,15,DT7437 -19-20DEC99-2/2

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 um (8 AA)	
Thrust Surface Finish (AA)	Lap 0.40 um (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

Complete Final Assembly

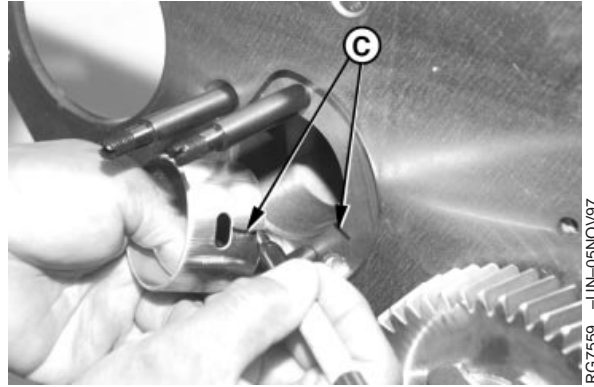
Use new gaskets and O-rings during final engine assembly. Clean all engine components as necessary prior to assembly.

1. Install oil bypass valve assembly in front face of block. (See REMOVE, INSPECT AND INSTALL OIL BYPASS VALVE in Group 060)
2. Install front plate. (See INSTALL CYLINDER BLOCK FRONT PLATE in Group 050.)
3. Install balancer shafts (if equipped). (See INSTALL AND TIME BALANCER SHAFTS in Group 050.)
4. Install timing gear train and camshaft. (See INSTALL CAMSHAFT in Group 050.)
5. Install oil pump assembly. (See INSTALL ENGINE OIL PUMP in Group 060.)
6. Install timing gear cover gasket and timing gear cover. (See INSTALL TIMING GEAR COVER in Group 050.)
7. Install oil pressure regulating valve assembly. (See REMOVE AND INSTALL OIL PRESSURE REGULATING VALVE AND SEAT in Group 060.)
8. Install front oil seal. (See REPLACE FRONT CRANKSHAFT OIL SEAL AND WEAR SLEEVE in this group.)
9. Install oil pan. (See INSTALL OIL PAN in Group 060.)
10. Install crankshaft pulley, or vibration damper. (See INSTALL PULLEY OR VIBRATION DAMPER AND PULLEY in this group.)
11. Install push rods, and rocker arm assembly. (See INSTALL ROCKER ARM ASSEMBLY in Group 020.)
12. Install fuel supply pump. See Section 02, Group 090 of CTM207 (Mechanical Fuel Systems) or CTM170 (Electronic Fuel Systems).
13. Install injection pump. See Section 02, Group 090 of CTM207 (Mechanical Fuel Systems) or CTM170 (Electronic Fuel Systems).
14. Install starter motor. (See REMOVE AND INSTALL STARTER in Group 100.)
15. Adjust valve clearance. (See CHECK AND ADJUST VALVE CLEARANCE in Group 020.)
16. Install and adjust poly-vee belts. (See Group 070.)
17. Fill engine with clean oil and proper coolant. (See Section 01, Group 002)
18. Perform engine break-in. (See PERFORM ENGINE BREAK-IN in Group 010.)

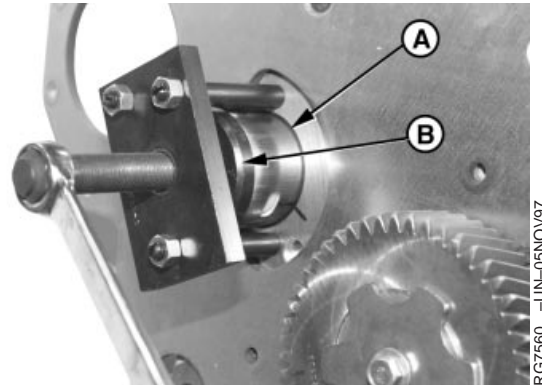
Install Camshaft Bushing

IMPORTANT: Bushings must be installed so oil supply hole in bushing aligns with oil drilling in block bore.

1. Mark orientation of oil supply hole (C) on front face of block and on bushing to help with bushing alignment during installation.
2. Apply TY6333 High-Temperature Grease to ID and OD of new bushing (A), and to ID of bushing bore. Slide bushing onto JDG739-5B Bushing Installer (B) so notched end of bushing will be toward front end of engine when installed.
3. Thread JDG739-4 Bushing Installer Screw into JDG739-3 Removing/Installing Plate. With bushing started, square in bore and oil hole aligned, tighten forcing screw until flange of bushing driver bottoms against face of block.
4. Remove bushing tool from cylinder block and check oil supply hole for correct alignment. If holes are not aligned, remove and discard bushing. Install a new bushing.



Camshaft Bushing Oil Hole Alignment

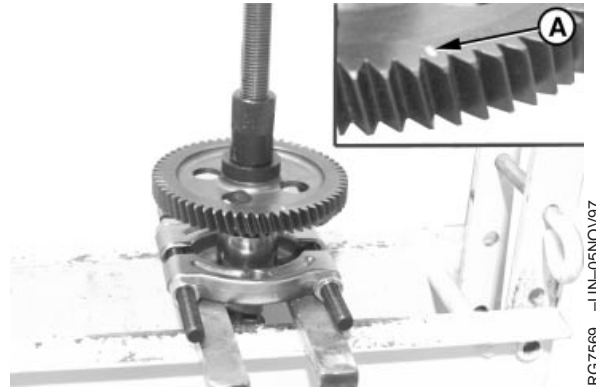


Camshaft Bushing Installation Tool

- A—Bushing
- B—JDG739-5B Bushing Installer
- C—Oil Supply Hole

RG,16,DT7505 -19-14NOV97-4/4

4. Support camshaft under first bearing journal in a hydraulic press.
5. Heat gear to 66—93°C (140—160°F) before pressing onto shaft to prevent metal transfer.
6. Apply LOCTITE® 680 (TY15969) Maximum Strength Retaining Compound to camshaft nose.
7. Install Woodruff key in camshaft nose.
8. Install gear with timing mark (A) away from camshaft (towards front timing gear cover). Press gear onto camshaft with a tubular driver until gear bottoms against camshaft shoulder.



Camshaft Gear to Camshaft Alignment

A—Timing mark

RG7569 -UN-05NOV97

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RG,16,DT7495 -19-14NOV97-2/2

Inspect Camshaft Followers

NOTE: Cylinder head must be removed before camshaft followers can be removed from engine. (See REMOVE CYLINDER HEAD in Group 020.)

1. Inspect followers for uneven wear or damage. Also inspect corresponding camshaft lobe for wear or damage. Replace as necessary.
2. Measure follower OD and follower bore ID in cylinder block.



Camshaft Follower

RG6324 -UN-23NOV97

Specification

Camshaft Follower OD	31.61—31.64 mm (1.245—1.246 in.)
Camshaft Follower Bore in Block.....	31.70—31.75 mm (1.248—1.250 in.)
Camshaft Follower-to-Bore.....	0.06—0.13 mm (0.002—0.005 in.)
Clearance	

Replace camshaft followers that are not within specification.

Replace cylinder block if any one camshaft follower bore is not within specification.

RG,16,DT7494 -19-14NOV97-1/1

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Remove Idler Gear Bushings

NOTE: Bushing for "wide" 30 mm (1.18 in.) upper idler gear is not replaceable. If bushing is worn, replace gear assembly.

1. For "narrow" 22 mm (0.87 in.) upper idler gear bushing, press worn bushing out of gear using 27527 Disc Driver from D01045AA Master Driver Set and JDG537 (OTC815) Handle.
2. For lower idler gear bushing, press worn bushing out of gear using discs from D01045AA Master Driver Set and JGD537 (OTC815) Handle.



22 mm (0.87 in.) Upper Idler Gear



Lower Idler Gear

RG,16,DT7483 -19-14NOV97-1/1

- 12. Tighten oil pump drive gear retaining nut to specifications. Stake nut to shaft in three places (B). (See INSTALL ENGINE OIL PUMP in Group 060 for oil pump installation.)

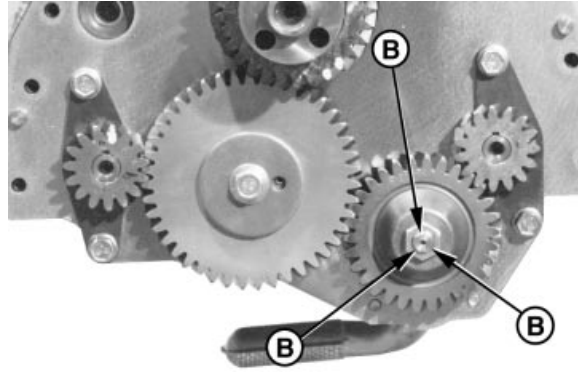
Specification

Oil Pump Drive Gear Staked Nut..... 50 N•m (37 lb-ft)
Torque

- 13. Tighten lubricated lower idler gear cap screws to specifications.

Specification

Lower Idler Gear Cap Screw..... 70 N•m (53 lb-ft)
(Lubricated Threads) Torque



Early Model Shown

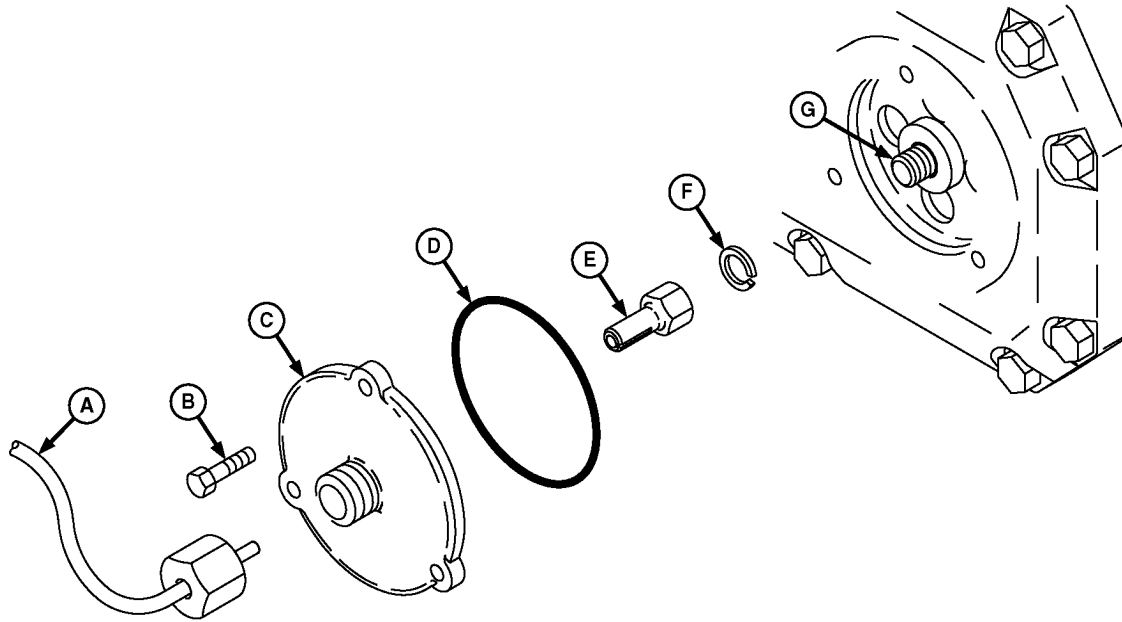
B—Stake Points

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RG,16,DT7475 -19-14NOV97-7/7

Replace Mechanical Tachometer Adapter



Mechanical Tachometer

A—Tachometer Cable
B—Cap Screws

C—Cover
D—O-Ring

E—Adapter
F—Lock Washer

G—Injection Pump Shaft

1. Disconnect cable (A) and remove cover (C) and O-ring (D).
2. Remove adapter (E) and lock washer from end of injection pump shaft (G). Be careful not to let adapter or washer fall inside timing cover.
3. Replace parts as required.
4. Install adapter (E) and lock washer on injection pump shaft. Tighten adapter to specifications.

Specification

Mechanical Tachometer 122 N•m (90 lb-ft)
Adapter (Stanadyne DB2)
Torque

Mechanical Tachometer 203 N•m (150 lb-ft)
Adapter (Stanadyne DB4)
Torque
Mechanical Tachometer 81 N•m (60 lb-ft)
Adapter (Lucas) Torque

5. Install new O-ring and cover. Tighten cap screws (B) to specifications.

Specification

Mechanical Tachometer Cover..... 6 N•m (4.5 lb-ft) (54 lb-in.)
Plate Torque

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RG9113 -JUN-01APR98

DPSG,OUO1004,42 -19-09APR98-1/1

Remove, Inspect, and Install Oil Bypass Valve

1. Remove timing gear cover and front plate. (See REMOVE TIMING GEAR COVER in Group 050.) (See REMOVE CYLINDER BLOCK FRONT PLATE in Group 050.)
2. Remove oil bypass valve and spring.
3. Inspect valve and spring for damage. Replace parts if necessary.
4. Check bypass valve spring free length and compression strength using D01168AA Spring Compression Tester. Replace parts if not within specification.



Oil Bypass Valve and Spring

RG7571 -UN-23NOV97

Specification

Oil Bypass Valve Springs Free Length 51 mm (2.00 in.)
 Spring Load at 29 mm (1.14 in.) 87.8 N (20 lb-force)
 Compressed Length

5. Install oil bypass valve and spring in cylinder block.
6. Install front plate and timing gear cover. (See INSTALL TIMING GEAR COVER in Group 050.) (See INSTALL CYLINDER BLOCK FRONT PLATE in Group 050.)

RG,20,DT7530 -19-17NOV97-1/1

Remove and Install Oil Pressure Regulating Valve and Seat

1. Remove oil pressure regulating valve plug from timing gear cover.



Oil Pressure Regulating Valve Plug

RG7554 -UN-23NOV97

Continued on next page

RG,20,DT7529 -19-10NOV99-1/5

5. Measure idler shaft OD and idler gear ID

Specification

Oil Pump Idler Shaft OD	12.316—12.332 mm (0.4849—0.4855 in.)
Oil Pump Idler Gear ID	12.355—12.363 mm (0.4864—0.4867 in.)



Measure Idler Shaft OD for Wear

RG7607 -UN-23NOV97



Measure Idler Gear ID for Wear

RG7608 -UN-23NOV97

RG,20,DT7523 -19-17NOV97-4/4

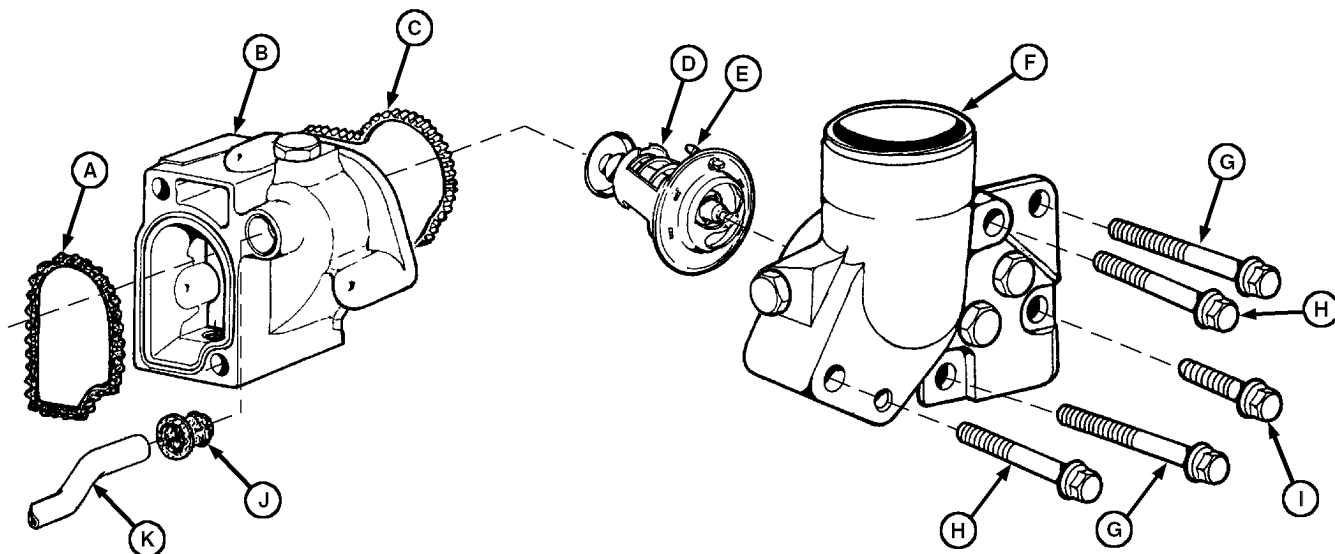
Complete Oil Pump Disassembly

1. Remove O-ring from pump housing and cylinder block (for outlet tube).
2. Remove O-ring from oil pick-up tube.
3. Clean oil pump parts in solvent. Dry with compressed air.
4. Inspect pick-up tube. Check flange-to-pick-up tube weld for cracks. If cracks or other defects are found, replace pick-up tube. (See REMOVE, INSPECT AND INSTALL OIL PUMP PICK-UP TUBE ASSEMBLY, earlier in this group.)



RG7609 -UN-23NOV97

RG,20,DT7522 -19-17NOV97-1/1



Water Manifold and Thermostat (6010 Series Tractors)

- | | | | |
|------------------|--|---|--|
| A—Seal | F—Thermostat Cover | I—Cap Screw (M10 x 25)
Thermostat Cover-to-Water
Manifold | J—Seal |
| B—Water Manifold | G—Cap Screw (M10 x 90)
Thermostat Cover-to-Water
Manifold-to-Cylinder Head | | K—Water Manifold-to-Water
Pump Tube |
| C—Seal | H—Cap Screw (M10 x 70)
Thermostat Cover-to-Water
Manifold | | |
| D—Thermostat | | | |
| E—Jiggle Pin | | | |

2. Remove water manifold-to-water pump tube (K) and seal (J).
3. Visually inspect area around water manifold/thermostat cover for leaks.
4. Remove cap screws (G) and remove water manifold/thermostat cover assembly with gasket.
5. Remove thermostat cover (F) and thermostat (D).
6. Remove and discard all gasket material. Clean gasket surfaces.
7. Clean and inspect cover for cracks or damage.

NOTE: Thermostat must be installed with jiggle pin (E) facing up in the 12 o'clock position.

8. Install thermostat (D), cover (F) and seal (C) on water manifold. Hand tighten cover cap screws (H) and (I).

9. Install water manifold/thermostat cover assembly on engine using cap screws (G). Tighten all cap screws to specifications.

Specification

Thermostat Cover-to-Water	30 N•m (22 lb-ft)
Manifold Cap Screws (H and I) (6010 Series Tractors with Single Thermostat) Torque	
Water Manifold-to-Cylinder	35 N•m (26 lb-ft)
Head Cap Screws (G) (6010 Series Tractors with Single Thermostat) Torque	

10. Install new seal (J) and tube (K). Tighten tube clamps securely.
11. Fill cooling system and check for leaks.

- Using a new O-ring, install water pump inlet elbow (C), if removed. Tighten cap screws to specifications.

Specification

Water Pump Inlet Elbow Cap..... 35 N•m (26 lb-ft)
Screws Torque

- Install poly-vee belt. Be sure that belt is correctly seated in all pulley grooves.

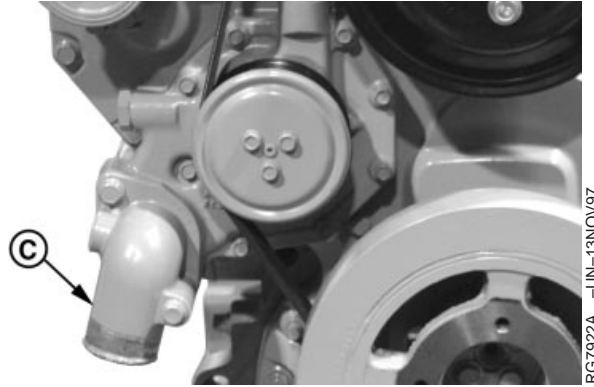
- Install fan and tighten cap screws with lock washers to the following specification:

Specification

Fan-to-Pulley Hub M8 Cap..... 35 N•m (26 lb-ft)
Screws Torque
Fan-to-Pulley Hub M10 Cap 70 N•m (52 lb-ft)
Screws Torque

- Fill cooling system with proper coolant. (See Section 01, Group 002.)

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



Water Pump Inlet Elbow

C—Inlet Elbow

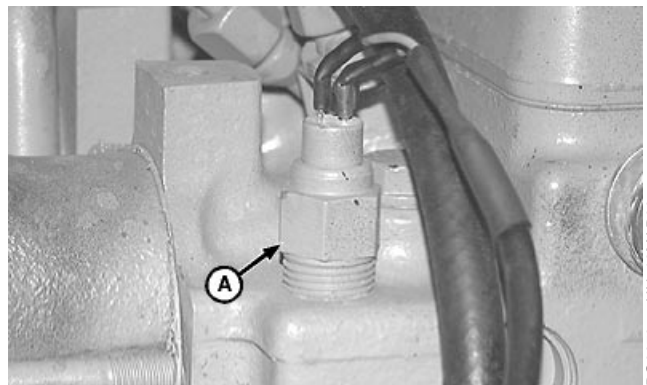
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RG,25,JW7553 -19-20NOV97-2/2

Cooling System Deaeration

Deaeration is normally accomplished by the jiggle pin in the thermostat flange. However, a pocket of air can stay on the top rear of the engine. When refilling the cooling system, loosen the coolant temperature sensor (A) or plug at the rear of the cylinder head to allow air to escape.

A—Coolant Temperature Sensor



Cooling System Deaeration

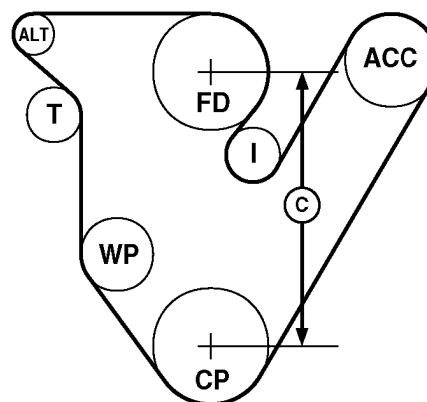
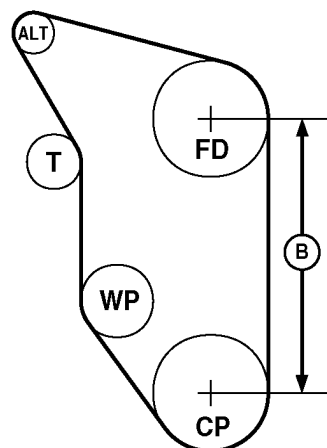
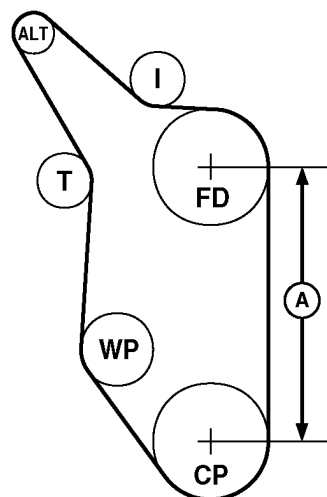
RG9076 -UN-12MAR98

DPSG,OUO1004,19 -19-03APR98-1/1

2. **For engines using poly-rib-belts:** If reference marks were not made on timing gear cover during removal of fan drive assembly, use figure to the right and following table to determine proper fan height.

POLY-RIB BELT		
4.5 L Fan Belt Option	Fan Height	6.8 L Fan Belt Option
210 mm (8.27 in.) W/Idler Pulley (A)		
24AG, 24AH, 24AJ, 24AK, 24AL, 24AM		24AJ, 24AN
226 mm (8.9 in.) W/Idler Pulley (A)		
2406, 2408, 2415, 2435, 2436, 2461, 240P, 240Q		2401, 2402, 2403, 2405, 2407, 2412, 2471, 2472, 2473, 2474, 240T, 240W
258 mm (10.16 in.) W/Idler Pulley (A)		
24AR, 24AT		
290 mm (11.42 in.) W/Idler Pulley (A)		
2404, 2407, 2409, 2410, 2411, 2412, 2437, 2439, 2440, 2460, 2462, 240U		2409, 2411, 2413, 2414, 2415, 2435, 2438, 2475, 2476, 240R, 240S, 240V
338 mm (13.31 in.) (B)		
2416, 2417, 2419, 2420, 2421, 2423, 2424, 2442, 2443, 2463, 2466, 2468		2416, 2418, 2420, 2421, 2422, 2423, 2424, 2441, 2477, 2478, 2479, 2482
402 mm (15.83 in.) (B)		
2426, 2428, 2430, 2431, 2432, 2444, 2445, 2464, 2465, 2469, 2470		2417, 2419, 2425, 2427, 2429, 2480
402 mm (15.83 in.) W/Idler Pulley (C)		
2434, 2446		2433

- A—Fan Height Distance
- B—Fan Height Distance
- C—Fan Height Distance
- ALT—Alternator
- CP—Crank Pulley
- ACC—Air Conditioning Compressor
- FD—Fan Drive
- I—Idler
- T—Tensioner
- WP—Water Pump



Fan Height (Poly-Rib Belt)

RG9128 -UN-01JUL98

Air Intake and Exhaust System

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TURBINE HOUSING OUTLET DEFECTS

Turbine Wheel Rub	Bearing failure. Manufacturing defect.	Determine if engine and/or operator contributed to lack of lubrication, contaminated lubrication, excessive temperature, or debris generating engine failure in progress. Correct as required. Correct as required (this group).
Foreign Object Damage	Internal engine failure. Objects left in intake system. Leaking air intake system.	Inspect and repair engine as required. Disassemble and inspect air intake system (this group). Correct as required (this group).
Oil and/or Excessive Carbon	Internal engine failure. Turbine seal failure. Prolonged periods of low rpm engine idling. Restricted oil drain line.	Verified by oil in turbine housing. Correct as required. Inspect for excessive heat from overfueling and/or restricted air intake. Ask operator to run engine under load or at a higher rpm (see Operator's Manual). Inspect and clear oil drain line as required.

EXTERNAL CENTER HOUSING AND JOINT DEFECTS

Leaks from Casting	Defective casting. Defective gasket.	Replace turbocharger (this group). Verify if leaks are occurring at gasket joints.
Leaks from Joints	Loose attaching screws. Defective gasket.	Tighten to specifications in CTM (this group). Inspect and repair as required.

INTERNAL CENTER HOUSING DEFECTS

Excessive Carbon Build-Up in Housing or on Shaft	Hot engine shutdown. Excessive operating temperature. Restricted oil drain line. Operating engine at high speeds and loads immediately after start-up.	Review proper operation with operator as shown in operator's manual. Restricted air intake; overfueling or mistimed engine. Inspect and clean oil drain lines as required. Idle engine for a few minutes to allow oil to reach bearings before applying heavy loads.
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RG, RG34710, 1258 -19-23OCT97-2/2

Adjust Turbocharger Wastegate Actuator (If Equipped)

1. Loosen jam nut (A).
2. Disconnect hose and pressurize actuator to 12 psi and hold at this calibration pressure.
3. Push bypass lever (D) as far as possible toward the actuator and apply pressure to keep lever in that position.

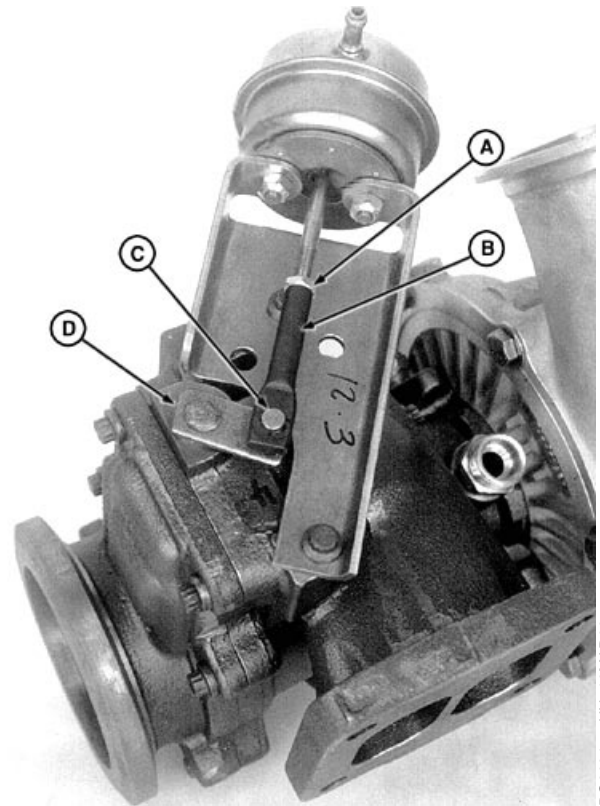
IMPORTANT: Twisting or forcing the entire rod in or out will change the calibration, causing damage to engine from overboost.

4. Turn rod end (B) in either direction until rod eye can just be slipped over bypass lever pin. Loosen rod end an additional half turn, install onto pin and secure with retainer clip (C). Release pressure on actuator.
5. Pressurize the actuator to 12 psi. Measure the end play with a dial indicator, moving the bypass assembly back and forth in a direction perpendicular to the actuator rod. End play should be within specifications listed. If necessary to adjust, set end play at 0.38 mm (0.015 in.)

Specification

Turbocharger Actuator End Play..... 0.05—0.056 mm (0.002—0.022 in.)

6. Vary the pressure from 9—12 psi a few times to verify smooth and free operation of the bypass assembly.
7. Attach hose to actuator and secure with hose clamp.



Turbo Wastegate

- A—Jam Nut
- B—Rod End
- C—Retainer Clip
- D—Bypass Lever

RG9084 -UN-16MAR98

DPSG,OUO1004,4 -19-31MAR98-1/1

Repair Turbocharger

Turbochargers used on the engines covered in this manual are available through service parts as a complete remanufactured assembly only. Individual components for repair are not available.

RG,30,JW7571 -19-20NOV97-1/1

Fuel System

NOTE: Repair, operation, diagnostics and testing of fuel systems has been moved to two other technical manuals: CTM207—Mechanical Fuel Systems and CTM170—Electronic Fuel Systems.

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DPSG,OUO1004,2652 -19-17APR00-1/1

General Engine Operation—Continued

Engines are vertical, in-line, valve-in-head, 4-cycle (stroke) diesel engines.

Direct fuel injection is provided by a rotary-type injection pump or an in-line injection pump and 9.5 mm injection nozzles mounted in cylinder head. The camshaft and injection pump are timed to the crankshaft by the timing gear train.

Some engines are equipped with a turbocharger. The turbocharger uses energy from exhaust gases to compress intake air and force it into the combustion chamber.

The cylinder block (F) is a one-piece casting. The block is available in structural and non-structural configurations.

The camshaft (E) is timed to the crankshaft (G) through the timing gear train. The camshaft rotates in honed bores in the cylinder block. All engines use a bushing in No. 1 camshaft bore. The camshaft lobes determine the duration and lift of each valve, and operate the fuel supply pump on rotary-type injection pumps.

Intake and exhaust valves (Q) are operated by camshaft followers (D), push rods (C) and rocker arm assembly (T). Valve seat inserts in cylinder head are used for intake and exhaust valves.

The crankshaft (G) is a one-piece, heat-treated, nodular-iron or steel forging which operates in replaceable two-piece main bearings. Crankshafts are dynamically balanced and are machined with undercut and rolled fillets. Two-piece main thrust bearing inserts are used to control crankshaft end play.

Cylinder liners (M) are “wet” sleeve type and are individually replaceable. Liner packing rings (L) are used at the lower connection between cylinder block and liners.

Pistons (N) are made of high-grade cast aluminum alloy with internal ribbing. The skirt is cam ground to allow for expansion during operation. The piston crown has a cut-out combustion bowl with a truncated cone center. All piston rings (P) are located above the piston pin. Two compression rings and one oil control ring are used. The top compression ring is a keystone-shaped ring, located close to the top of the piston for improved engine performance.

The hardened, fully-floating piston pins (O) are held in place by snap rings. Spray jets (piston cooling orifices) in cylinder block spray pressurized oil on the underside of the piston to lubricate piston pins and cool pistons.

The forged steel connecting rods (K) have replaceable pin bushing and bearing inserts. Some connecting rods have a tapered pin-end while others have a straight pin-end. Rods and caps have a tongue-and-groove on earlier engines and a PRECISION JOINT™ on later engines.

The engine is equipped with a gear-driven oil pump and full-flow oil filter. The oil filter has an internal bypass valve which opens if the filter element becomes restricted. Engines are equipped with an oil cooler mounted on the right side of the cylinder block. The engine is equipped with a pressure regulator valve to relieve excessive pressure build-up in the main oil gallery, and a bypass valve to prevent oil starvation if the oil cooler and filter become plugged.

Balancer shafts (J) are used on four-cylinder engines to reduce vibration. The two shafts rotate on bushings in cylinder block and are counter-rotating at twice engine speed.

The engine has a pressurized cooling system, consisting of radiator, water pump, multi-blade fan, and one or two thermostats.

Section 04 Diagnostics

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Test Engine Compression Pressure

IMPORTANT: Compression pressures are affected by the cranking speed of the engine. Before beginning test, ensure that batteries are fully charged and injection nozzle area is thoroughly cleaned.

1. Start engine and run at rated speed until it warms up to normal operating temperature. (From a cold start, operate engine 10—15 minutes at slow idle.)

Shut off fuel supply and remove fuel injection nozzles. See CTM207 (Mechanical Fuel Systems) or CTM170 (Electronic Fuel Systems).

Continued on next page

RG,105,JW7652 -19-21NOV97-1/3

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Inspect Thermostat and Test Opening Temperature

Visually inspect thermostat for corrosion or damage.
Replace as necessary.

Test thermostat as follows:

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

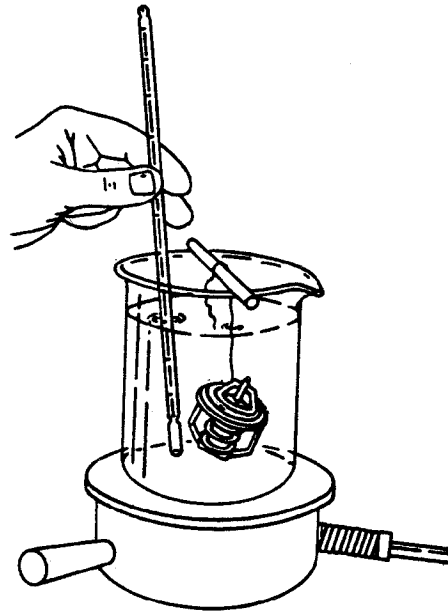
1. Remove thermostats. (See procedure in Section 02, Group 070.)
2. Suspend thermostat and a thermometer in a container of water.
3. Stir the water as it heats. Observe opening action of thermometer and compare temperatures with specification given in chart below.

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

THERMOSTAT TEST SPECIFICATIONS

Rating	Initial Opening (Range)	Full Open (Nominal)
71°C (160°F)	69—72°C (156—162°F)	84°C (182°F)
77°C (170°F)	74—78°C (166—172°F)	89°C (192°F)
82°C (180°F)	80—84°C (175—182°F)	94°C (202°F)
89°C (192°F)	86—90°C (187—194°F)	101°C (214°F)
90°C (195°F)	89—93°C (192—199°F)	103°C (218°F)
92°C (197°F)	89—93°C (193—200°F)	105°C (221°F)
96°C (205°F)	94—97°C (201—207°F)	100°C (213°F)
99°C (210°F)	96—100°C (205—212°F)	111°C (232°F)

4. Remove thermostat and observe its closing action as it cools. In ambient air the thermostat should close completely. Closing action should be smooth and slow.
5. If any thermostat is defective on a multiple thermostat engine, replace all thermostats.



Test Thermostat Opening Temperature

RG5971 -JUN-23NOV/97

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IMPORTANT: On some vehicles, it may not be possible to meet the turbo boost pressure due to inability to get full load rated speed. In these cases, see Machine Operation and Test Manual for the appropriate test method and pressure.

3. Observe pressure reading on gauge. Compare readings with charts in Section 06, Group 210. Boost pressure should be within ranges shown in charts when engine is developing rated power at full load rated speed.
4. If boost pressure is too high, remove fuel injection pump and have it checked for high fuel delivery by an authorized diesel repair station.

If boost pressure is too low, check the following:

- Restricted air filter elements.
 - Restricted fuel filter elements.
 - Incorrect fast idle adjustment.
 - Incorrect injection pump timing.
 - Exhaust manifold leaks.
 - Intake manifold leaks.
 - Faulty fuel transfer pump.
 - Low compression pressure.
 - Faulty fuel injection nozzles.
 - Carbon build-up in turbocharger.
 - Turbocharger compressor or turbine wheel rubbing housing.
 - Low fuel injection pump fuel delivery.
 - Restricted exhaust.
5. After completing test, remove test equipment and reinstall nozzle adapter and plug. Tighten securely.

Repair Tools and Other Materials

RG5084 -UN-23AUG88

Nozzle Bore Cleaning Tool JDE39

Clean injection nozzle bores in cylinder head.



JDE39

DPSG,OUO1004,2707 -19-26APR00-8/15

RG5064 -UN-05DEC97

Valve Guide Knurler Kit JT05949

Knurl valve guides.



JT05949

RG5064

DPSG,OUO1004,2707 -19-26APR00-9/15

RG5065 -UN-05DEC97

Valve Seat Driver JDG676

Use with JDG675 Adapter to install intake and exhaust valve seat inserts in cylinder head.



JDG676

RG5065

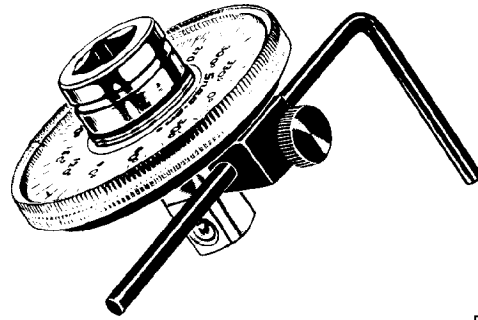
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DPSG,OUO1004,2707 -19-26APR00-10/15

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Torque Angle Gauge JT05993

Used to torque-turn flanged-head cylinder head and connecting rod cap screws.



JT05993

RG5698

RG5698 -UN-05DEC97

DPSG,OUO1004,2711 -19-26APR00-15/15

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Camshaft, Balancer Shafts and Timing Gear Train Essential Tools

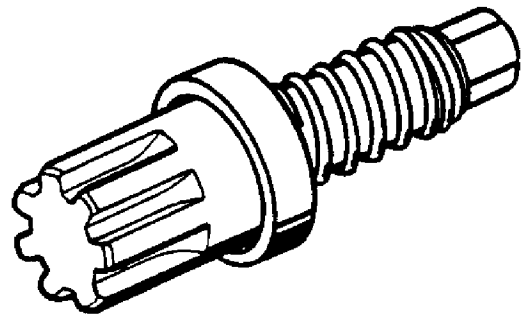
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

SERVICEGARD is a trademark of Deere & Company

DPSG,OUO1004,2723 -19-26APR00-1/12

Flywheel Turning Tool JDG820

Used to rotate flywheel on engines with 129-tooth flywheel ring gears and a 29.9 mm (1.18 in.) ID flywheel housing guide bore diameter. JDE81-1 may be used also if JDG820 is not available.



JDG820

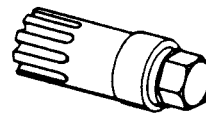
RG7056 -UN-05DEC97
RG7056

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DPSG,OUO1004,2723 -19-26APR00-2/12

Flywheel Turning Tool JDE83

Used to rotate flywheel on engines with 142-tooth flywheel ring gears and a 26.5 mm (1.04 in.) ID flywheel housing guide bore diameter.



JDE83

RG6251 -UN-22JUL92

Continued on next page

DPSG,OUO1004,2723 -19-26APR00-3/12

Lubrication System Other Materials

Number	Name	Use
T43512 (U.S.) TY9473 (Canadian) 242 (LOCTITE®)	Thread Lock and Sealer (Medium Strength)	Apply to oil cooler-to-housing cap screws, oil fill tube cap screws, and end of dipstick tube.
T43513 (U.S.) TY9474 (Canadian) 271 (LOCTITE®)	Thread Lock and Sealer (High Strength)	Apply to dipstick tube with fitting.
TY6304 (U.S.) TY9484 (Canadian) 515 (LOCTITE®)	Flexible Form-in-Place Gasket	Apply to oil pan rail.
TY9375 (U.S.) TY9480 (Canadian) 592 (LOCTITE®)	Pipe Sealant	Apply to oil pan elbow drain fitting.

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LOCTITE is a registered trademark of Loctite Corp.

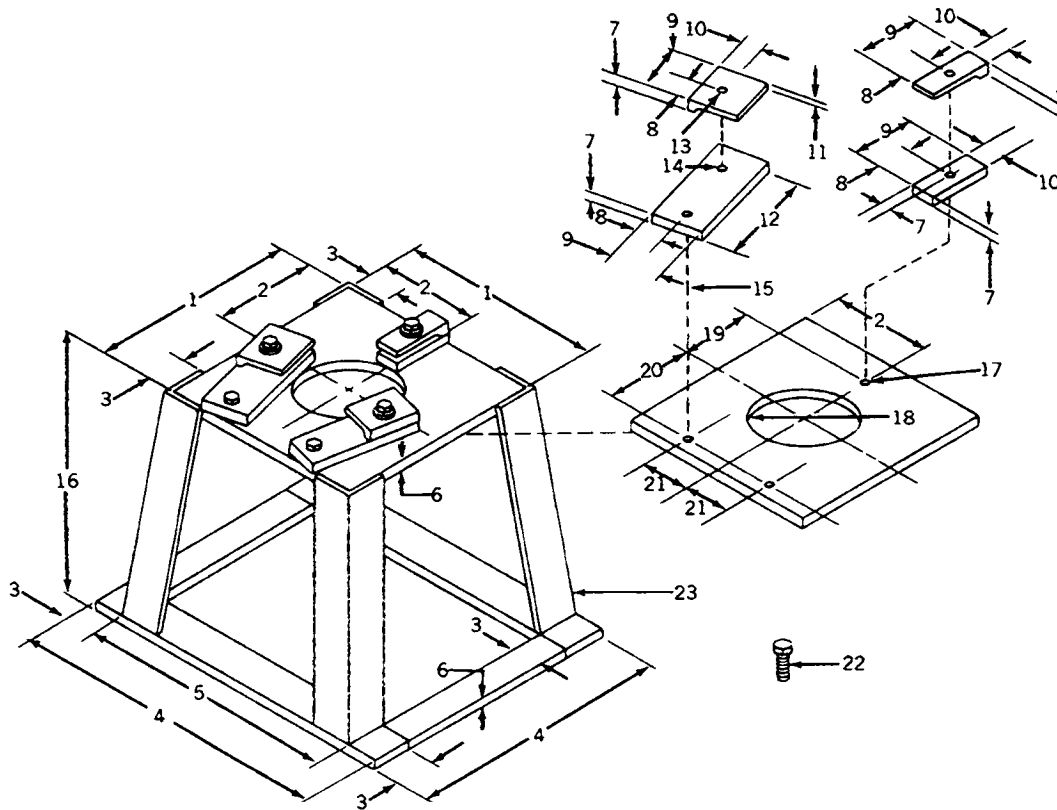
DPSG,OUO1004,2729 -19-26APR00-1/1

How to Make Tools

These tools can be made in a service shop using common shop tools and locally obtained materials.

RG,199,JW7719 -19-25NOV97-1/1

DFRG3—Cylinder Liner Holding Fixture



Cylinder Liner Holding Fixture

1—254.0 mm (10 in.)
2—127.0 mm (5 in.)
3—38.1 mm (1.5 in.)
4—405.4 mm (16 in.)
5—330.2 mm (13 in.)
6—9.52 mm (0.38 in.)

7—12.7 mm (0.5 in.)
8—31.8 mm (1.25 in.)
9—63.5 mm (2.5 in.)
10—25.4 mm (1 in.)
11—6.35 mm (0.25 in.)
12—152.4 mm (6 in.)

13—0.328 in. Drill Through
14—5/16 in. —18 Tap
15—2 (assemblies above) used
16—304.8 mm (12 in.)
17—5/16 in. —18 Tap
18—69.85 mm (2.75 in.) Radius

19—101.6 mm (4 in.)
20—111.25 mm (4.38 in.)
21—60.45 mm (2.38 in.)
22—5/16 in. x 1 in. Cap Screw
23—38.1 mm (1.5 in.) Angle
Iron

RG,199,JW7720 -19-23MAY00-1/1

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RG10743 -UN-07JUN00

Repair and General OEM Specifications

Item	Measurement	Specification
Fuel Supply Pump Push Rod	OD	9.891—9.917 mm (0.3894—0.3904 in.)
Fuel Supply Pump Push Rod Bore in Block	ID	10.00—10.05 mm (0.3937—0.3957 in.)
Camshaft Follower	OD	31.61—31.64 mm (1.245—1.246 in.)
Intake Valves	Recess in Cylinder Head	0.61—1.11 mm (0.024—0.044 in.)
	Wear Limit	1.63 mm (0.064 in.)
Exhaust Valve	Recess in Cylinder Head	1.22—1.72 mm (0.048—0.068 in.)
	Wear Limit	2.26 mm (0.089 in.)
Valve Springs		
Spring Free Length 0 N (0 lb-force) ¹	Height	54.0 mm (2.125 in.)
Spring Compressed 240—280 N (54—62 lb-force)	Height	46.0 mm (1.81 in.)
Spring Compressed 590—680 N (133—153 lb-force)	Height	34.5 mm (1.36 in.)
Intake Valve Head	OD	46.47—46.73 mm (1.830—1.840 in.)
Exhaust Valve Head	OD	42.37—42.63 mm (1.668—1.678 in.)
Intake Valve Stem	OD	7.864—7.884 mm (0.3096—0.3104 in.)
Exhaust Valve Stem	OD	7.848—7.874 mm (0.3090—0.3100 in.)
Valve Face	Maximum Runout (Intake and Exhaust)	0.038 mm (0.0015 in.)

¹ Free length may vary slightly between valve springs.

Continued on next page

DPSG,OUO1004,2710 -19-26APR00-2/4

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Repair and General OEM Specifications

Item	Measurement	Specification
Crankshaft Rod Journal	OD	77.800—77.826 mm (3.0629—3.0640 in.)
Crankshaft Main or Rod Journal	Maximum Taper	0.010 mm (0.0004 in.)
Crankshaft Main or Rod Journal	Maximum Out-of-Round	0.005 mm (0.0002 in.)
Crankshaft Main Thrust Bearing Journal (New)	Width	38.952—39.028 mm (1.5335—1.5365 in.)
Crankshaft Main Thrust Bearing	Overall Width	38.79—38.87 mm (1.527—1.530 in.)
Crankshaft Main Bearing Bore (Without Bearings)	ID	84.455—84.481 mm (3.3250—3.3260 in.)
Crankshaft Main Bearing Bore Centerline-to-Top Deck	Distance	337.896—337.972 mm (13.3029—13.3059 in.)
Piston Cooling Orifice	Diameter	1.4 mm (0.055 in.)
Piston Cooling Orifice	Torque	11 N•m (8 lb-ft) (96 lb-in.)
Crankshaft Main Bearing Cap Screws	Torque	135 N•m (100 lb-ft)
Crankshaft Rear Main (Thrust) Bearing Cap Screws	Torque	135 N•m (100 lb-ft)
Flywheel Housing Cap Screws	Torque	125 N•m (92 lb-ft)
Flywheel Housing Seal Bore	Maximum Permissible Runout (Concentricity)	0.152 mm (0.006 in.)

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DPSG,OUO1004,2718 -19-26APR00-2/2

Repair and General OEM Specifications

Item	Measurement	Specification
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 Tension Used Belt Tension	535—715 N (120—160 lb-force) 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.)
Shaft	OD	18.948—18.961 mm (0.7460—0.7465 in.)
Hub	ID	18.910—18.936 mm (0.7445—0.7455 in.)
Fan Drive (Option Codes 2303, 2304, 2312, 2313, and 2314)		
Bearing Housing	ID	47.573—47.599 mm (1.8730—1.8740 in.)
Bearing	OD	47.612—47.625 mm (1.8745—1.8750 in.)
Shaft	OD	25.387—25.400 mm (0.9995—1.0000 in.)
Hub	ID	25.337—25.353 mm (0.9975—0.9985 in.)
Fan Drive		
Rear Housing Face-to-Hub Front Face (Option Codes 2301 and 2303)	Distance	110.85—110.87 mm (4.364—4.365 in.)

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Continued on next page

DPSG,OUO1004,2734 -19-26APR00-2/3

Diagnostic Specifications

POWER RATINGS ON DYNAMOMETER FOR OEM ENGINES

Engine Model	Injection Pump Option Code	Original Injection Pump (Part No.)	Replaced By Injection Pump (Part No.)	Governor Regulation	Rated Speed (rpm)	Fast Idle (rpm)	Power Rating kW (BHP)
	16DK	RE70938		STD	2100	2300	96 (129)
	16DY	RE501758		STD	2500	2700	116 (155)
	16GM	RE502693		STD	2300	2500	110 (148)
	16GN	RE502704		STD	2400	2600	116 (155)
	16LS	RE67572		3—5%	1800	1870	112 (150)
	16MG	RE503742		3—5%	1800	1870	123 (165)
	16MH	RE504967		3—5%	1800	1870	123 (165)
6068TF151	1681	RE67571	RE505358	3—5%	1800	1870	112 (150)
6068TF151	1681	RE505358		3—5%	1800	2240	112 (150)
	1696	RE69787		STD	2500	2700	116 (155)
	16NJ	RE505358		3—5%	1800	2240	112 (150)
6068TF152	1696	RE69787		STD	2500	2700	116 (155)
	16JU	RE69787		STD	2500	2700	116 (155)
6068TF157	16GS	RE503049		3—5%	1500	1560	120 (161)
	16LX	RE503834		3—5%	1500	1560	120 (161)
6068TF158	16GS	RE503049		3—5%	1500	1560	120 (161)
	16JV	RE503872		3—5%	1500	1560	100 (134)
	16JW	RE503874		3—5%	1500	1560	100 (134)
	16MG	RE503742		3—5%	1800	1870	123 (165)
	16MH	RE504966	RE504967	3—5%	1800	1870	123 (165)
	16MH	RE504967		3—5%	1800	1870	123 (165)
	16MX	RE503740		3—5%	1500	1560	105 (141)
	16MY	RE504699	RE505052	3—5%	1500	1560	105 (141)
	16MY	RE505052		3—5%	1500	1560	105 (141)
6068TF159	16PD	RE70938		STD	2100	2250	96 (129)
6068TF220	16GS	RE503049		3—5%	1500	1560	121 (162)
	16KK	RE502694		STD	2500	2700	127 (170)
	16LX	RE503836		3—5%	1500	1560	121 (162)
	16RK	RE506083		3—5%	2600	2700	138 (185)
	16RJ	RE506084		3—5%	2100	2200	172 (231)
	16SG	RE506625		3—5%	2100	2200	172 (231)
	16SH	RE506626		3—5%	2600	2700	138 (185)
6068TF250	1615	RE62366	RE69791	STD	2400	2600	138 (185)
	1615	RE69791		STD	2400	2600	138 (185)
	1619	RE67573		3—5%	1800	1870	124 (166)
	1668	RE59969 ^a		STD	2400	2600	138 (185)
	1685	RE67574		3—5%	1800	1870	124 (166)
	1686	RE60131	RE69792	STD	2400	2600	138 (185)
	1686	RE69792		STD	2400	2600	138 (185)
	16CW	RE501344		STD	2200	2400	106 (142)
	16CX	RE70390		STD	2300	2500	128 (172)

^aIn-line fuel injection pump.

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RG.100,JW7641 -19-10JAN00-7/8

Diagnostic Specifications

TURBO BOOST PRESSURES (JOHN DEERE OEM/OUTSIDE EQUIPMENT MANUFACTURERS)

Engine Number	Injection Pump Option 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)
	16MV	RE503736		100 (134)	1800	117—131 kPa (1.2—1.3 bar) (17—19 psi)
	16MW	RE504682		100 (134)	1800	117—131 kPa (1.2—1.3 bar) (17—19 psi)
4045TFM50	16HM	RE503163		73 (98)	1800	52 kPa (0.5 bar) (8 psi)
	16HN	RE503162		73 (98)	1800	52 kPa (0.5 bar) (8 psi)
	16HP	RE503861		101 (135)	2500	106 kPa (1.0 bar) (15 psi)
	16HQ	RE503860		101 (135)	2500	106 kPa (1.0 bar) (15 psi)
	16LK	RE503160		111 (149)	2600	142 kPa (1.4 bar) (21 psi)
	16LL	RE503161		111 (149)	2600	142 kPa (1.4 bar) (21 psi)
6068HF150	1621	RE66575		157 (210)	2400	108—132 kPa (1.1—1.3 bar) (16—19 psi)
	160D	RE69589		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)
	16ML	RE503746		187 (251)	1800	153—167 kPa (1.5—1.7 bar) (22—24 psi)
	16MM	RE505049		187 (251)	1800	153—167 kPa (1.5—1.7 bar) (22—24 psi)
	16GT	RE503051		155 (208)	1500	138—152 kPa (1.4—1.5 bar) (20—22 psi)
	16LY	RE503836		155 (208)	1500	138—152 kPa (1.4—1.5 bar) (20—22 psi)
	16QV	RE503051		166 (223)	1800	151—165 kPa (1.5—1.7 bar) (22—24 psi)
	16QW	RE503836		166 (223)	1800	151—165 kPa (1.5—1.7 bar) (22—24 psi)
6068HF157	16GT	RE503051		155 (208)	1500	138—152 kPa (1.4—1.5 bar) (20—22 psi)
	16LY	RE503836		155 (208)	1500	138—152 kPa (1.4—1.5 bar) (20—22 psi)
6068HF158	16GT	RE503051		155 (208)	1500	138—152 kPa (1.4—1.5 bar) (20—22 psi)
	16LY	RE503836		155 (208)	1500	138—152 kPa (1.4—1.5 bar) (20—22 psi)
	16ML	RE503746		187 (251)	1800	153—167 kPa (1.5—1.7 bar) (22—24 psi)
	16MM	RE505049		187 (251)	1800	153—167 kPa (1.5—1.7 bar) (22—24 psi)
6068HF250	1622	RE59521		168 (225)	2400	117—143 kPa (1.2—1.4 bar) (17—21 psi)
	1623	RE66761		148 (198)	1800	100—122 kPa (1.0—1.2 bar) (15—18 psi)
6068TF120	16MX	RE503740		105 (141)	1500	85—99 kPa (0.9—1.0 bar) (12—14 psi)
	16MY	RE505052		105 (141)	1500	85—99 kPa (0.9—1.0 bar) (12—14 psi)
6068TF150	1614	RE61669	RE69789	127 (170)	2500	95—116 kPa (1.0—1.2 bar) (14—17 psi)
	1614	RE69789		127 (170)	2500	95—114 kPa (1.0—1.1 bar) (14—17 psi)
	1680	RE60105	RE69790	127 (170)	2500	95—116 kPa (1.0—1.2 bar) (14—17 psi)
	1680	RE69790		127 (170)	2500	95—114 kPa (1.0—1.1 bar) (14—17 psi)
	1681	RE67571		112 (150)	1800	80—98 kPa (0.8—1.0 bar) (12—14 psi)
	1688	RE67572		112 (150)	1800	80—98 kPa (0.8—1.0 bar) (12—14 psi)
	1696	RE67864	RE69787	116 (155)	2500	85—105 kPa (0.8—1.1 bar) (12—15 psi)
	1696	RE69787		116 (155)	2500	85—105 kPa (0.8—1.1 bar) (12—15 psi)
	1697	RE68740	RE69788	116 (155)	2500	85—105 kPa (0.8—1.1 bar) (12—15 psi)
	1697	RE69788		116 (155)	2500	85—105 kPa (0.8—1.1 bar) (12—15 psi)
	16BE	RE63559	RE501302	117 (157)	2200	79—97 kPa (0.8—1.0 bar) (12—14 psi)
	16BE	RE501302		117 (157)	2200	79—97 kPa (0.8—1.0 bar) (12—14 psi)
	16CN	RE501522		110.5 (148)	2100	76—94 kPa (0.8—0.9 bar) (11—14 psi)
	16CP	RE501523		94 (126)	2200	52—64 kPa (0.5—0.6 bar) (7—9 psi)
	16DK	RE70938		96 (129)	2100	58—70 kPa (0.6—0.7 bar) (8—10 psi)

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