PowerTech™ 2.9 L Diesel Engines

COMPONENT TECHNICAL MANUAL

POWERTECH 2.9 L Diesel Engines

CTM125 09DEC13 (ENGLISH)

For complete service information also see:

OEM Engine Accessories	CTM67 (English)
Alternators and Starter Motors	CTM77
Application List..	CTM106819 (English)

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

TP-6145 12/13

Introduction

Foreword

This manual is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use.

Live with safety: Read the safety messages in the introduction of this manual and the cautions presented throughout the text of the manual.

This is the safety-alert symbol. When you see this symbol on the machine or in this manual, be alert to the potential for personal injury.

Use this component technical manual in conjunction with the machine technical manual. See the machine technical manual for information on component removal and installation, and gaining access to the components.

This manual is divided in three parts: repair, operation and tests, tools and specifications. Repair sections contain necessary instructions to repair the component. Operation and tests sections help you identify the majority of routine failures quickly. Tools and specifications sections are summary listings of all applicable essential tools, service equipment and tools, other materials needed to do the job, service parts kits, specifications, wear tolerances, and torque values

Information is organized in groups for the various components requiring service instruction.

Component Technical Manuals are concise service guides for specific components. Component technical manuals are written as stand-alone manuals covering multiple machine applications.

Fundamental service information is available from other sources covering basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes.

Read each block of material completely before performing service to check for differences in procedures or specifications. Follow only the procedures that apply to the engine model number you are working on. If only one procedure is given, that procedure applies to all the engines in the manual.

CALIFORNIA PROPOSITION 65 WARNING
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

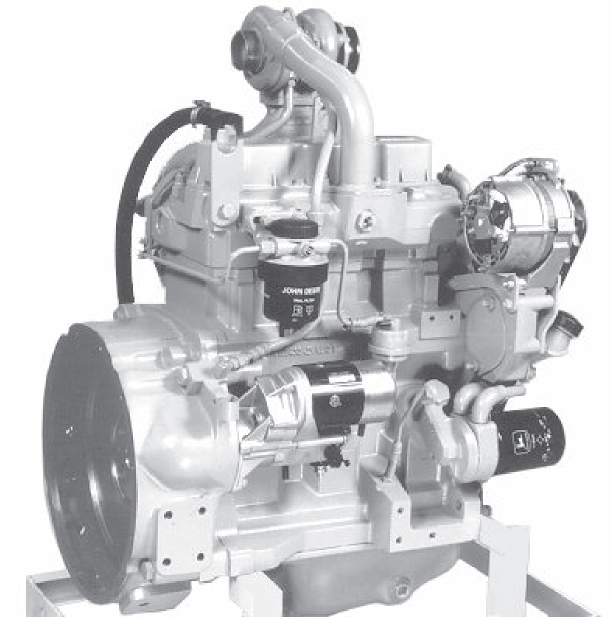
CD03523,00000DB -19-09DEC09-1/1

Record of Changes

Publication and Translation Date: CTM125 (09Dec13)			
Group	**Group Title**	**Block Title**	**Comment**

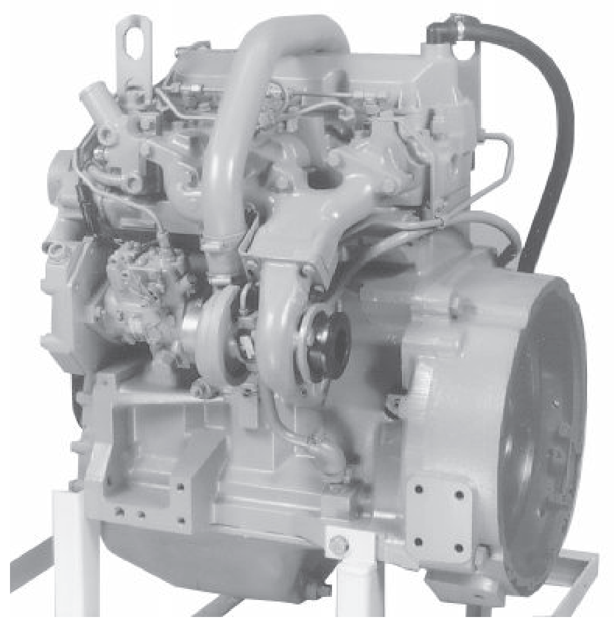
CD03523,0000384 -19-09DEC13-1/1

PowerTech™ 3.9 L Engines



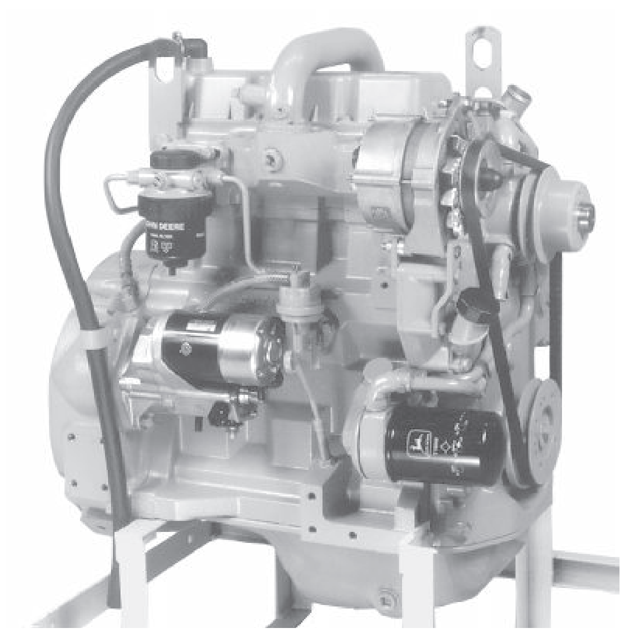
CD30517A —UN—23FEB01

3/4 Right Rear View



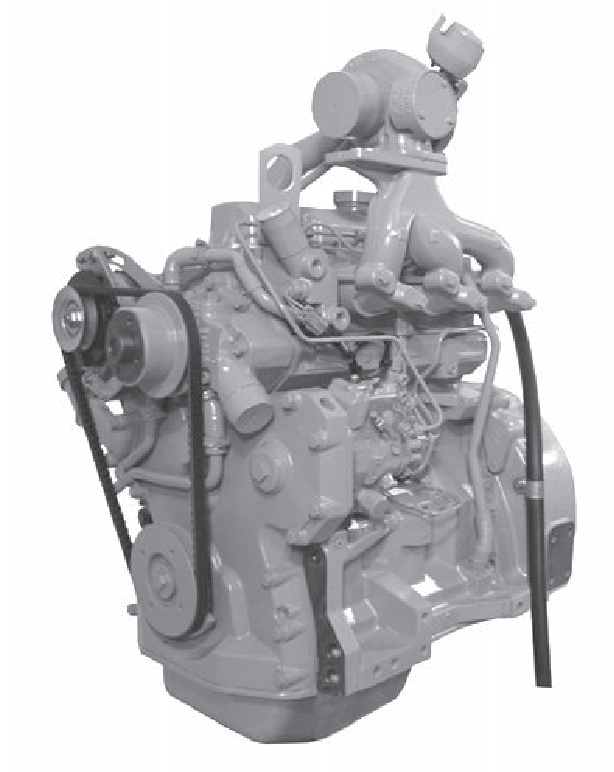
CD30518A —UN—22FEB01

3/4 Left Rear View



CD30519A —UN—23FEB01

3/4 Right front View



RG12835 —UN—05MAR03

3/4 Left Front View

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DPSG,OUOE003,33 -19-19SEP11-1/1

Information relative to emissions regulations

Depending on the final destination, engines can meet the emissions regulations according to the US Environmental Protection Agency (EPA), California Air Resources Board (CARB) and for Europe, the Directive 97/68/EC relating the measures against the emissions of particles and gaseous pollutant from internal combustion engines. Such engines are called “CERTIFIED” and receive an emission label stuck on the engine.

The regulations prohibit tampering with the emission-related components listed below which would render that component inoperative or to make any adjustment on the engine beyond published specifications. It is also illegal to install a part or component where the principal effect of that component is to bypass, defeat, or render inoperative any engine component or device which would affect the engine's conformance to the emission regulations. **To summarize, it is illegal to do anything except return the engine to its original published specifications.**

List of emission-related components:

- Fuel injection system
- Intake manifold
- Turbocharger
- Charge air cooling system
- Piston

CD03523,00000DD -19-04JAN01-1/1

Contents

Original Instructions. All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

Section 01
General Information

Contents

Handle Fluids Safely—Avoid Fires

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

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

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

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

TS227 —UN—15APR13

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

Avoid Static Electricity Risk When Refueling

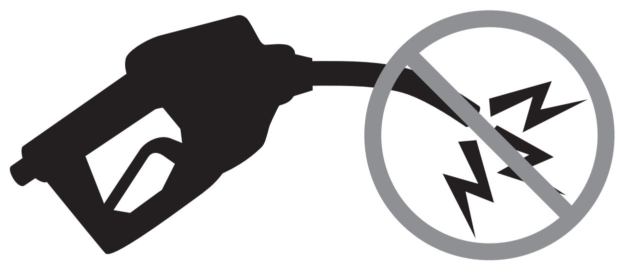
The removal of sulfur and other compounds in Ultra-Low Sulfur Diesel (ULSD) fuel decreases its conductivity and increases its ability to store a static charge.

Refineries may have treated the fuel with a static dissipating additive. However, there are many factors that can reduce the effectiveness of the additive over time.

Static charges can build up in ULSD fuel while it is flowing through fuel delivery systems. Static electricity discharge when combustible vapors are present could result in a fire or explosion.

Therefore, it is important to ensure that the entire system used to refuel your machine (fuel supply tank, transfer pump, transfer hose, nozzle, and others) is properly grounded and bonded. Consult with your fuel or fuel system supplier to ensure that the delivery system is in compliance with fueling standards for proper grounding and bonding practices.

RG22142 —UN—21AUG13



RG21992 —UN—21AUG13

DX,FUEL,STATIC,ELEC -19-12JUL13-1/1

Prevent Battery Explosions

Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).

TS204 —UN—15APR13

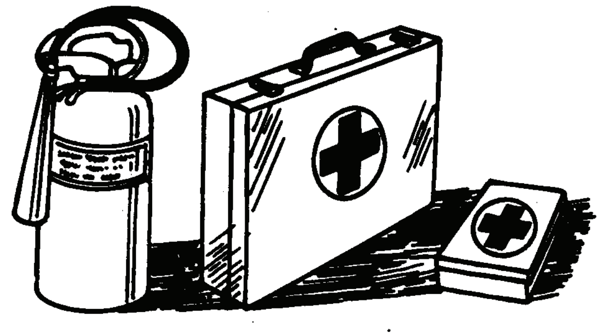
DX,SPARKS -19-03MAR93-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 —UN—15APR13

DX,FIRE2 -19-03MAR93-1/1

Prevent Acid Burns

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 15—30 minutes. Get medical attention immediately.

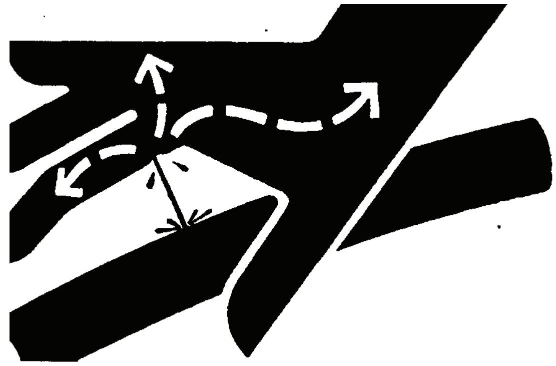
If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.

TS203 —UN—23AUG88

DX,POISON -19-21APR93-1/1

Avoid High-Pressure Fluids



X9811 —UN—23AUG88

Inspect hydraulic hoses periodically – at least once per year – for leakage, kinking, cuts, cracks, abrasion, blisters, corrosion, exposed wire braid or any other signs of wear or damage.

Replace worn or damaged hose assemblies immediately with John Deere approved replacement parts.

Escaping fluid under pressure can penetrate the skin causing serious injury.

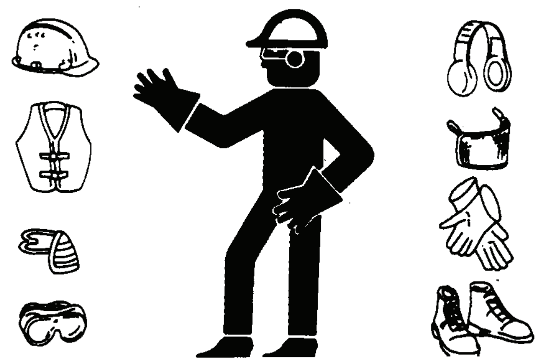
Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available in English from Deere & Company Medical Department in Moline, Illinois, U.S.A., by calling 1-800-822-8262 or +1 309-748-5636.

DX,FLUID -19-12OCT11-1/1

Wear Protective Clothing



TS206 —UN—15APR13

Wear close fitting clothing and safety equipment appropriate to the job.

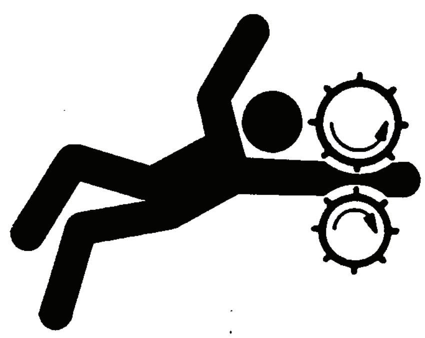
Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

DX,WEAR -19-10SEP90-1/1

Service Machines Safely



TS228 —UN—23AUG88

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.

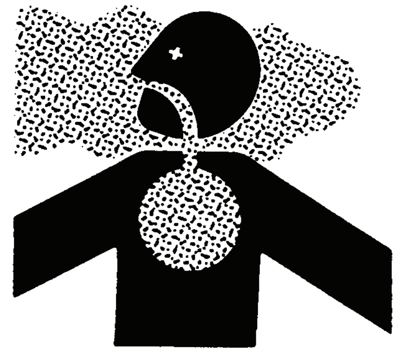
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.

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

Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.



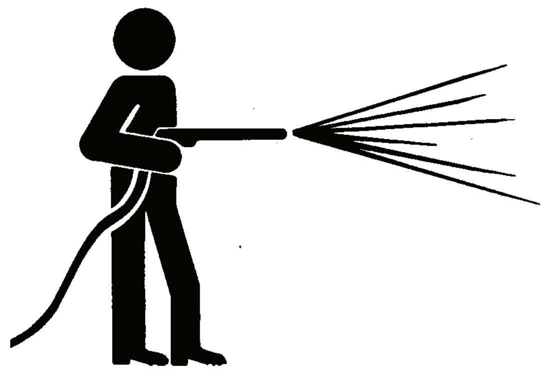
TS220 —UN—15APR13

DX,AIR -19-17FEB99-1/1

Work in Clean Area

Before starting a job:

- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.



T6642EJ —UN—18OCT88

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

Remove Paint Before Welding or Heating

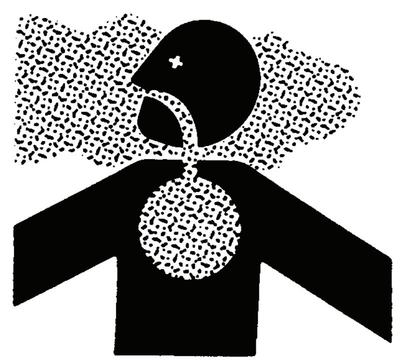
Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

- Remove paint a minimum of 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator before heating or welding.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Do not use a chlorinated solvent in areas where welding will take place.



TS220 —UN—15APR13

Do all work in an area that is well ventilated to carry toxic fumes and dust away.

Dispose of paint and solvent properly.

DX,PAINT -19-24JUL02-1/1

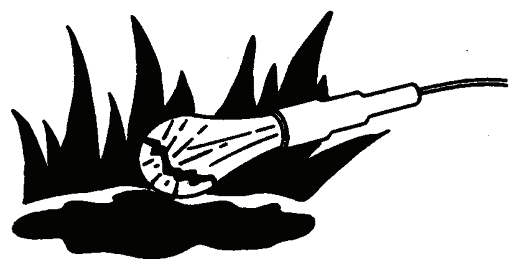
Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when heat goes beyond the immediate flame area.

DX,TORCH -19-10DEC04-1/1

Illuminate Work Area Safely

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

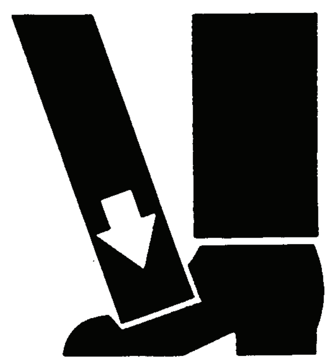


DX,LIGHT -19-04JUN90-1/1

Use Proper Lifting Equipment

Lifting heavy components incorrectly can cause severe injury or machine damage.

Follow recommended procedure for removal and installation of components in the manual.



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

Practice Safe Maintenance

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.

TS218 —UN—23AUG88

DX,SERV -19-17FEB99-1/1

Use Proper Tools

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only service parts meeting John Deere specifications.

TS779 —UN—08NOV89

DX,REPAIR -19-17FEB99-1/1

Dispose of Waste Properly

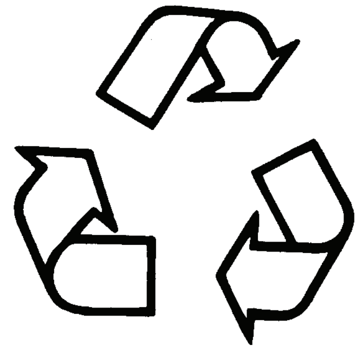
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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.



TS1133 —UN—15APR13

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.

TS231 —19—07OCT88

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

Engine Identification

Engines can be identified from the serial number plate (A) located on the right-hand side of engine.

1. Each engine has a 13-digit John Deere engine serial number (B) giving the following information:

CD3029C123456

CD	Producing factory: **CD**= Saran-FRANCE **PE**= Torreon-MEXICO **PY**= Pune-INDIA
3029	Engine model designation: **3**= Number of cylinders **029**= Total displacement (029 = 2.9 liters)
C	Aspiration Code (early engines) or Emission Tier Level (later engines): **D** = Naturally Aspirated **T** = Turbocharged, no aftercooling **H** = Turbocharged and air-to-air 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 Sequential serial number

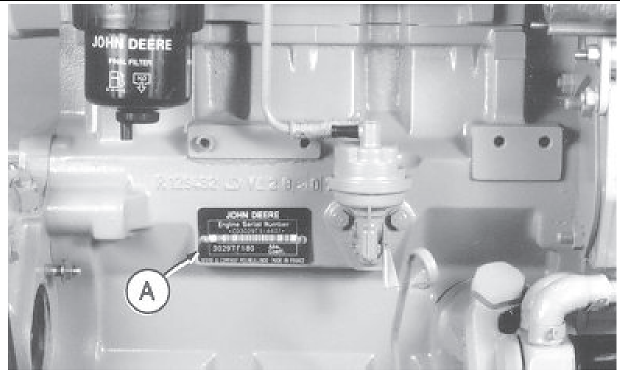
2. The second line of information (C) identifies the engine/machine or OEM relationship. See Application manual, CTM106819.

3029DF150

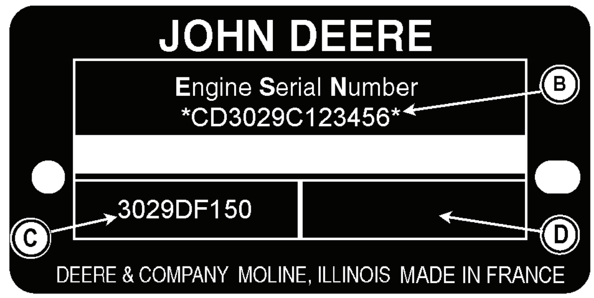
3029D	See above
F............	User code: **AT** = Agritalia-built tractor **F** = OEM applications **FG** = Goldoni (Italy) **FS** = OEM Engines - SDMO Application **FU** = OEM Engines - Saran Power Unit for Gen-Set **KV** = John Deere Knoxville **LV** = John Deere Augusta **PY** = John Deere Pune
150.........	Application number

3. The second line of information on Saran serial number plate (D) may also contain the coefficient of absorption value for smoke emissions or, for later engines, an internal factory identification number.

A—Engine serial number plate
B—Engine serial number
C—Engine model designation
D—Coefficient of Absorption or Saran internal factory identification



CD30521 —UN—30APR98

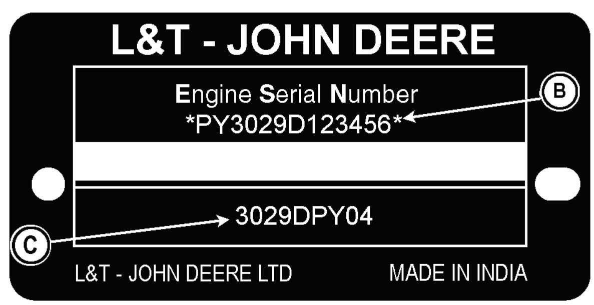


CD30522A —UN—13FEB06

Saran Engine Plate (with later numbering system)

CD30523A —UN—13FEB06

Torreon Engine Plate (with early numbering system)



CD30855 —UN—13FEB06

L & T - John Deere Pune Engine Plate

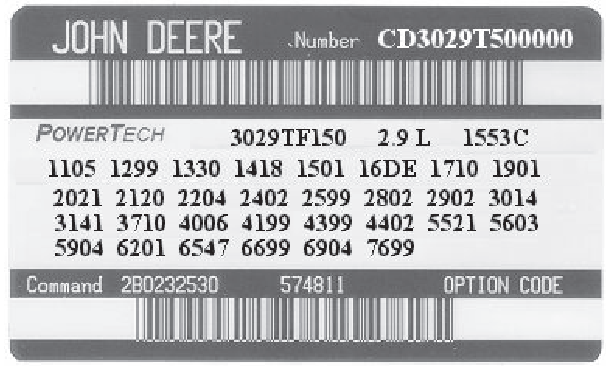
CD,CTM125,003 -19-09DEC09-1/1

OEM Engine Option Code Label

An option code label is secured to the top of the valve cover and identifies the factory installed options on each OEM engine to ensure correct parts acquisition.

Always provide option code information and engine base code when ordering repair parts. A listing of option codes is given in Parts Catalogs and Operator's Manual.

NOTE: Before "hot tank" cleaning, ensure that option codes are recorded elsewhere.



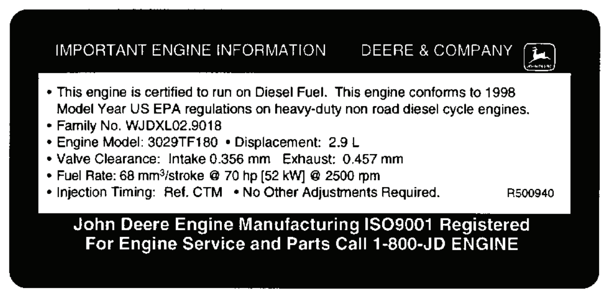
CD30524 —UN—27MAY98

Option Code Label

CD,CTM125,004 -19-01DEC97-1/1

Emission Certified Engine Label

Emission certified engines have a label, like the one shown, stuck on the rocker arm cover. Information on this label states the conditions this engine is emission certified.



CD30697 —UN—17JUN98

Emission Label

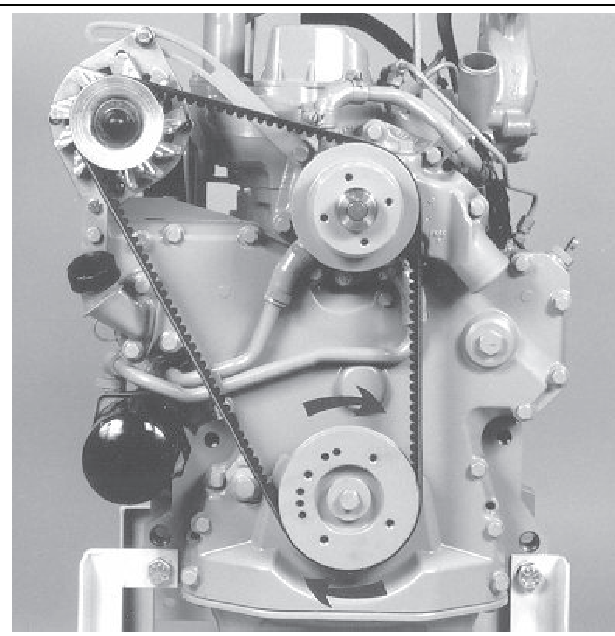
CD,CTM125,228 -19-01DEC97-1/1

Engine References

Direction of engine rotation:
Clockwise rotation when viewed from water pump end.

Engine front reference:
The water pump end is the "front" of the engine. Cylinder number 1 is at the front of engine.

Engine side references:
"Right-hand" and "left-hand" sides are determined by facing the flywheel end (rear) of the engine. Right-hand side is the camshaft side while left-hand side is the fuel injection pump side.



CD30525 —UN—04MAY98

CD,CTM125,005 -19-01DEC97-1/1

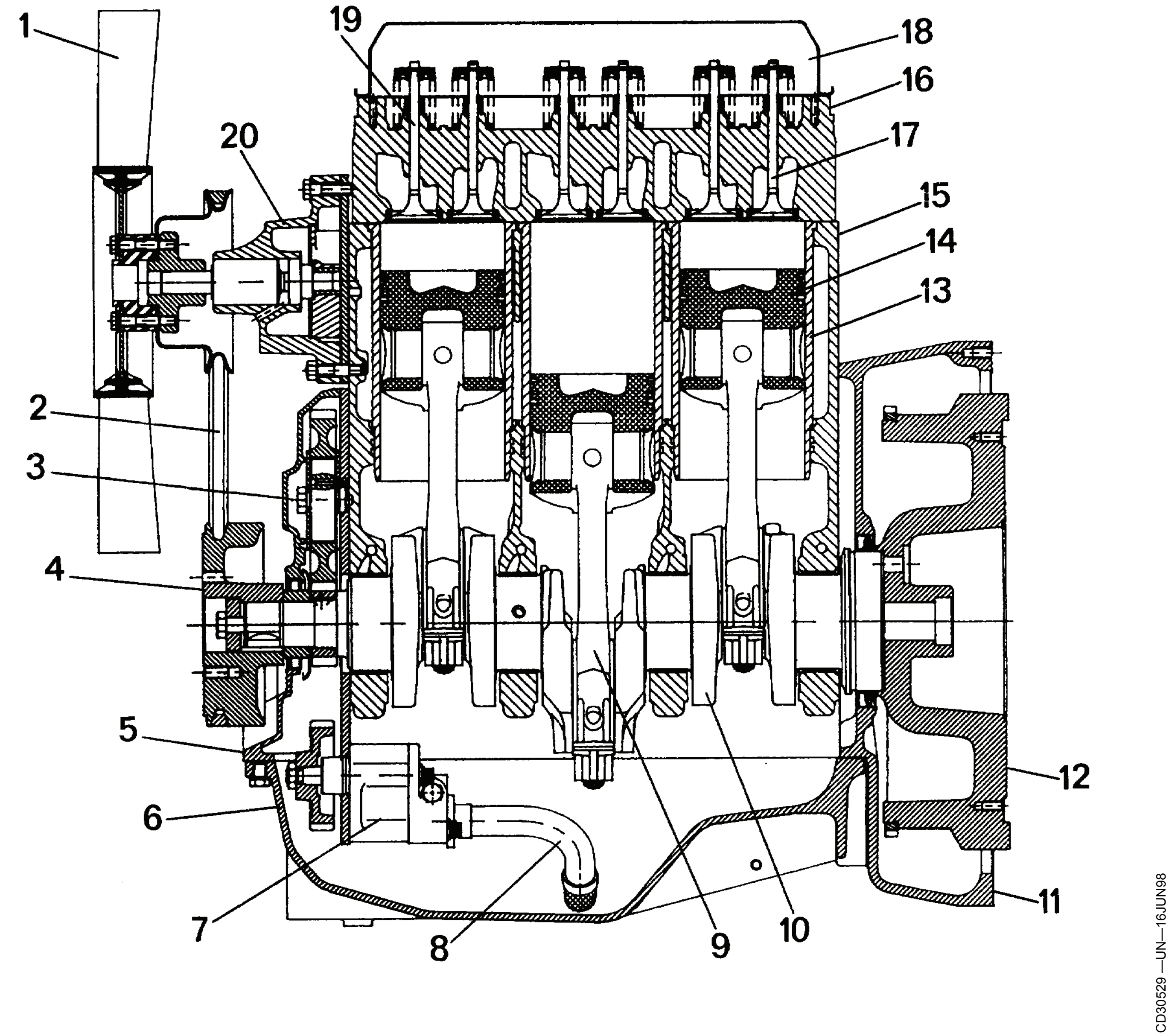
Basic Engine Specifications

	UNIT of Measure	3029D	3029T	3029H
Number of Cylinders	---	3	3	3
Bore	mm (in.)	106.5 (4.19)	106.5 (4.19)	106.5 (4.19)
Stroke	mm (in.)	110 (4.33)	110 (4.33)	110 (4.33)
Displacement	L ($in.^3$)	2.9 (179)	2.9 (179)	2.9 (179)
Compression Ratio	---	17.2:1	17.2:1	17.2:1
Firing Order	---	1-2-3	1-2-3	1-2-3
Injection System	---	Direct	Direct	Direct
Aspiration	---	Natural	Turbocharged	Turbocharged and air-to-air aftercooled
Rated Speed[a]	rpm	2500	2500	
Power[b]	kW	43	59	
@ Rated Speed	(hp)	(58)	(79)	
Power[b]	kW	35		
@ 1800 rpm	(hp)	(47)		
Power[b]	kW	31	28	37
@ 1500 rpm	(hp)	(42)	37	50
Weight (dry)	kg (lbs)	323 (712)	330 (728)	330 (728)

[a] *Vary by application; refer to the machine technical or operator's manual for specific engine speeds and powers.*
[b] *Without fan.*

CD,CTM125,040 -19-13JAN09-1/1

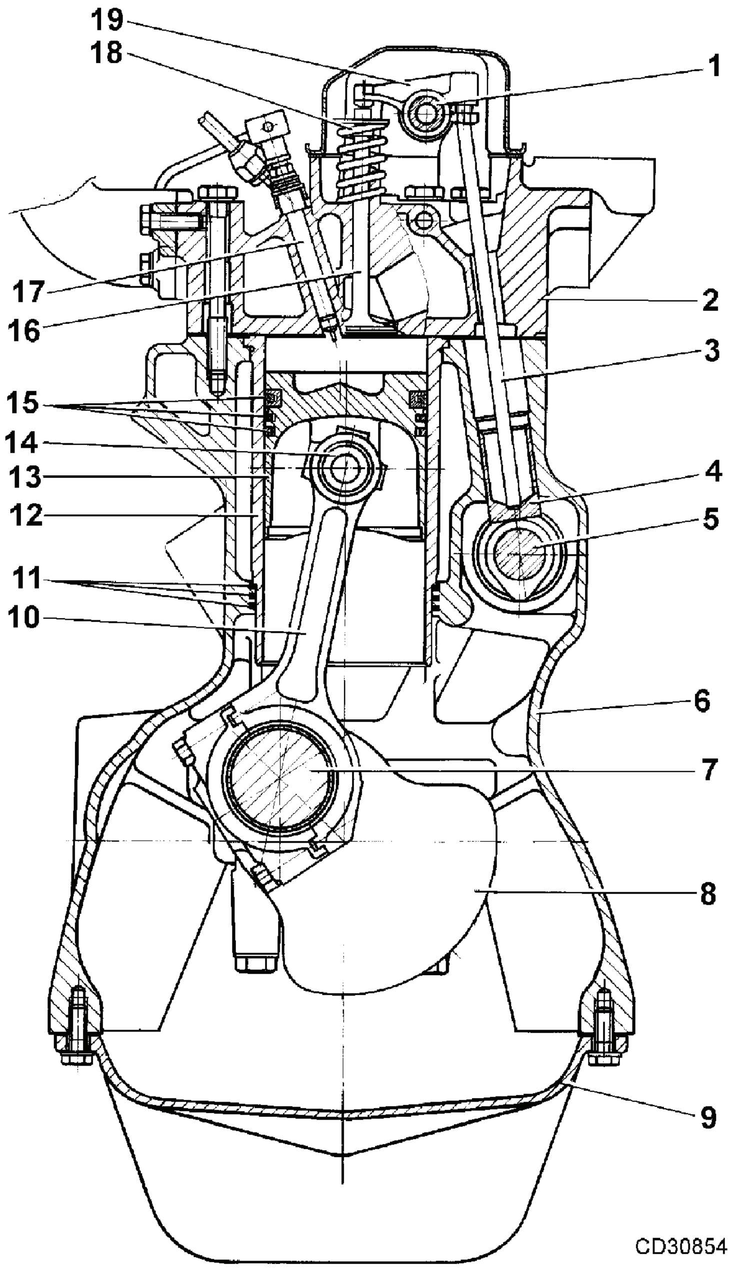
Longitudinal Cut-Away



1— Fan
2— Belt fan
3— Timing gear
4— Crankshaft pulley
5— Timing gear cover
6— Oil pan
7— Oil pump
8— Oil pump intake
9— Connecting rod
10— Crankshaft
11— Flywheel housing
12— Flywheel
13— Cylinder liner
14— Piston
15— Cylinder block
16— Cylinder head
17— Exhaust valve
18— Rocker arm cover
19— Intake valve
20— Water pump

CD,CTM125,013 -19-01DEC97-1/1

Transversal Cutaway



CD30854 —UN—30SEP04

1— Rocker arm shaft
2— Cylinder head
3— Push rod
4— Cam follower
5— Camshaft
6— Cylinder block
7— Crankshaft
8— Crankshaft counterweight
9— Oil pan
10— Connecting rod
11— Liner seals
12— Cylinder liner
13— Piston
14— Piston pin
15— Piston rings
16— Valve
17— Fuel injection nozzle
18— Valve spring
19— Rocker arm

CD,CTM125,014 -19-23SEP04-1/1

General Engine Description

The POWERTECH™ 2.9 L engine is a 3 cylinders, vertical, in-line, valve-in-head, 4-stroke diesel engine.

The direct fuel injection is provided by a rotary-type injection pump and 9.5 mm injection nozzles mounted in cylinder head. Injection pump is driven by the crankshaft through the timing gear train. A cold start advance system allows easy start-up when engine is cold.

The “wet” cylinder liners (liner forms cylinder and is surrounded with coolant) can be replaced individually.

The pistons 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 re-entrant bowl swirl chamber to reduce particulate matters and smoke. The three piston rings, 2 for compression and 1 for oil control, are located above piston pin. The top compression ring is a keystone shaped ring located close to the top of piston for improved engine performance.

The hardened piston pins are fully-floating and held in position by means of 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 crankshaft is a one-piece, heat treated, nodular-iron. It is supported in replaceable two-piece main bearings machined to close tolerances. The rear thrust bearing has a flange on each side to support crankshaft thrust and to limit end play.

The connecting rods have a bronze bushing as bearing surface for the piston pins. The steel-backed rod bearings are aluminum lined and tin plated. Some connecting rods have a tapered pin-end while others have a straight pin-end. Connecting rods and caps have a tongue-and-groove joint on earlier engines and a PRECISION JOINT™ on later engines.

The camshaft is timed to the crankshaft through the timing gear train. Camshaft rotates in a bushing for the no. 1 camshaft journal and directly in honed cylinder block bores for the others camshaft journals. The camshaft lobes determine duration and lift of each valve, and operate the fuel supply pump.

The intake and exhaust valves are supported in the cylinder head. The valve stems slide in bores in the cylinder head. The rocker arm shaft assembly is fitted on top of the cylinder head.

The engine is supplied with lubricating oil by a gear pump. The lubricating oil passes through a full-flow oil filter in the main oil circuit. To ensure engine lubrication, the oil filter is provided with a by-pass valve which opens when the filter element is restricted. On most engines, engine oil is cooled by means of an oil cooler mounted externally on the cylinder block. Engine oil passes through the oil cooler before flowing to the oil filter. A by-pass valve located between oil pump and main gallery relieves any pressure build-up in this area.

The engine has a pressurized cooling system, consisting of radiator, water pump, multi-blade fan and thermostat.

Some engines are equipped with a turbocharger. Operated by exhaust gases, the turbocharger draws in filtered air to the combustion chambers. On “H” version, the compressed intake air is cooled by an additional radiator before to enter engine.

CD,CTM125,206 -19-13JAN09-1/1

Diesel Fuel

Consult your local fuel distributor for properties of the diesel fuel available in your area.

In general, diesel fuels are blended to satisfy the low temperature requirements of the geographical area in which they are marketed.

Diesel fuels specified to EN 590 or ASTM D975 are recommended. Renewable diesel fuel produced by hydrotreating animal fats and vegetable oils is basically identical to petroleum diesel fuel. Renewable diesel that meets EN 590 or ASTM D975 is acceptable for use at all percentage mixture levels.

Required Fuel Properties

In all cases, the fuel shall meet the following properties:

Cetane number of 43 minimum. Cetane number greater than 47 is preferred, especially for temperatures below –20 °C (–4 °F) or elevations above 1500 m (5000 ft.).

Cold Filter Plugging Point (CFPP) should be at least 5 °C (9 °F) below the expected lowest temperature or **Cloud Point** below the expected lowest ambient temperature.

Fuel lubricity should pass a maximum scar diameter of 0.52 mm as measured by ASTM D6079 or ISO 12156-1. A maximum scar diameter of 0.45 mm is preferred.

Diesel fuel quality and 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 10000 mg/kg (10000 ppm).

Sulfur content for Interim Tier 4, Final Tier 4, Stage III B, and Stage IV Engines

- Use ONLY ultra low sulfur diesel (ULSD) fuel with a maximum of 15 mg/kg (15 ppm) sulfur content.

Sulfur Content for Tier 3 and Stage III A Engines

- Use of diesel fuel with sulfur content less than 1000 mg/kg (1000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content 1000—2000 mg/kg (1000—2000 ppm) REDUCES the oil and filter change interval.
- BEFORE using diesel fuel with sulfur content greater than 2000 mg/kg (2000 ppm), contact your John Deere dealer.

Sulfur Content for Tier 2 and Stage II Engines

- Use of diesel fuel with sulfur content less than 2000 mg/kg (2000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content 2000—5000 mg/kg (2000—5000 ppm) REDUCES the oil and filter change interval.
- BEFORE using diesel fuel with sulfur content greater than 5000 mg/kg (5000 ppm), contact your John Deere dealer.

Sulfur Content for Other Engines

- Use of diesel fuel with sulfur content less than 5000 mg/kg (5000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content greater than 5000 mg/kg (5000 ppm) REDUCES the oil and filter change interval.

IMPORTANT: Do not mix used diesel engine oil or any other type of lubricating oil with diesel fuel.

Improper fuel additive usage may cause damage on fuel injection equipment of diesel engines.

DX,FUEL1 -19-17JUN13-1/1

Diesel Fuel Additive Products

John Deere diesel engines with high pressure fuel systems rely on high quality diesel fuel to maintain the performance, reliability, and durability customers demand. A variety of diesel fuel aftermarket products may be used to ensure diesel fuel meets those needs:

- Fuel-Protect Diesel Fuel Conditioner
- Diesel Fuel System Clean-Up
- Fuel-Protect Keep Clean
- Performance Formula Conditioner
- Biodiesel Protect 100
- Fuel Test Kits
- FUELSAVER™

These products are available through John Deere Merchandise.

NOTE: Not all products will be available in all markets.

VN40298,00000ED -19-14MAY12-1/1

BioDiesel Fuel

BioDiesel fuel is comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. BioDiesel blends are BioDiesel mixed with petroleum diesel fuel on a volume basis.

Before using fuel containing BioDiesel, review the BioDiesel Use Requirements and Recommendations in this Operator's Manual.

Environmental laws and regulations can encourage or prohibit the use of biofuels. Operators should consult with appropriate governmental authorities prior to using biofuels.

All John Deere Engines with Exhaust Filter (Released 2011 and After)

While 5% blends (B5) are preferred, BioDiesel concentrations up to a 20% blend (B20) in petroleum diesel fuel can be used. BioDiesel blends up to B20 can be used ONLY if the BioDiesel (100% BioDiesel or B100) meets ASTM D6751, EN 14214, or equivalent specification. Expect a 2% reduction in power and a 3% reduction in fuel economy when using B20.

BioDiesel concentrations above B20 can harm the engine's emission control systems and should not be used. Risks include, but are not limited to, more frequent stationary regeneration, soot accumulation, and increased intervals for ash removal.

John Deere approved fuel conditioners, which contain detergent and dispersant additives, are required when using BioDiesel blends from B10—B20, and are recommended when using lower BioDiesel blends.

All John Deere Engines Excluding Exhaust Filter (Primarily Released Prior to 2012)

While 5% blends (B5) are preferred, BioDiesel concentrations up to a 20% blend (B20) in petroleum diesel fuel can be used. BioDiesel blends up to B20 can be used ONLY if the BioDiesel (100% BioDiesel or B100) meets ASTM D6751, EN 14214, or equivalent specification. Expect a 2% reduction in power and a 3% reduction in fuel economy when using B20.

These John Deere engines can operate on BioDiesel blends above B20 (up to 100% BioDiesel). Operate at levels above B20 ONLY if the BioDiesel is permitted by law and meets the EN 14214 specification (primarily available in Europe). Engines operating on BioDiesel blends above B20 might not fully comply with or be permitted by all applicable emissions regulations. Expect up to a 12% reduction in power and an 18% reduction in fuel economy when using 100% BioDiesel.

John Deere approved fuel conditioners, which contain detergent and dispersant additives, are required when using BioDiesel blends from B10—B20, and are recommended when using lower BioDiesel blends.

BioDiesel Use Requirements and Recommendations

The petroleum diesel portion of all BioDiesel blends must meet the requirements of ASTM D975 (US) or EN 590 (EU) commercial standard.

BioDiesel users in the U.S. are strongly encouraged to purchase BioDiesel blends from a BQ-9000 Certified Marketer and sourced from a BQ-9000 Accredited Producer (as certified by the National BioDiesel Board). Certified Marketers and Accredited Producers can be found at the following website: http://www.bq9000.org.

BioDiesel contains residual ash. Ash levels exceeding the maximums allowed in either ASTM D6751 or EN14214 can result in more rapid ash loading and require more frequent cleaning of the Exhaust Filter (if present).

The fuel filter can require more frequent replacement, when using BioDiesel fuel, particularly if switching from diesel. Check engine oil level daily prior to starting engine. A rising oil level can indicate fuel dilution of the engine oil. BioDiesel blends up to B20 must be used within 90 days of the date of BioDiesel manufacture. BioDiesel blends above B20 must be used within 45 days from the date of BioDiesel manufacture.

When using BioDiesel blends up to B20, the following must be considered:

- Cold-weather flow degradation
- Stability and storage issues (moisture absorption, microbial growth)
- Possible filter restriction and plugging (usually a problem when first switching to BioDiesel on used engines)
- Possible fuel leakage through seals and hoses (primarily an issue with older engines)
- Possible reduction of service life of engine components

Request a certificate of analysis from your fuel distributor to ensure that the fuel is compliant with the specifications provided in this Operator's Manual.

Consult your John Deere dealer for approved fuel conditioners to improve storage and performance with BioDiesel fuels.

The following must also be considered if using BioDiesel blends above B20:

- Possible coking or blocked injector nozzles, resulting in power loss and engine misfire if John Deere approved fuel conditioners are not used
- Possible crankcase oil dilution (requiring more frequent oil changes)
- Possible lacquering or seizure of internal components
- Possible formation of sludge and sediments
- Possible thermal oxidation of fuel at elevated temperatures
- Possible compatibility issues with other materials (including copper, lead, zinc, tin, brass, and bronze) used in fuel handling equipment

Continued on next page DX,FUEL7 -19-15MAY13-1/2

- Possible reduction in water separator efficiency
- Possible damage to paint if exposed to BioDiesel
- Possible corrosion of fuel injection equipment
- Possible elastomeric seal and gasket material degradation (primarily an issue with older engines)
- Possible high acid levels within fuel system
- Because BioDiesel blends above B20 contain more ash, using blends above B20 can result in more rapid ash loading and require more frequent cleaning of the Exhaust Filter (if present)

IMPORTANT: Raw pressed vegetable oils are NOT acceptable for use as fuel in any concentration in John Deere engines. Their use could cause engine failure.

DX,FUEL7 -19-15MAY13-2/2

Handling and Storing Diesel Fuel

CAUTION: Reduce the risk of fire. Handle fuel carefully. DO NOT fill the fuel tank when engine is running. DO NOT smoke while you fill the fuel tank or service the fuel system.

Fill the fuel tank at the end of each day's operation to prevent water condensation and freezing during cold weather.

Keep all storage tanks as full as practicable to minimize condensation.

Ensure that all fuel tank caps and covers are installed properly to prevent moisture from entering. Monitor water content of the fuel regularly.

When using BioDiesel fuel, the fuel filter may require more frequent replacement due to premature plugging.

Check engine oil level daily prior to starting engine. A rising oil level may indicate fuel dilution of the engine oil.

IMPORTANT: The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

When fuel is stored for an extended period or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and prevent water condensation. Contact your fuel supplier or John Deere dealer for recommendations.

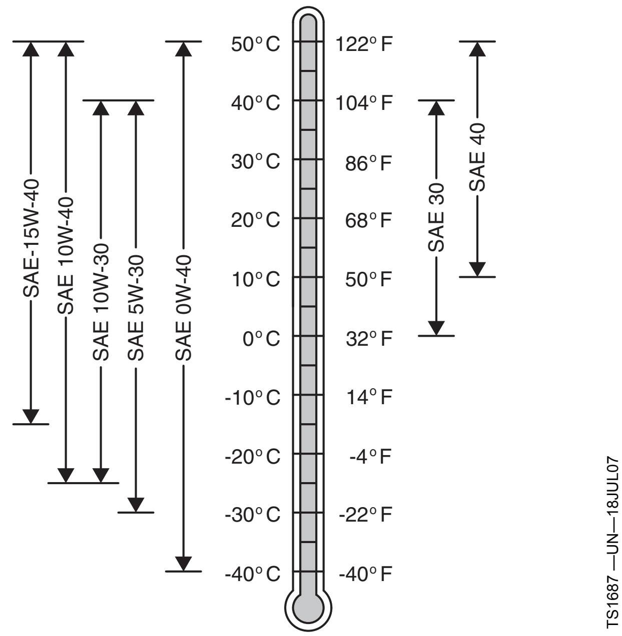
DX,FUEL4 -19-15FEB13-1/1

Oil Information for Non-certified, Tier 1 or Trem 3 Engines (see application list)

The following oil information (DX,ENOIL and DX,ENOIL6) applies to engines that are not certified for emissions or meet Tier 1 or Trem 3 emission standards.

CD03523,00001C6 -19-30JAN09-1/1

Diesel Engine Oil — Non-Emissions Certified and Certified Tier 1 and Stage I



Oil Viscosities for Air Temperature Ranges

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
- API Service Category CH-4
- API Service Category CG-4
- API Service Category CF-4
- ACEA Oil Sequence E9
- ACEA Oil Sequence E7
- ACEA Oil Sequence E6
- ACEA Oil Sequence E5
- ACEA Oil Sequence E4
- ACEA Oil Sequence E3
- ACEA Oil Sequence E2

If oils meeting API CG-4, API CF-4, or ACEA E2 are used, reduce the service interval by 50%.

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.

If diesel fuel with sulfur content greater than 5000 mg/kg (5000 ppm) is used, reduce the service interval by 50%.

DO NOT use diesel fuel with sulfur content greater than 10000 mg/kg (10000 ppm).

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Torq-Gard is a trademark of Deere & Company

DX,ENOIL -19-15JUN10-1/1

Extended Diesel Engine Oil Service Intervals — Non-Emissions Certified and Certified Tier 1 and Stage I

When John Deere Plus-50™ II or John Deere Plus-50™ is used with the specified John Deere filter, the service interval for engine oil and filter changes may be increased by 50% but not to exceed a maximum of 500 hours.

Use oil analysis to evaluate the condition of the oil and to aid in selection of the proper oil and filter service interval. Contact your John Deere dealer for more information on engine oil analysis.

Change the oil and oil filter at least once every 12 months even if the hours of operation are fewer than the otherwise recommended service interval.

When ACEA E9, ACEA E7, ACEA E6, ACEA E5, or ACEA E4 oils are used with specified John Deere filter, use engine oil analysis to determine if the service interval for engine oil and filter changes may be increased by a maximum of 50% but not to exceed 500 hours.

If John Deere Plus-50™ II or John Deere Plus-50™, ACEA E9, ACEA E7, ACEA E6, ACEA E5, or ACEA E4 oils are used with other than the specified John Deere filter, change the engine oil and filter at the normal service interval.

If John Deere Torq-Gard™, API CJ-4, API CI-4 PLUS, API CI-4, API CH-4, or ACEA E3 oils are used, change the engine oil and filter at the normal service interval.

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

IMPORTANT: To avoid engine damage:

- **Reduce oil and filter service intervals by 50% when using BioDiesel blends greater than B20. Oil analysis may allow longer service intervals.**
- **Use only approved oil types.**

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DX,ENOIL6 -19-15JUN10-1/1

Oil Information for Tier 2 Engines (see application list)

The following oil information (DX,ENOIL7 and DX,ENOIL12) applies to engines that meet Tier 2 emission standards.

CD03523,00001C7 -19-13JAN09-1/1

Diesel Engine Oil — Tier 2 and Stage II

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
- API Service Category CH-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 10000 mg/kg (10000 ppm).

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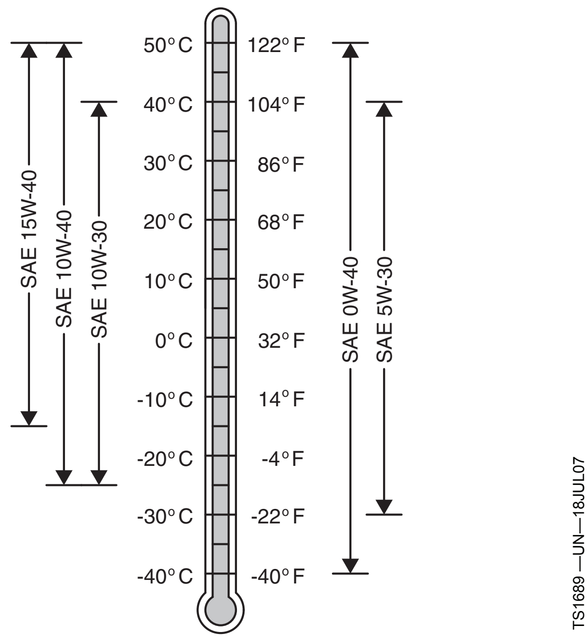
Torq-Gard is a trademark of Deere & Company



Oil Viscosities for Air Temperature Ranges

DX,ENOIL7 -19-17JUN13-1/1

Diesel Engine Oil and Filter Service Intervals

The oil and filter service intervals in the following table should be used as guidelines. Actual service intervals also depend on operation and maintenance practices. It is suggested to use oil analysis to determine the actual useful life of the oil and to aid in selection of the proper oil and filter service interval.

Oil and filter service intervals are based on a combination of oil pan capacity, type of engine oil and filter used, and sulfur content of the diesel fuel.

Engine Oil and Filter Service Intervals		
	Standard Drain Oil Pan	**Extended Drain Oil Pan**
Fuel Sulfur	Less than 0.05% (500 mg/kg)	
Plus-50	375 hours	500 hours
Other Oils	250 hours	250 hours
Fuel Sulfur	0.05 - 0.50% (500 - 5000 mg/kg)	
Plus-50	275 hours	400 hours
Other Oils	150 hours	150 hours
Fuel Sulfur	0.50 - 1.00% (5000 - 10 000 mg/kg)	
Plus-50	187 hours	250 hours
Other Oils	125 hours	125 hours
The service interval of “Other Oils” may be extended only if oil analysis is performed to determine the actual service life, to a maximum not to exceed that of Plus-50.		

Diesel fuel sulfur level will affect engine oil and filter service intervals. Higher fuel sulfur levels reduce oil and filter service intervals as shown in the table.

- Use of diesel fuel with sulfur content less than 0.05% (500 mg/kg) is strongly recommended.
- Use of diesel fuel with sulfur content 0.05% (500 mg/kg) to 0.50% (5000 mg/kg) may result in REDUCED oil and filter change intervals as shown in the table.
- BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 mg/kg), contact your John Deere dealer.

IMPORTANT: When using biodiesel blends greater than B20, reduce the oil and filter service interval by 50% or monitor engine oil based on test results from Oilscan.

Oil types in the table include:

- John Deere Plus-50™ II and John Deere Plus-50 oils.
- “Other Oils” include John DeereTorq-Gard Supreme™, API CJ-4, API CI-4 PLUS, API CI-4, API CH-4, ACEA E9, ACEA E7, ACEA E6, ACEA E5, ACEA E4, or ACEA E3 oils.

NOTE: The 500 hour extended oil and filter change interval is only allowed if all the following conditions are met:

- *Engine equipped with an extended drain interval oil pan*
- *Use of diesel fuel with sulfur content less than 0.05% (500 mg/kg)*
- *Use of John Deere Plus-50™ II or John Deere Plus-50 oil*
- *Use of an approved John Deere oil filter*

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

DX,ENOIL12 -19-03AUG09-1/1

Oil Information for Tier 3 Engines (see application list)

The following oil information (DX,ENOIL11 and DX,ENOIL13) applies to engines that meet Tier 3 emission standards.

CD03523,00001C8 -19-13JAN09-1/1

Diesel Engine Oil — Tier 3 and Stage III

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 10000 mg/kg (10000 ppm).

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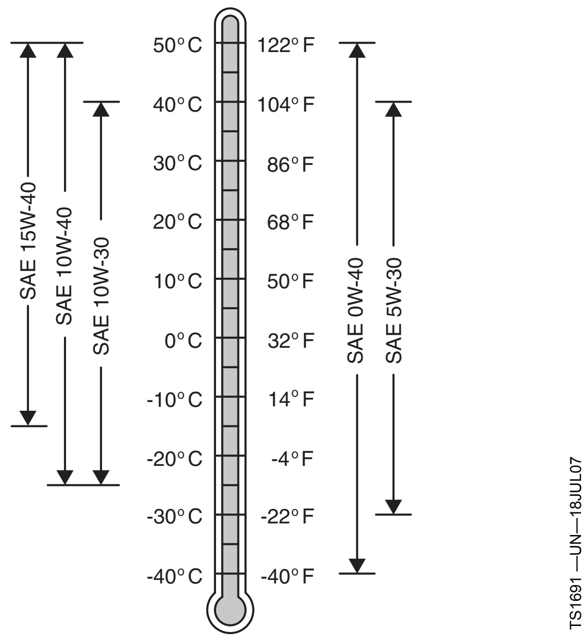
Torq-Gard is a trademark of Deere & Company



Oil Viscosities for Air Temperature Ranges

DX,ENOIL11 -19-15JUN10-1/1

Diesel Engine Oil and Filter Service Intervals

The oil and filter service intervals in the following table should be used as guidelines. Actual service intervals also depend on operation and maintenance practices. It is suggested to use oil analysis to determine the actual useful life of the oil and to aid in selection of the proper oil and filter service interval.

Oil and filter service intervals are based on a combination of oil pan capacity, type of engine oil and filter used, and sulfur content of the diesel fuel.

Diesel fuel sulfur level will affect engine oil and filter service intervals. Higher fuel sulfur levels reduce oil and filter service intervals as shown in the table.

- Use of diesel fuel with sulfur content less than 0.10% (1000 mg/kg) is strongly recommended.
- Use of diesel fuel with sulfur content 0.10% (1000 mg/kg) to 0.50% (5000 mg/kg) may result in REDUCED oil and filter change intervals as shown in the table.
- BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 mg/kg), contact your John Deere dealer.
- DO NOT use diesel fuel with sulfur content greater than 1.00% (10 000 mg/kg).

IMPORTANT: When using biodiesel blends greater than B20, reduce the oil and filter service interval by 50% or monitor engine oil based on test results from Oilscan.

Oil types in the table include:

- John Deere Plus-50™ II and John Deere Plus-50
- “Other Oils” include John Deere Torq-Gard Supreme™, API CJ-4, API CI-4 PLUS, API CI-4, ACEA E9, ACEA E7, ACEA E6, ACEA E5, or ACEA E4 oils.

Use of lower specification oils in Tier 3 engines may result in premature engine failure.

NOTE: The 500 hour extended oil and filter change interval is only allowed if all the following conditions are met:

- *Engine equipped with an extended drain interval oil pan*
- *Use of diesel fuel with sulfur content less than 0.50% (5000 mg/kg)*
- *Use of John Deere Plus-50™ II or John Deere Plus-50 oil*
- *Use of an approved John Deere oil filter*

	U.S. Tier 3 and EU Stage III A - PowerTech Plus™				**U.S. Tier 3 and EU Stage III A -** PowerTech™		
	Oil Pan Size (L/kW)				Oil Pan Size (L/kW)		
Oil pan capacity	Greater than or equal to 0.10	Greater than or equal to 0.12	Greater than or equal to 0.14	Greater than or equal to 0.22	Greater than or equal to 0.10	Greater than or equal to 0.12	Greater than or equal to 0.14
Fuel Sulfur	Less than 0.10% (1000 mg/kg)				Less than 0.10% (1000 mg/kg)		
Plus-50	375 hours	500 hours	500 hours	500 hours	375 hours	500 hours	500 hours
Other Oils	250 hours	250 hours	250 hours	250 hours	250 hours	250 hours	250 hours
Fuel Sulfur	0.10 - 0.20% (1000 - 2000 mg/kg)				0.10 - 0.20% (1000 - 2000 mg/kg)		
Plus-50	300 hours	300 hours	500 hours	500 hours	300 hours	400 hours	500 hours
Other Oils	200 hours	200 hours	250 hours	250 hours	200 hours	200 hours	250 hours
Fuel Sulfur	0.20 - 0.50% (2000 - 5000 mg/kg)				0.20 - 0.50% (2000 - 5000 mg/kg)		
Plus-50	250 hours	250 hours	300 hours	500 hours	275 hours	350 hours	500 hours
Other Oils	150 hours	150 hours	200 hours	250 hours	150 hours	175 hours	250 hours
Fuel Sulfur	0.50 - 1.00% (5000 - 10 000 mg/kg)				0.50 - 1.00% (5000 - 10 000 mg/kg)		
Plus-50	Contact John Deere Dealer (dealer refers to DTAC solutions)				187 hours	250 hours	250 hours
Other Oils	Contact John Deere Dealer (dealer refers to DTAC solutions)				125 hours	125 hours	125 hours
The service interval of “Other Oils” may be extended only if oil analysis is performed to determine the actual service life, to a maximum not to exceed that of Plus-50.							

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Torq-Gard Supreme is a trademark of Deere & Company
PowerTech Plus is a trademark of Deere & Company
PowerTech is a trademark of Deere & Company

DX,ENOIL13 -19-03AUG09-1/1

Oil Information for Interim Tier 4 Engines (see application list)

The following oil information (DX,ENOIL14 and DX,ENOIL15) applies to engines that meet Interim Tier 4 emission standards.

CD03523,00001CB -19-10MAR09-1/1

Diesel Engine Oil — Interim Tier 4, Final Tier 4, Stage IIIB, and Stage IV

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

John Deere Plus-50™ II is the recommended engine oil.

Extended service intervals may apply when John Deere Plus-50™ II engine oil is used. Refer to the engine oil drain interval table and consult your John Deere dealer for more information.

If John Deere Plus-50™ II engine oil is not available, engine oil meeting one or more of the following may be used:

- API Service Category CJ-4
- ACEA Oil Sequence E9
- ACEA Oil Sequence E6

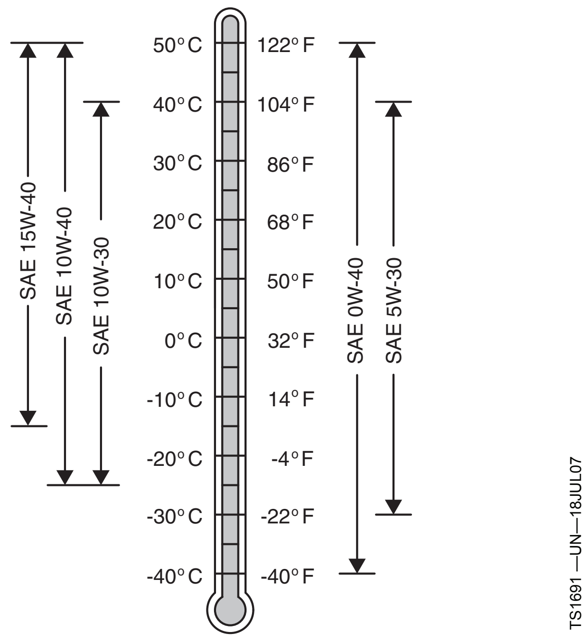
DO NOT use engine oil containing more than 1.0% sulfated ash, 0.12% phosphorus, or 0.4% sulfur.

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.

IMPORTANT: Use only ultra low sulfur diesel (ULSD) fuel with a maximum sulfur content of 15 mg/kg (15 ppm).

Plus-50 is a trademark of Deere & Company



Oil Viscosities for Air Temperature Ranges

DX,ENOIL14 -19-15JUN10-1/1

Diesel Engine Oil and Filter Service Intervals

The oil and filter service intervals in the following table should be used as guidelines. Actual service intervals also depend on operation and maintenance practices. It is suggested to use oil analysis to determine the actual useful life of the oil and to aid in selection of the proper oil and filter service interval.

Change the oil and filter at least once every 12 months even if the hours of operation are fewer than the otherwise recommended service interval.

Oil and filter service intervals are based on a combination of oil pan capacity and the type of engine oil and filter used.

Diesel fuel sulfur level will affect engine oil and filter service intervals.

Use of diesel fuel with sulfur content less than 0.0015% (15 mg/kg) is required.

IMPORTANT: When using biodiesel blends greater than B20, reduce the oil and filter service interval by 50% or monitor engine oil based on test results from Oilscan.

Oil types in the table are:

- John Deere Plus-50™ II
- “Other Oils” include oils meeting API CJ-4, ACEA E9, or ACEA E6.

Use of other specification oils in Interim Tier 4 and Stage IIIB engines can result in premature failure.

NOTE: The 500 hour extended oil and filter change interval is only allowed if all the following conditions are met:

- *Engine equipped with an extended drain interval oil pan*
- *Use of diesel fuel with sulfur content less than 0.0015% (15 mg/kg)*
- *Use of John Deere Plus-50™ II oil*
- *Use of an approved John Deere oil filter*

	U.S. Interim Tier 4 and EU Stage IIIB	
Oil Pan Capacity (L/kW)	Greater than or equal to 0.10	Greater than or equal to 0.12
John Deere Plus-50™ II	375 hours	500 hours
Other Oils	250 hours	250 hours

Plus-50 is a trademark of Deere & Company

DX,ENOIL15 -19-03AUG09-1/1

Lubricant Storage

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

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

Mixing of Lubricants

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Consult your John Deere dealer to obtain specific information and recommendations.

DX,LUBMIX -19-18MAR96-1/1

Diesel Engine Coolant (engine with wet sleeve cylinder liners)

Preferred Coolants

The following pre-mix engine coolants are preferred:

- **John Deere COOL-GARD™II**
- **John Deere COOL-GARD II PG**

COOL-GARD II pre-mix coolant is available in several concentrations with different freeze protection limits as shown in the following table.

COOL-GARD II pre-mix	Freeze Protection Limit
COOL-GARD II 20/80	-9 °C (16 °F)
COOL-GARD II 30/70	-16 °C (3 °F)
COOL-GARD II 50/50	-37 °C (-34 °F)
COOL-GARD II 55/45	-45 °C (-49 °F)
COOL-GARD II PG 60/40	-49 °C (-56 °F)
COOL-GARD II 60/40	-52 °C (-62 °F)

Not all COOL-GARD II pre-mix products are available in all countries.

Use COOL-GARD II PG when a non-toxic coolant formulation is required.

Additional Recommended Coolants

The following engine coolant is also recommended:

- John Deere COOL-GARD II Concentrate in a 40—60% mixture of concentrate with quality water.

IMPORTANT: When mixing coolant concentrate with water, do not use less than 40% or greater than 60% concentration of coolant. Less than 40% gives inadequate additives for corrosion protection. Greater than 60% can result in coolant gelation and cooling system problems.

Other Coolants

Other ethylene glycol or propylene glycol base coolants may be used if they meet the following specification:

- Pre-mix coolant meeting ASTM D6210 requirements
- Coolant concentrate meeting ASTM D6210 requirements in a 40—60% mixture of concentrate with quality water

If coolant meeting one of these specifications is unavailable, use a coolant concentrate or pre-mix coolant that has a minimum of the following chemical and physical properties:

- Provides cylinder liner cavitation protection according to either the John Deere Cavitation Test Method or a fleet study run at or above 60% load capacity
- Is formulated with a nitrite-free additive package
- Protects the cooling system metals (cast iron, aluminum alloys, and copper alloys such as brass) from corrosion

Water Quality

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate.

Coolant Drain Intervals

Drain and flush the cooling system and refill with fresh coolant at the indicated interval, which varies with the coolant used.

When COOL-GARD II or COOL-GARD II PG is used, the drain interval is 6 years or 6000 hours of operation.

If a coolant other than COOL-GARD II or COOL-GARD II PG is used, reduce the drain interval to 2 years or 2000 hours of operation.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

Do not mix ethylene glycol and propylene glycol base coolants.

Do not use coolants that contain nitrites.

DX,COOL3 -19-15MAY13-1/1

Drain Intervals for Diesel Engine Coolant

Drain and flush the cooling system and refill with fresh coolant at the indicated interval, which varies with the coolant used.

John Deere COOL-GARD™ II Premix, COOL-GARD II PG Premix and COOL-GARD II Concentrate are maintenance free coolants for up to six years or 6000 hours of operation, provided that the cooling system is topped off using only John Deere COOL-GARD II Premix or COOL-GARD II PG Premix.

Test the coolant condition annually with Coolant Test Strips designed for use with John Deere COOL-GARD II coolants. If the test strip chart indicates that additive is required, add John Deere COOL-GARD II Coolant Extender as directed.

COOL-GARD is a trademark of Deere & Company

If John Deere COOL-GARD™ II Premix, COOL-GARD II PG Premix, or COOL-GARD II Concentrate is used, but the coolant is not tested OR additives are not replenished by adding John Deere COOL-GARD II Coolant Extender, the drain interval is four years or 4000 hours of operation. This drain interval only applies to COOL-GARD II coolants that have been maintained within a 40—60% mixture of concentrate with quality water.

If a coolant other than COOL-GARD II, or COOL-GARD II PG is used, reduce the drain interval to two years or 2000 hours of operation.

DX,COOL11 -19-14APR11-1/1

Operating in Warm Temperature Climates

John Deere engines are designed to operate using recommended engine coolants.

Always use a recommended engine coolant, even when operating in geographical areas where freeze protection is not required.

IMPORTANT: Water may be used as coolant *in emergency situations only.*

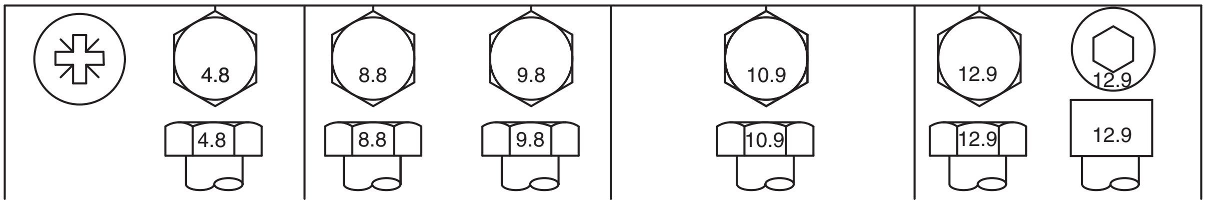
Foaming, hot surface aluminum and iron corrosion, scaling, and cavitation occur when water is used as the coolant, even when coolant conditioners are added.

Drain cooling system and refill with recommended engine coolant as soon as possible.

DX,COOL6 -19-15MAY13-1/1

Metric Bolt and Screw Torque Values

TS1670 —UN—01MAY03



Bolt or Screw Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
	N·m	**lb.-in.**	**N·m**	**lb.-in.**	**N·m**	**lb.-in.**	**N·m**	**lb.-in.**	**N·m**	**lb.-in.**	**N·m**	**lb.-in.**	**N·m**	**lb.-in.**	**N·m**	**lb.-in.**
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N·m	**lb.-ft.**	**N·m**	**lb.-ft.**	**N·m**	**lb.-ft.**	**N·m**	**lb.-ft.**
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N·m	**lb.-ft.**	**N·m**	**lb.-ft.**	**N·m**	**lb.-ft.**								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N·m	**lb.-ft.**														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

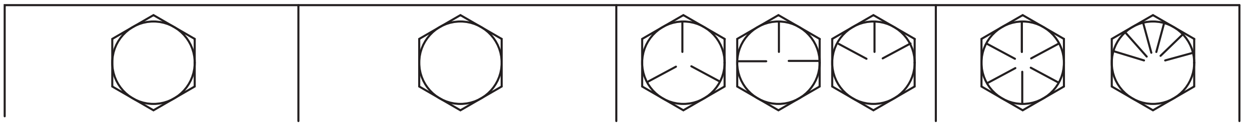
Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] *"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.*
[b] *"Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B, F13E or F13H zinc flake coating.*

DX,TORQ2 -19-12JAN11-1/1

Unified Inch Bolt and Screw Torque Values

TS1671 —UN—01MAY03



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

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

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

[a] *Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.*
[b] *“Lubricated” means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.*
[c] *“Dry” means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B, F13E or F13H zinc flake coating.*

DX,TORQ1 -19-12JAN11-1/1

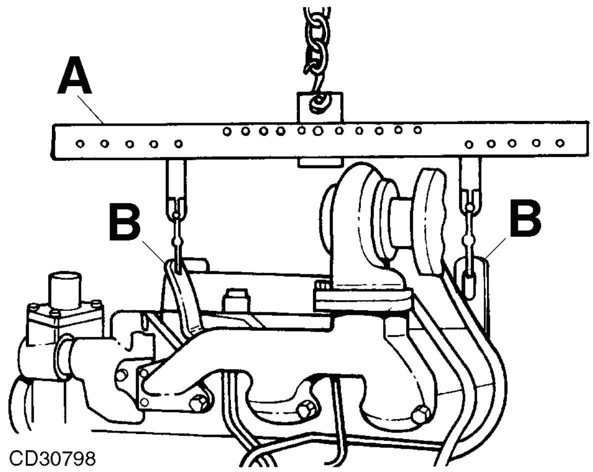
Clean Engine

1. Cap or plug all openings on engine. If electrical components (starting motor, alternator, etc...) are not removed prior to cleaning, cover with plastic and tape securely to prevent moisture from entering.
2. Steam-clean engine thoroughly.

IMPORTANT: Never steam-clean or pour cold water on an injection pump while it is still warm. To do so may cause seizure of pump parts.

CD,CTM125,006 -19-01DEC97-1/1

Engine Lifting Procedure



CD30798 —UN—26FEB01

JDG23 Engine Lifting Sling

NOTE: See the machine technical manual for additional information on removing engine from the machine.

CAUTION: The only recommended method for lifting the engine is with JDG23 Engine Lifting Sling (A) and safety approved lifting straps (B).

Approved lifting straps are designed only to lift the engine and small accessories, such as hydraulic pump or air compressor mounted to the engine auxiliary gear drive, or belt-driven components, such as air conditioning compressor or alternator. In case where larger components, such as PTO's, transmissions, generators or air compressor are attached to other locations on the engine, technician is responsible for providing adequate lifting devices.

NOTE: If engine lifting straps are misplaced, they should be procured through Service Parts channel under part number JD244 (JD-244)[1].

1. Attach JDG23 Engine Lifting Sling (A) to engine lifting straps (B) and to overhead hoist or to floor crane.
2. Carefully lift engine and slowly lower to desired location.

[1] *Order JD-244 when tool is ordered from European Parts Distribution Center (EPDC).*

CD,CTM125,007 -19-09JUL04-1/1

Engine Repair Stand

To facilitate engine repair, D01003AA or D05223ST repair stand can be used in conjunction with D05225ST adapter.

Safety Precautions

This repair stand should be used only by qualified service technicians familiar with this equipment.

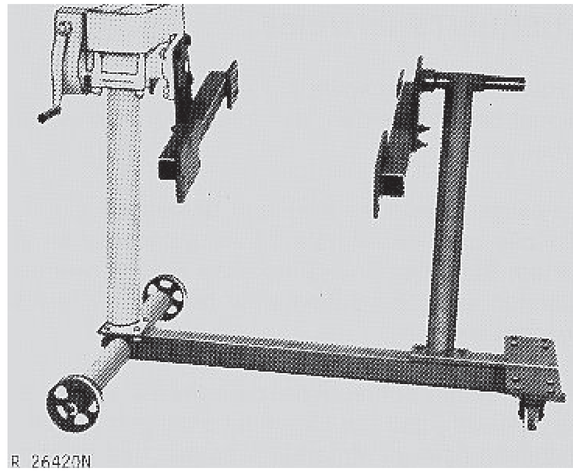
To maintain shear strength specifications, alloy steel SAE Grade 8 or higher cap screws must be used to mount adapters or engine.

For full thread engagement, be certain that tapped holes in adapters and engine blocks are clean and not damaged. A thread length engagement equal to 1-1/2 screw diameters minimum is required to maintain strength requirements.

To avoid structural damage or personal injury, do not exceed the maximum weight capacity.

To prevent possible personal injury due to engine slippage, recheck to make sure engine is solidly mounted before releasing support from engine lifting device.

Never permit any part of the body to be positioned under a load being lifted or suspended. Accidental slippage may result in personal injury.

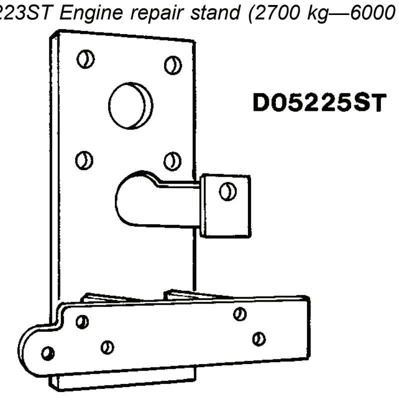


R26420N —UN—22MAY95

D01003AA Repair Stand (900 kg—2000 lb.)

CD31030 —UN—11FEB09

D05223ST Engine repair stand (2700 kg—6000 lb.)



D05225ST —UN—22MAY95

D05225ST Adapter

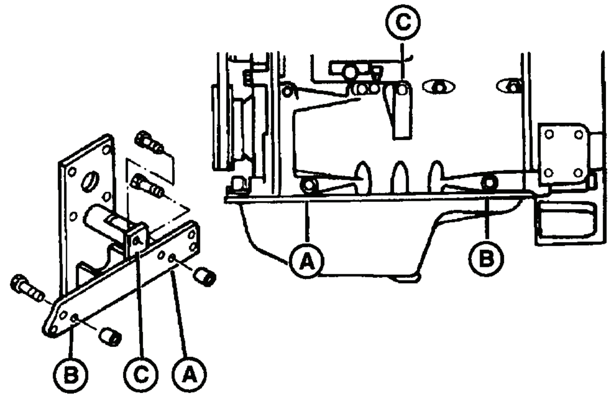
CD,CTM125,008 -19-13FEB09-1/1

Mounting Engine on Repair Stand

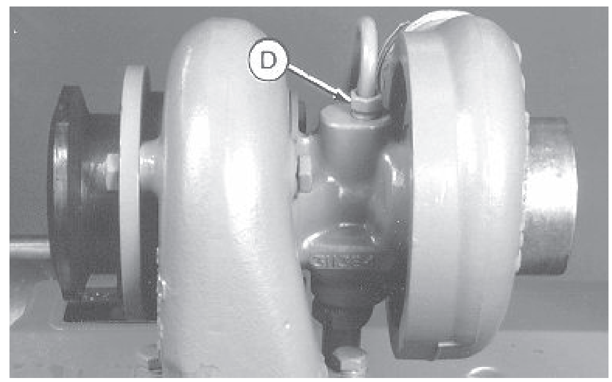
NOTE: In case of turbocharged engine with low-profile design, remove turbocharger before mounting engine onto repair stand.

1. Use a 73 mm spacer at hole (A) and a 79 mm spacer at hole (B).
2. Mount engine to adapter using the cap screws listed below at the hole locations as shown:
   - Holes A and B....9/16-12 x 4-1/2 in (114 mm)
   - Hole C...............9/16-12 x 1-1/12 in (38 mm)
3. Drain all engine oil and coolant
4. Disconnect oil inlet line at turbocharger (D) to prevent a hydraulic lock.

NOTE: Hydraulic lock occurs when trapped oil in the oil filter housing drains through the turbocharger, the exhaust and intake manifolds, and then into the cylinder head. After starting the engine, the trapped oil in the manifold and head is released into the cylinders filling them with oil causing hydraulic lock and severe engine damage.



CD30527 —UN—16JUN98



CD30528 —UN—19MAY98

CD,CTM125,009 -19-04JAN01-1/1

Engine Disassembly Sequence

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

1. Drain all coolant and engine oil. Check engine oil for metal contaminates (see Groups 25 and 30).
2. Remove fan belts, fan, and alternator (see Group 30).
3. Remove turbocharger (if equipped) and exhaust manifold (see Group 35).
4. Remove rocker arm cover with vent tube. On engines having an Option Code label on rocker arm cover, be careful not to damage label (see Group 05).
5. Remove rocker arm assembly and push rods. Keep rods in sequence (see Group 05). Check for bent push rods and condition of wear pad contact surfaces on rockers.
6. Remove thermostat housing and by-pass tube (see Group 30).
7. Remove oil cooler piping and water pump (see Groups 25 and 30).
8. Remove dipstick, oil filter, and engine oil cooler. Discard standard-flow oil cooler if oil contained metal particles (see Group 25).
9. Remove starting motor.
10. Remove fuel filter, fuel transfer pump, and fuel lines (see Group 40).
11. Remove injection lines, injection pump, and injection nozzles (see Group 40).
12. Remove cylinder head (see Groups 05 and 10).
13. Remove cam followers. Keep in same sequence as removed (see Group 20).
14. Remove oil pan (see Group 25).
15. Remove crankshaft pulley (see Group 15).
16. Remove oil pressure regulating valve assembly (see Group 25).
17. Remove timing gear cover (see Group 20).
18. Remove oil pump drive gear, outlet tube (and its O-ring in block) and pump body (see Group 25).
19. Remove oil deflector, timing gears and camshaft. Perform wear checks (see Group 20).
20. Remove engine front plate (see Group 20).
21. Remove lube oil system by-pass valve (see Group 25).
22. Remove flywheel and flywheel housing (see Group 15).
23. Stamp cylinder number on rod (if required). Remove pistons and rods. Perform wear checks with PLASTIGAGE® (see Group 10).
24. Remove main bearings and crankshaft. Perform wear checks with PLASTIGAGE® (see Group 15).
25. Remove cylinder linersand mark each one with cylinder number from which removed (see Group 10).
26. Remove piston cooling orifices (see Groups 10 and 15).
27. Remove camshaft bushings (if equipped), see Group 10.
28. Remove cylinder block plugs and serial number plate (as required) when block is to be put in a “hot tank” (see Group 10).
29. Clean out liner bores (upper and lower areas) with nylon brush (see Group 10).
30. Measure cylinder block (see Groups 10, 15, and 20).

PLASTIGAGE is a trademark of DANA Corp.

CD,CTM125,010 -19-01DEC97-1/1

Sealant Application Guidelines

Listed below are sealants which have been tested and are used by the John Deere factory to control leakage and assure hardware retention. Use the following recommended sealants when re-assembling your John Deere engine to assure quality performance.

JOHN DEERE Part Number	CONTENT	PRODUCT	EXAMPLE OF USE
TY9370	6 ml tube	LOCTITE® 242 Thread Lock & Sealer Medium Strengh (blue)	Cap screws: Crankshaft pulley Flywheel
TY9371	6 ml tube	LOCTITE® 271 Thread Lock & Sealer High Strenght (clear)	Studs: Water pump-to-cylinder block Injection pump-to-front plate Exhaust manifold-to-turbocharger Oil filter nipple
T43514	50 ml tube	LOCTITE® 277 Plastic Gasket High Strength (red)	Steel cap plugs: Cylinder block, cylinder head Water pump
DD15664 or TY6304	25 ml tube 50 ml bottle	LOCTITE® 515 Flexible Sealant Gen. purpose (purple)	Flywheel housing-to-cylinder block Front plate/Timing gear-to-oil pan
TY9374 or TY9375	6 ml tube 50 ml bottle	LOCTITE® 592 Pipe Sealant with TEFLON® (white)	Pipe plugs: Cylinder block, water pump Dipstick tube threads Temperature sending unit
TY15969	50 ml bottle	LOCTITE® 609 Retaining Compound (green)	Wear ring sleeve-to-crankshaft

LOCTITE is a trademark of Loctite Corp.
TEFLON is a trademark of Du Pont Co.

CD,CTM125,011 -19-01DEC97-1/1

Engine Re-Assembly Sequence

The following re-assembly sequence is suggested when engine has been completely disassembled. Be sure to check run-out specifications, clearance tolerances, torques, etc. as engine is assembled. Refer to the appropriate repair group when assembling engine components.

1. Install all plugs (and serial number plates) in cylinder block that were removed to service block (see Groups 10 and 15).
2. Install clean piston cooling orifices and new camshaft bushings (see Groups 10 and 20).
3. Install cylinder liners without O-rings and measure protrusion. Install liners with O-rings (see Group 10).
4. Install crankshaft and main bearings (see Group 15).
5. Install flywheel housing, rear oil seal and flywheel (see Group 15).
6. Install pistons and rods. Check for piston protusion (see Group 10).
7. Install lube oil system by-pass valve.
8. Install front plate (see Group 20).
9. Install oil outlet tube, O-ring in block, and oil pump (see Group 25).
10. Install injection pump (STANADYNE or DELPHI/LUCAS) on front plate (see Group 40).
11. Install camshaft,upper and lower timing gears, and oil deflector (see Group 20).
12. Time all gears to TDC, No. 1 cylinder on compression stroke (see Group 20).
13. Install timing gear cover (with new front seal), see Group 20.
14. Install oil pan (see Group 25).
15. Install oil pressure regulating valve, see Group 25.
16. Install cam follower in the same sequence as removed (see Group 20).
17. Install cylinder head gasket, cylinder head, push rods, and rocker arm assembly (see Group 05).
18. Install injection nozzles(with new seals) and injection lines (see Group 40).
19. Install fuel filter, fuel transfer pump, and fuel lines (see Group 40).
20. Install starting motor.
21. Install engine oil cooler, new oil filter, and dipstick. Never clean or reuse a contaminated standard-flow oil cooler. Install a new one (see Group 25).
22. Install thermostat housing with thermostat (see Group 35).
23. Install exhaust manifold and turbocharger. Prelube the turbocharger (see Group 35).
24. Install water pump and hoses (see Group 35).
25. Install crankshaft pulley (see Group 15).
26. Install alternator, fan, and fan belts (see Group 30).
27. Adjust valves and install rocker arm cover (see Group 05).
28. Install vent tube.
29. Fill engine with break-in oil and proper coolant.
30. Perform engine break-in and perform normal standard performance checks.

CD,CTM125,012 -19-01DEC97-1/1

Engine break-in guidelines

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

1. Main bearings, rod bearings, crankshaft, or any combination of these parts have been replaced.
2. Pistons, rings, or liners have been replaced.
3. Rear crankshaft oil seal and wear sleeve have been replaced. (Primary objective is to see if oil seal still leaks).
4. Cylinder head has been removed.
5. Injection pump has been removed or critical adjustments have been made while it is on the engine. (Primary objective is to check power).

CD03523,00000DE -19-04JAN01-1/1

Perform engine break-in

Use a dynamometer to perform the following break-in procedure. Fill engine crankcase with oil specified in "Engine break-in oil".

Time	Load	Engine Speed	Remarks
5 minutes	No load	800 rpm	Check oil pressure, coolant temperature and check for leakages
5 minutes	No load	1500 to 2300 rpm	
10 minutes	1/4 load	2000 rpm to rated speed	
15 minutes	1/2 load	2000 rpm to rated speed	
15 minutes	1/2 to 3/4 load	2000 rpm to rated speed	
10 minutes	3/4 to full load	Rated speed	

After break-in, run the engine for 1 or 2 minutes at 1500 rpm, no load, before shutting it off. Check and reset the valve clearances.

NOTE: It is not necessary to retorque the cylinder head cap screws once the engine is broken in.

During the first 100 hours of operation, avoid overloading, excessive idling and no-load operation. After 100 hours, drain the crankcase oil and change the oil filter. Fill the crankcase with oil of the specified viscosity.

CD,3274,G210,2 -19-04JAN01-1/1

Diesel Engine Break-In Oil — Non-Emissions Certified and Certified Tier 1, Tier 2, Tier 3, Stage I, Stage II, and Stage III

New engines are filled at the factory with either John Deere Break-In™ or John Deere Break-In Plus™ Engine Oil. During the break-in period, add John Deere Break-In™ or Break-In Plus™ Engine Oil, respectively, as needed to maintain the specified oil level.

Operate the engine under various conditions, particularly heavy loads with minimal idling, to help seat engine components properly.

If John Deere Break-In™ Engine Oil is used during the initial operation of a new or rebuilt engine, change the oil and filter at a maximum of 100 hours.

If John Deere Break-In Plus™ Engine Oil is used, change the oil and filter at a minimum of 100 hours and a maximum equal to the interval specified for John Deere Plus-50™ II or Plus-50™ oil.

After engine overhaul, fill the engine with either John Deere Break-In™ or Break-In Plus™ Engine Oil.

If John Deere Break-In™ or Break-In Plus™ Engine Oil is not available, use an SAE 10W-30 viscosity grade diesel engine oil meeting one of the following and change the oil and filter at a maximum of 100 hours of operation:

- API Service Classification CE
- API Service Classification CD
- API Service Classification CC
- ACEA Oil Sequence E2
- ACEA Oil Sequence E1

IMPORTANT: Do not use Plus-50™ II, Plus-50™, or engine oils meeting any of the following for the initial break-in of a new or rebuilt engine:

API CJ-4	**ACEA E9**
API CI-4 PLUS	**ACEA E7**
API CI-4	**ACEA E6**
API CH-4	**ACEA E5**
API CG-4	**ACEA E4**
API CF-4	**ACEA E3**
API CF-2	
API CF	

These oils do not allow the engine to break in properly.

John Deere Break-In Plus™ Engine Oil can be used for all John Deere diesel engines at all emission certification levels.

After the break-in period, use John Deere Plus-50™ II, John Deere Plus-50™, or other diesel engine oil as recommended in this manual.

Break-In is a trademark of Deere & Company.
Break-In Plus is a trademark of Deere & Company
Plus-50 is a trademark of Deere & Company.

DX,ENOIL4 -19-15MAY13-1/1

Section 02
Repair and Adjustments

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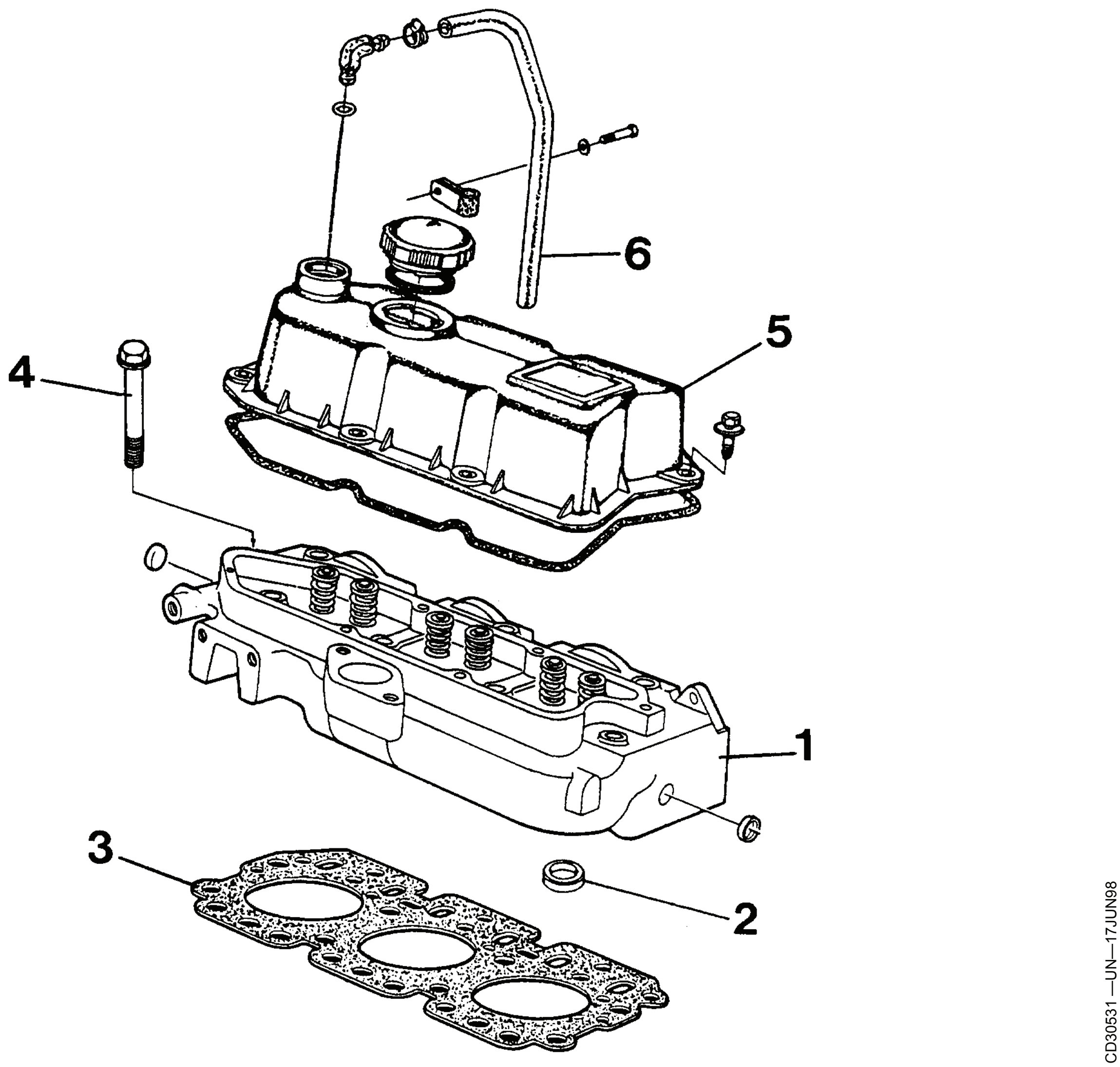
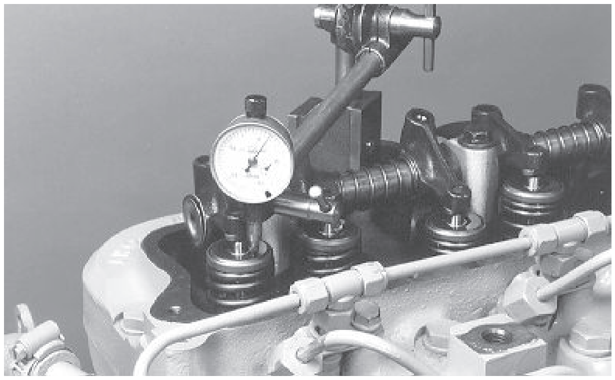
Cylinder Head - Exploded View



1— Cylinder head
2— Valve seat
3— Cylinder head gasket
4— Cylinder head bolt (1/2-13UNC X 112 mm; 4.41 in.)
5— Rocker arm cover
6— Vent tube

CD,CTM125,017 -19-01DEC97-1/1

Check Valve Lift



CD30532 —UN—04MAY98

NOTE: Measuring valve lift can give an indication of wear on cam lobes.

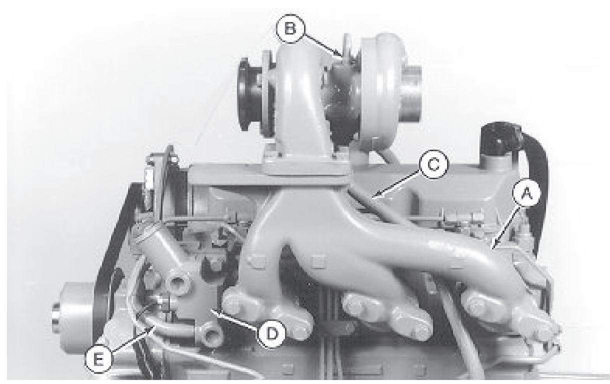
Valve lift—Specification

Intake valve—Valve lift at 0.00 mm (in.) clearance	11.56—12.37 mm (0.455—0.487 in.)
Wear Tolerance	11.13 mm (0.438 in.)
Exhaust valve—Valve lift at 0.00 mm (in.) clearance	11.28—12.12 mm (0.444—0.477 in.)
Wear Tolerance	10.85 mm (0.427 in.)

1. Rotate engine and determine valve locations as indicated under "Valve Clearance" in this group.
2. Adjust valve to zero clearance.
3. Position dial indicator on valve rotator and adjust indicator to "0".
4. Rotate engine and observe indicator reading as valve moves to the fully open position. Compare readings with specifications.
5. Repeat above procedure for all valves and readjust valves to specified clearance after this operation.
6. If valve lift is not within specification, remove and inspect camshaft.

CD,CTM125,018 -19-08JAN01-1/1

Remove Cylinder Head



CD30533A —UN—26FEB01

NOTE: Before removal, mark all parts so that they can be reinstalled in their original positions.

1. Drain engine coolant.
2. Remove exhaust manifold (A). On turbocharged engine, disconnect oil inlet line (B) and oil return line (C), then remove the exhaust manifold and the turbocharger with air inlet as an assembly.
3. Remove thermostat housing (D), by-pass tube (E) and thermostat.

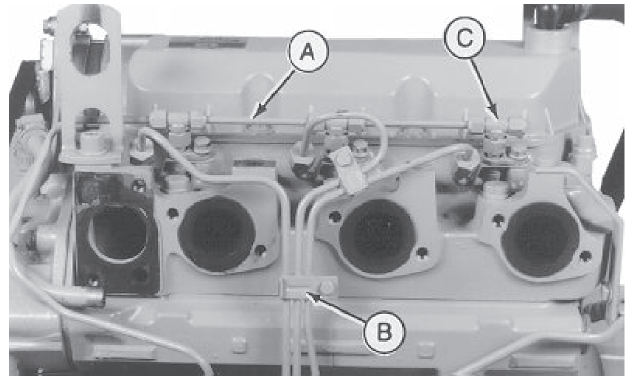
A—Exhaust manifold
B—Turbocharger oil inlet line
C—Turbocharger oil return line
D—Thermostat housing
E—Coolant by-pass tube

Continued on next page

CD,CTM125,024 -19-01DEC97-1/6

4. Remove fuel leak-off (A) and fuel delivery lines (B) as assemblies.
5. Remove fuel injection nozzles (C) as shown in Group 40.

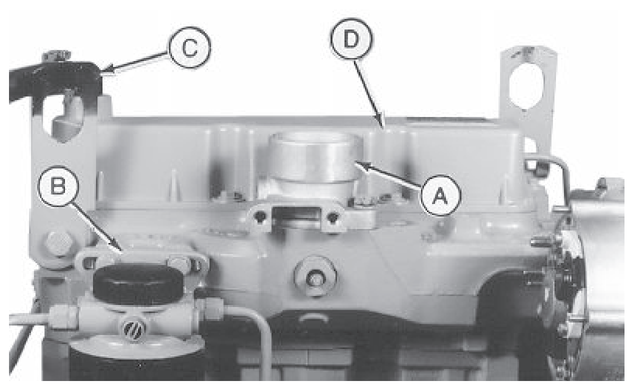
NOTE: Removal of fuel injection nozzles is necessary to prevent them being damaged when cylinder head is removed.



CD30534A —UN—26FEB01

CD,CTM125,024 -19-01DEC97-2/6

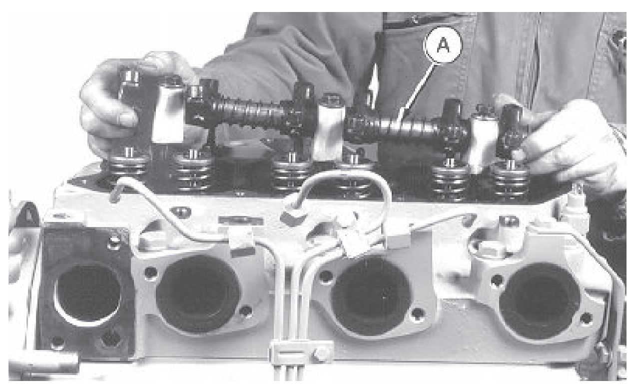
6. Remove air inlet adapter (A).
7. Remove fuel filter (B).
8. Remove crankcase vent hose (C).
9. Remove rocker arm cover (D).



CD30535A —UN—26FEB01

CD,CTM125,024 -19-01DEC97-3/6

10. Remove rocker arm assembly (A).
11. Remove all push rods.

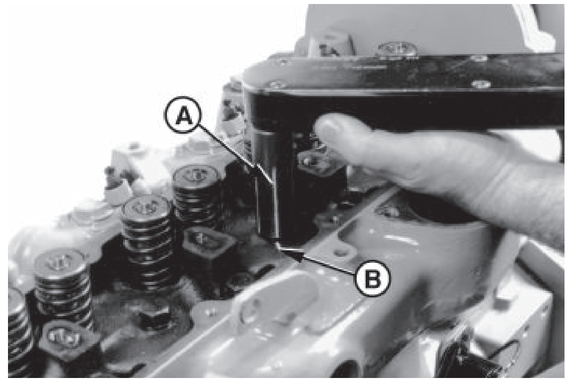


CD30536A —UN—26FEB01

Continued on next page

CD,CTM125,024 -19-01DEC97-4/6

12. In case of cylinder head failure, record torque of each bolt before removing. These values can be asked by the factory for further investigations. To record bolt torque, proceed as follows:
    a. Mark a reference mark (in-line) on socket (A) and cylinder head surface (B)
    b. Loosen bolt at least 1/4 turn then, using a torque wrench, retighten until reference marks be aligned
    c. Record torque
13. Remove all cylinder head bolts.

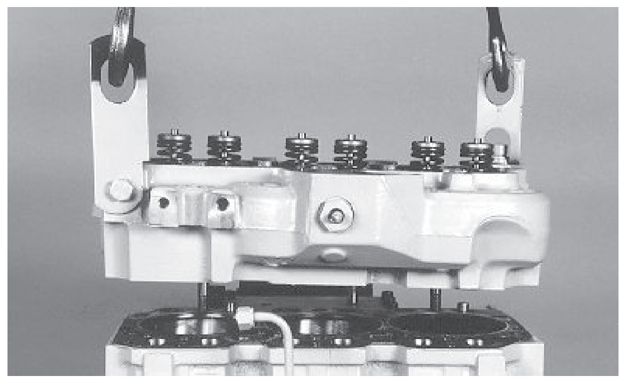


RG6310 —UN—03NOV97

CD,CTM125,024 -19-01DEC97-5/6

14. Lift cylinder head from block. If cylinder head sticks, use a soft hammer to tap cylinder head. Do not use screw driver or prybar which can damage the sealing surface.

NOTE: Do not turn crankshaft after removal of cylinder head until each liner has been secured with washer and cap screw.

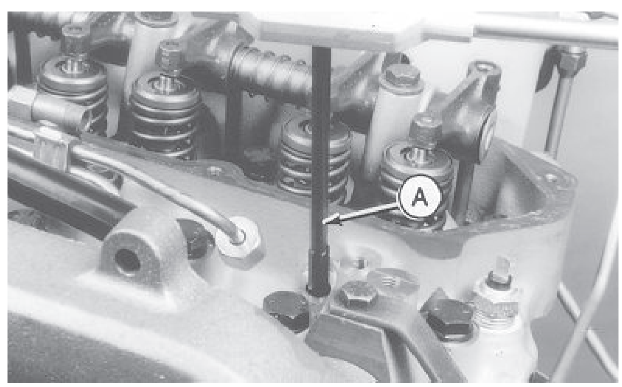

CD30537 —UN—04MAY98

CD,CTM125,024 -19-01DEC97-6/6

Clean Injection Nozzle Bores

Clean injection nozzle bores. Blow debris from bore using compressed air, and plug the bore to prevent entry of foreign material.

NOTE: JDE39 Nozzle Bore Cleaning Tool (A) can be used to clean the 9.5 mm nozzle bores. Always turn the tool clockwise through the bore, even when pulling back. Otherwise tool will get dull.

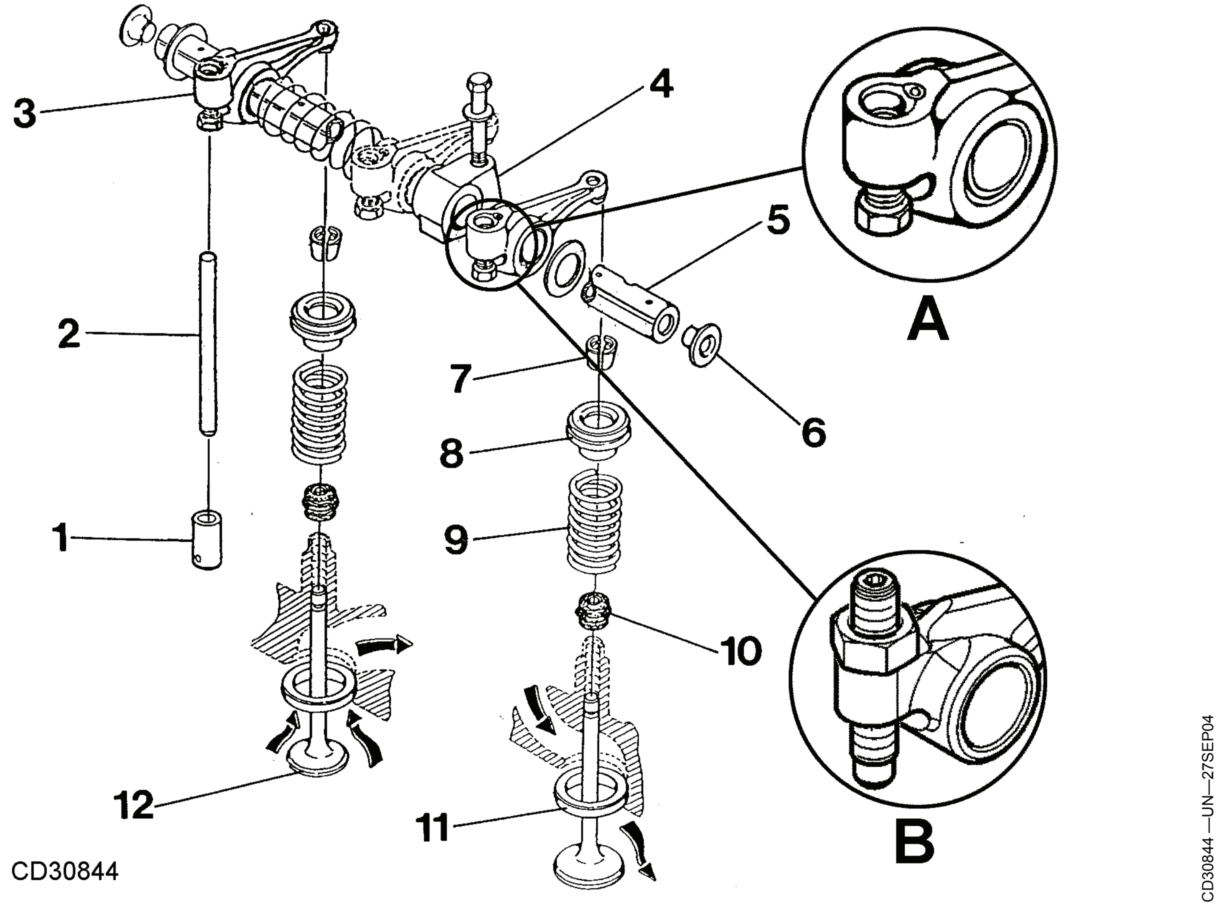


CD30538 —UN—04MAY98

JDE39 Nozzle Bore Cleaning Tool

CD,CTM125,025 -19-10APR12-1/1

Valve Actuating Parts

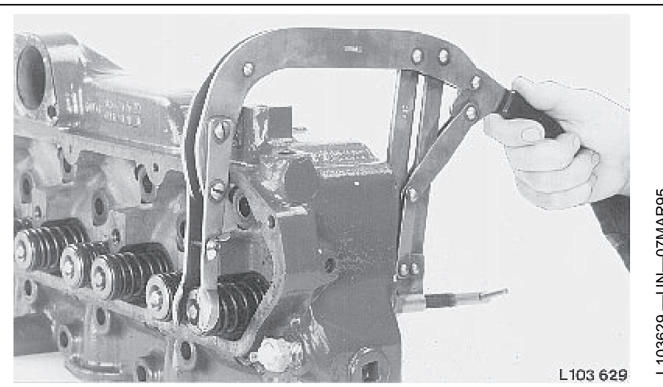


1— Cam follower
2— Push rod
3— Rocker arm
4— Support
5— Shaft
6— Plug
7— Keepers
8— Rotator
9— Spring
10— Metering seal
11— Valve seat insert
12— Valve
A—Earlier design
B—Later design

CD,3274,G05,54 -19-09JUL04-1/1

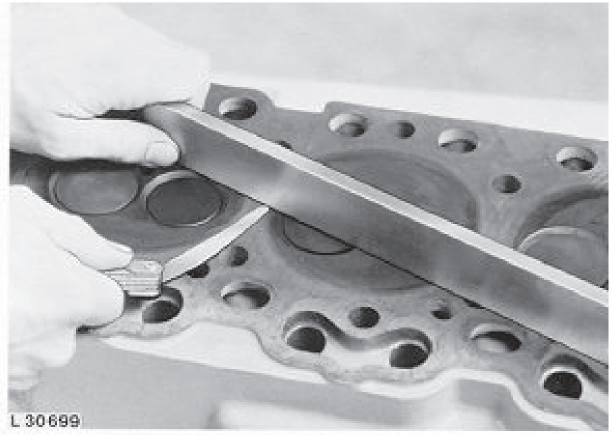
Remove Valves and Valve Springs

1. Using JDE138 Valve Spring Compressor, compress the valve springs far enough to remove keepers.
2. Release spring tension and remove valve rotator and valve spring. Mark each part so that it can be reassembled in the same position it was removed from.
3. Remove valves, marking them for reassembly.
4. Remove valve stem seals from valve guide tower.



CD,3274,G05,8 -19-24FEB92-1/1

Checking Cylinder Head Flatness



L30699 —UN—08AUG89

Check cylinder head flatness using D05012ST Precision Straightedge and feeler gauge. Check lengthwise, crosswise, and diagonally in several places.

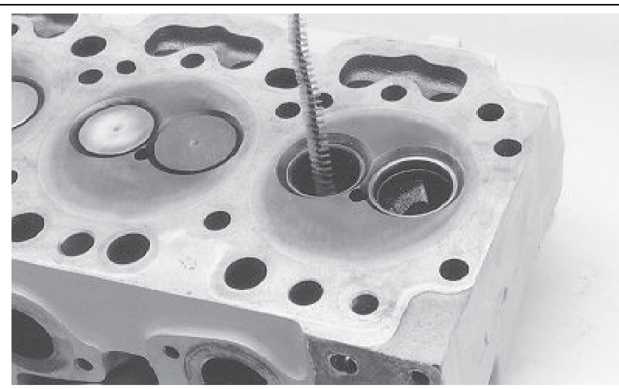
Machined surface of cylinder head must be refaced if flatness is more than specified maximum.

Specification

Combustion face—Flatness...0.08 mm (0.003 in.) Maxi
New cylinder head—Thickness.......................104.87—105.13 mm (4.129—4.139 in.)
Refaced cylinder head—Minimum thickness...104.11 mm (4.099 in.)
Cylinder head combustion face—Surface finish.................................2.5 micron (0.0001 in.) C.L.A.

CD,3274,G05,6 -19-04JAN01-1/1

Clean Valve Guides



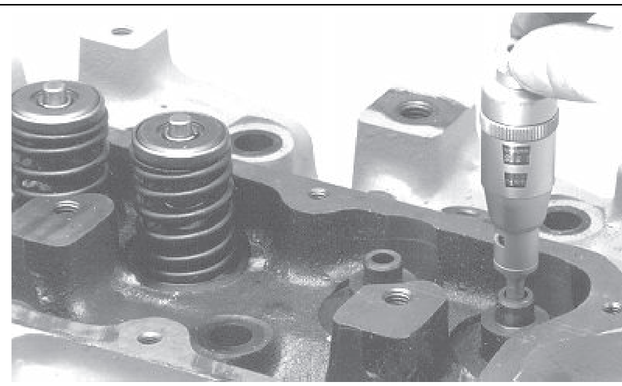
CD30539 —UN—04MAY98

Using a plastic brush, clean valve guides.

NOTE: A few drops of light oil or kerosene will make cleaning of valve guides easier.

CD,CTM125,026 -19-01DEC97-1/1

Measure Valve Guides



CD30550 —UN—04MAY98

Using a micrometer, measure valve guides then compare with specifications.

Valve guide—Specification

Cylinder head bore—Diameter.............................7.912—7.938 mm (0.312—0.313 in.)
Guide-to-valve stem—Clearance...............................0.05—0.10 mm (0.002—0.004 in.)
Wear tolerance ....0.15 mm (0.006 in.)

Oversized valve stem—Specification

1st size—Diameter..+ 0.38 mm (0.015 in.)
2nd size—Diameter...+ 0.76 mm (0.015 in.)

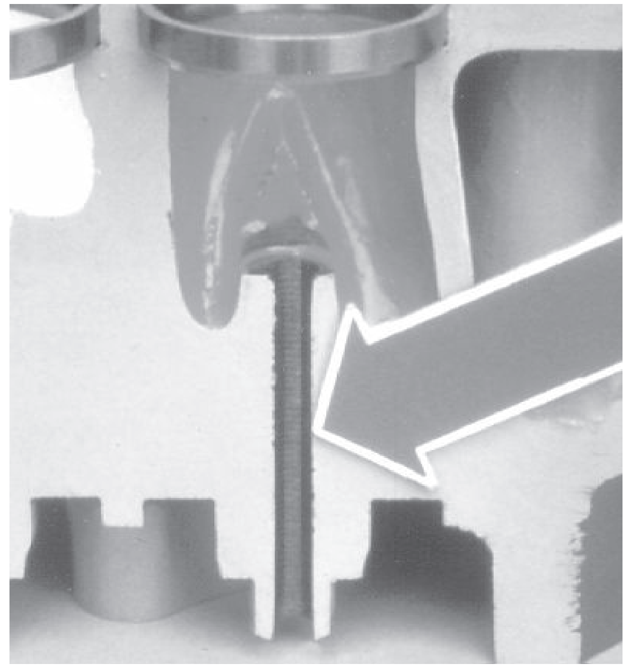
If valve guide-to-stem oil clearance exceeds the wear limit, 0.38 mm (0.015 in.) and 0.76 mm (0.030 in.) oversize valve stems are available. Have valve guides reamed by a qualified workshop to assure the proper guide-to-stem clearance.

If valve guide-to-stem oil clearance exceeds the wear limit, but is less than 0.20 mm (0.008 in.), it is acceptable to knurl guides and ream to size. However, installing oversize valve stems is preferred. (See KNURL VALVE GUIDES).

Continued on next page

CD,CTM125,027 -19-04JAN01-1/2

NOTE: Production valve guides have a 5/16-24 NF modified internal thread (arrow), to lubricate the valve stem with a metered supply of oil. Be sure, when valve guides are reamed that this groove is restored.



CD30548 —UN—19MAY98

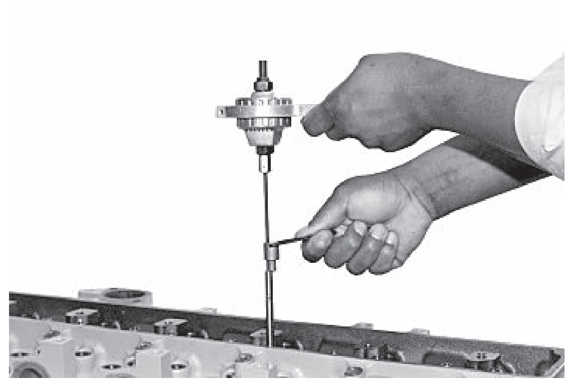
CD,CTM125,027 -19-04JAN01-2/2

Knurl Valve Guides

IMPORTANT: Valve guide knurling should only be done by experienced personnel familiar with equipment and capable of maintaining required specification.

ALWAYS knurl valve guides before reaming to assure proper valve guide-to-stem clearance.

1. Use JT05949 Valve Guide Knurler Kit to knurl valve guides. Use kit exactly as directed by the manufacturer.
2. After knurling, ream valve guide to finished size to provide specified stem-to-guide clearance.



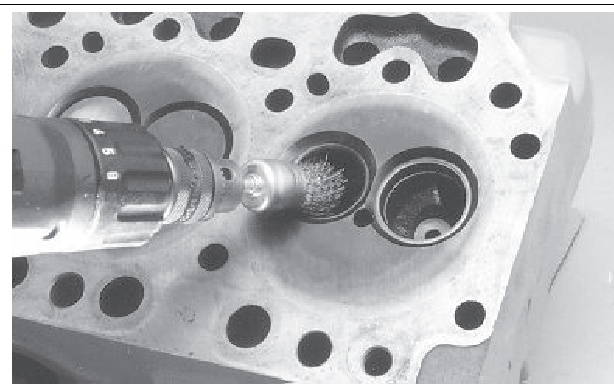
RG7437 —UN—28AUG09

Knurling Valve Guides

CD03523,0000129 -19-26FEB01-1/1

Clean and Inspect Valve Seats

1. Use an electric hand drill with D17024BR End Brush to remove all carbon on valve seats.
2. Inspect seats for excessive wear, cracks, or damage.



CD30540 —UN—04MAY98

CD,CTM125,028 -19-04JAN01-1/1

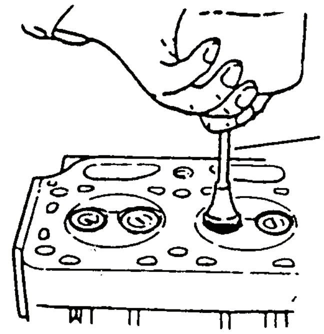
Lapping Valve Seats

Check seat width and contact pattern between seat and valve with blueing. If necessary lap the valve onto its seat using a lapping tool and lapping compound.

Specification

Valve seat—Width	1.50—2.00 mm (0.059—0.079 in.)
Maximum runout	0.08 mm (0.003 in.)
Angle	30°

IMPORTANT: Always check valve recess in cylinder head after lapping, as described in this group.



CD30380

CD30380 —UN—10MAY95

CD,3274,G05,55 -19-04JAN01-1/1

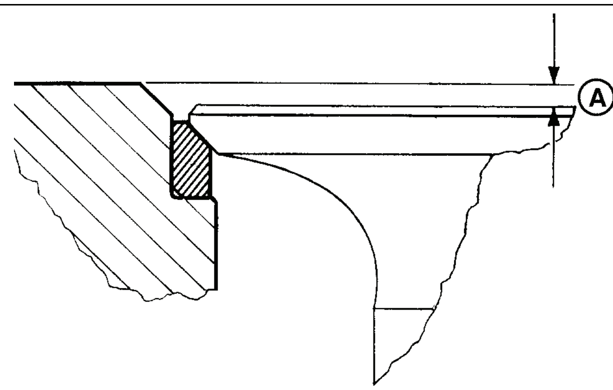
Check Valve Recess

After lapping valve seat or remachining combustion face, install refaced or new valves in cylinder head and check valve recess (A).

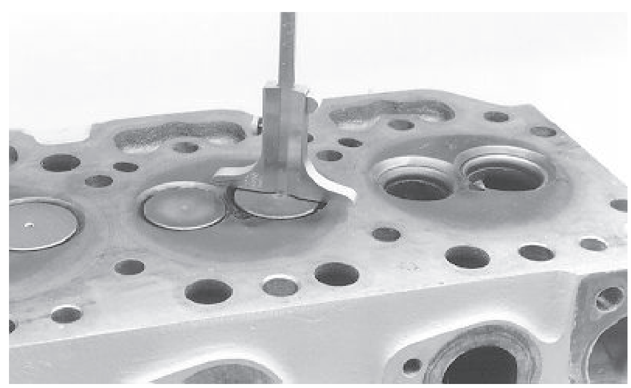
Specification

Intake Valve—Recess	0.61—1.11 mm (0.024—0.044 in.)
Wear tolerance	1.63 mm (0.064 in.)
Exhaust Valve—Recess	1.22—1.72 mm (0.048—0.068 in.)
Wear tolerance	2.26 mm (0.089 in.)

When maximum valve recess is reached, replace valve seat inserts.



RG4756 —UN—31OCT97



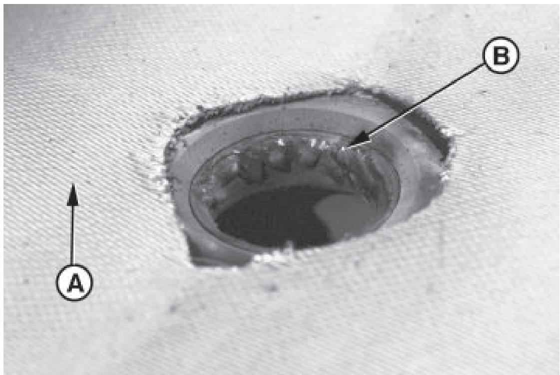
CD30541 —UN—04MAY98

CD,CTM125,029 -19-04JAN01-1/1

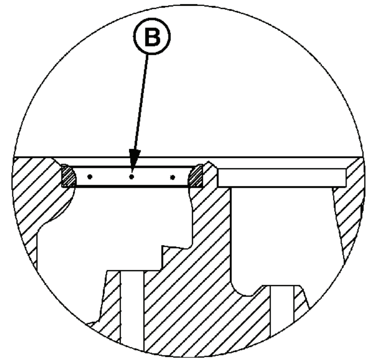
Remove Valve Seat Inserts

Valve seat inserts are made of sintered metal. Following methods, performed by experienced personnel or specialized workshop, can be used to remove inserts.

Using an Arc Welder

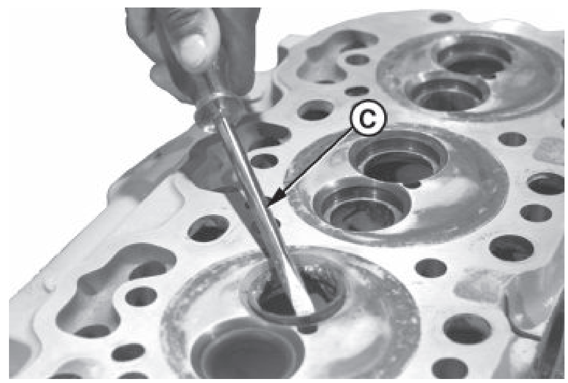


RG7761 —UN—10NOV97



RG7813 —UN—13NOV97

1. Protect the valve guide by installing a cap screw or dowel in guide to protect from weld spatter.
2. Protect the cylinder head surface with a non-flammable welder's cloth (A). Apply a thin bead of weld (B) around internal diameter of valve seat insert. Allow insert to cool and use a screwdriver (C) or similar tool and carefully pry insert from bore.
3. After removal of inserts, thoroughly clean area around valve seat bore and inspect for damage or cracks. Replace cylinder head as necessary.



RG7763 —UN—10NOV97

A—Non-flammable welder's cloth
B—Bead of weld
C—Pry insert from bore

CD,CTM125,031 -19-04JAN01-1/2

Machining Valve Seat Insert

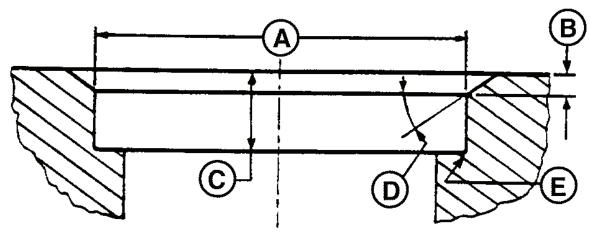
1. Machine insert according to valve seat bore specifications as shown, until a thin layer of material stays in cylinder head.
2. Remove rest of material and clean valve seat bore.

Exhaust valve seat—Specification

Bore—Diameter	42.987—43.013 mm (1.6924—1.6934 in.)
Chamfer height	3.82 mm (0.150 in.) Reference
Depth	9.936—10.064 mm (0.3912—0.3962 in.)
Chamfer angle	38—42°
Radius	0.5 mm (0.019 in.) Maxi

Intake valve seat—Specification

Bore—Diameter	47.104—47.130 mm (1.8545—1.8555 in.)
Chamfer height	3.45 mm (0.136 in.) Reference
Depth	9.936—10.064 mm (0.3912—0.3962 in.)
Chamfer angle	38—42°
Radius	0.5 mm (0.019 in.) Maxi

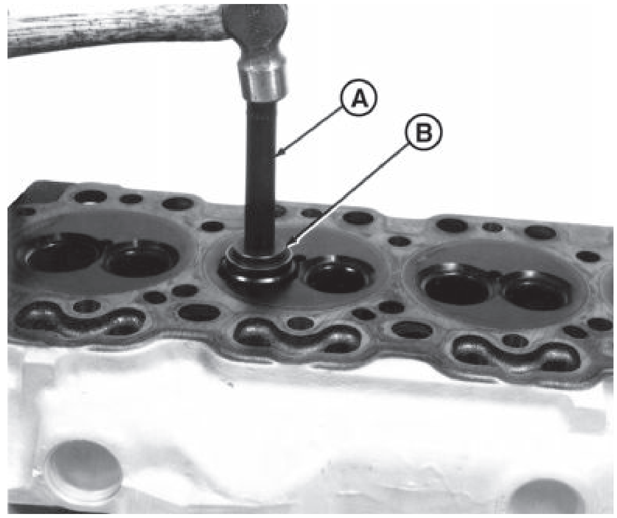


RG5606 —UN—30JUN99

A—Valve seat bore diameter
B—Chamfer height
C—Valve seat bore depth
D—Chamfer angle
E— Radius

CD,CTM125,031 -19-04JAN01-2/2

Valve Seat Insert Installation



RG5653 —UN—31OCT97

1. Freeze the valve seat inserts to -30°C (-22°F).

Specification

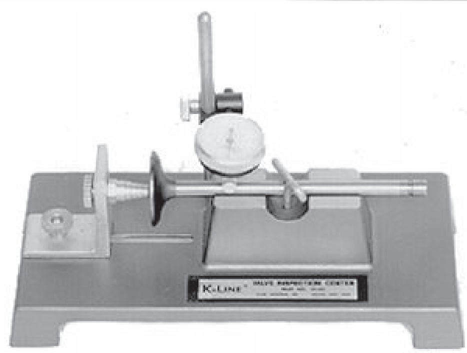
Intake valve insert—Outside diameter.....................................47.205—47.231 mm (1.858—1.859 in.)
Exhaust valve insert—Outside diameter.....................................43.087—43.113 mm (1.696—1.697 in.)

2. Using JDG676 Pilot Driver (A) and JDG675 Valve Seat Insert Installing Adapter (B), install valve seat inserts.
3. Lap valve seats to maintain correct valve recess and valve to valve seat sealing. (See “Lapping valve seats”, in this group)

CD,3274,G05,16 -19-04JAN01-1/1

Check Valves

T82053 —UN—07NOV88



RG4234 —UN—05DEC97

Thoroughly clean and inspect valves to help determine if they can be reused. Replace valves that are burned, cracked, eroded, or chipped.

Specification

Intake valve head—Diameter.............................46.47—46.73 mm (1.830—1.840 in.)
Exhaust valve head—Diameter.............................42.37—42.63 mm (1.668—1.678 in.)

1. Measure valve stem diameter and compare with corresponding valve guide diameter to check clearance (See “Measure valve guides”, in this group).

Specification

Intake Valve Stem—Diameter.........................7.864—7.884 mm (0.3096—0.3104 in.)
Exhaust Valve Stem—Diameter.........................7.848—7.874 mm (0.3090—0.3100 in.)

2. Check for valve face runout and bent valves.

Specification

Valve Face—Maximum permissible runout..0.038 mm (0.0015 in.)

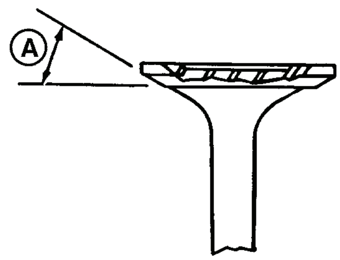
CD,CTM125,032 -19-05JAN01-1/1

Grind Valves

Serviceable valves should be refaced to specified angle (A).

Specification

Valve face—Angle.. 29.25° ± 0.25°



RG4755 —UN—31OCT97

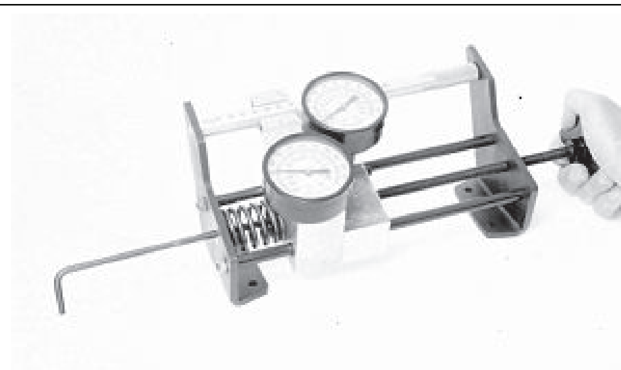
CD,3274,G05,3 -19-05JAN01-1/1

Check Valve Spring Compression

Using D01168AA Spring Compression Tester, check valve spring compression and compare with specifications. Replace if necessary.

Specification

Valve Spring Compression—Free length...approx. 54 mm (2.125 in.)
Load with spring compressed to 46 mm (1.81 in.) .... 240—280 N (54—62 lb.)
Load with spring compressed to 34.5 mm (1.36 in.) .... 590—680 N (133—153 lb.)

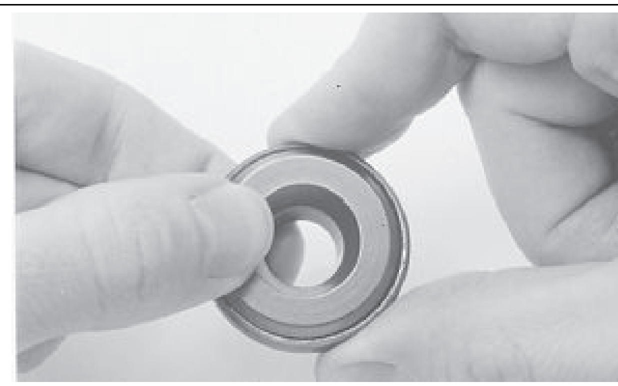


T82054 —UN—08NOV88

CD,3274,G05,19 -19-05JAN01-1/1

Inspect Valve Rotators

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



T91224 —UN—28OCT88

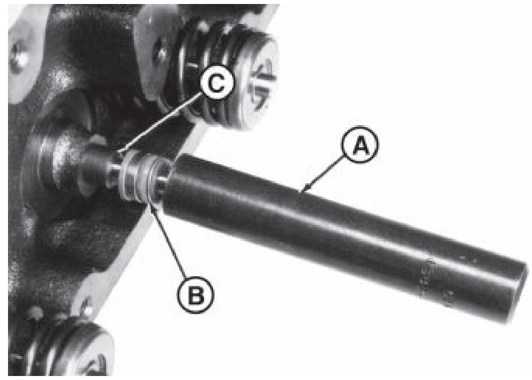
CD,3274,G05,20 -19-24FEB92-1/1

Install Valves

1. Apply engine oil to valve stems and guides.
2. Insert valves in head (in same location as found during removal).

NOTE: Valves must move freely and seat properly.

3. Using JDG678 Valve Stem Seal Installer (A), slide seal (B) over valve stem and onto valve guide tower (C).

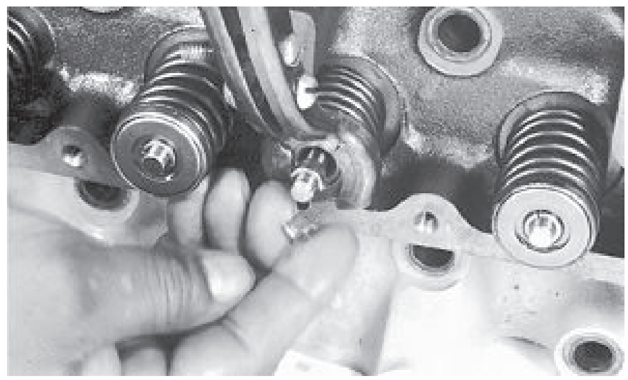


RG5654 —UN—31OCT97

A—JDG678 Valve Stem Seal Installer
B—Stem seal
C—Valve guide tower

CD,3274,G05,21 -19-05JAN01-1/3

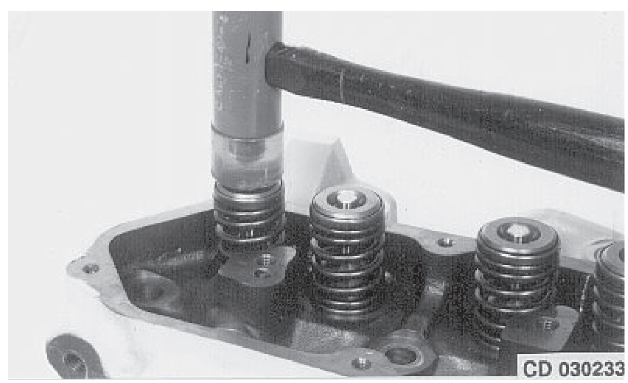
4. Install valve springs and rotators.
5. Compress valve springs using JDE138 Valve Spring Compressor and install new keepers on valves.



RG5655 —UN—12APR90

CD,3274,G05,21 -19-05JAN01-2/3

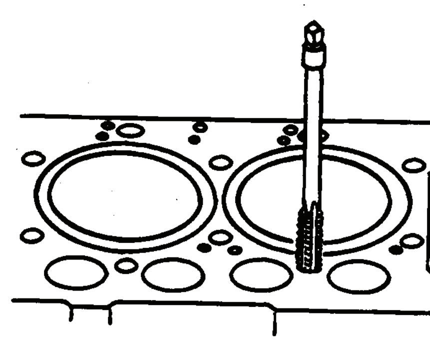
NOTE: After having installed the valves, strike end of each valve three times with a soft mallet to ensure proper positioning of the keepers.

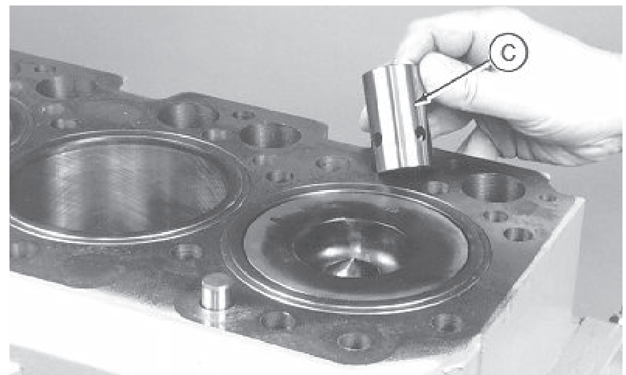


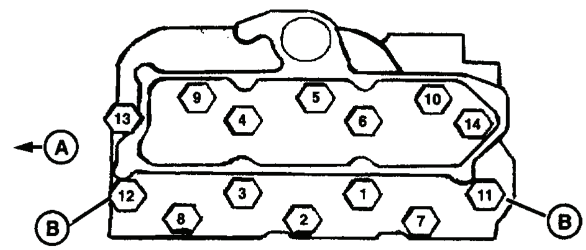
CD30233 —UN—07MAR95

CD,3274,G05,21 -19-05JAN01-3/3

Install Cylinder Head







1. Clean tapped holes in cylinder block using JDG680 Tap (or any 1/2-13 UNC-2A tap). Use compressed air to remove debris or any fluids from cap screw holes.

IMPORTANT: Insure that cam followers (C) are present before cylinder head installation.

2. Install new cylinder head gasket dry (without sealant)

IMPORTANT: Without guide studs, the Viton O-ring attached to cylinder head gasket (at rocker arm lube oil passage) could be damaged when repositioning cylinder head on engine block to align cap screw holes.

3. Install two guide studs in cylinder block at locating holes (B).
4. Position cylinder head over guide studs and lower into place on cylinder block.

NOTE: Always use new cap screws to install cylinder head.

5. Dip new cap screws entirely in clean engine oil.
6. Remove guide studs and install cap screws in all open bores.
7. Tighten cap screws in sequence to the torque specified, beginning with No. 1, then torque turn to specified angle. Use JD-307 Torque Wrench Adapter if necessary.

Cylinder head bolts—Specification

1st step—Torque	100 N·m (75 lb-ft)
2nd step—Torque	150 N·m (110 lb-ft)
Recheck after 5 minutes—Torque	150 N·m (110 lb-ft)
Final step—Torque Turn	60° ± 10°

A—Front of engine
B—Guide stud locations
C—Cam follower

CD,CTM125,034 -19-15FEB06-1/1

Torque Turn Tightening Method

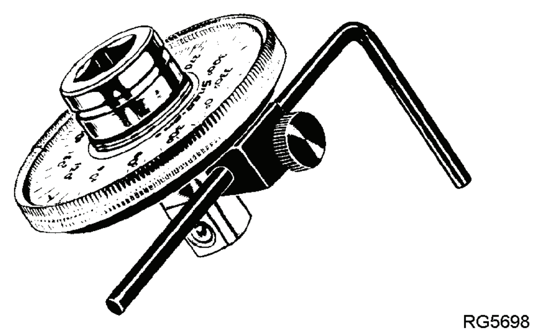
After tightening cap screws to 150 N·m (110 lb-ft), use JT05993 Torque Angle Gauge or the line scribble method below to tighten each cap screw an additional 60° angle.

Line scribe method:

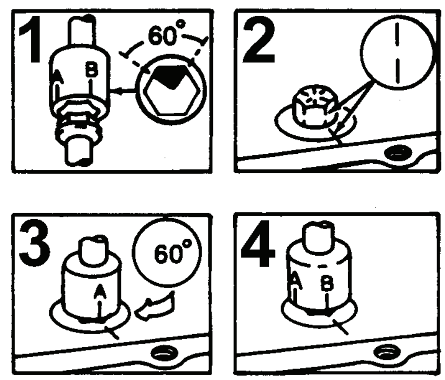
1. Make a mark on socket and make a second mark 60° counterclockwise from the first.
2. Make a mark on cylinder head next to each cap screw.
3. Place socket on cap screw so that first mark aligns with mark on cylinder head.
4. Tighten (in sequence) all cap screws until second mark on socket aligns with mark on cylinder head.

NOTE: The torque turn method eliminates the need to retorque the cylinder head bolts after the first hours of engine operation. However, valve clearance adjustment is still required.

A—Reference mark **B—60° mark**



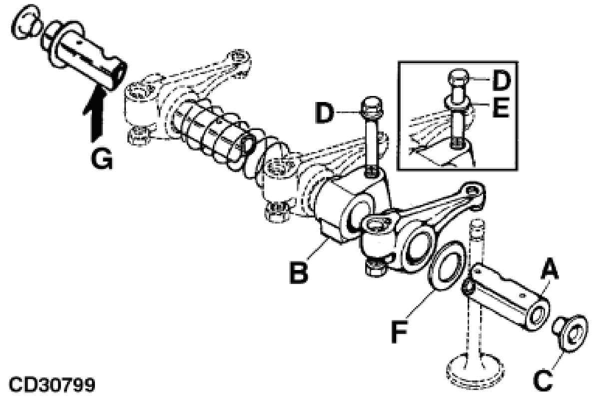
JT05993 Torque Angle Gauge



Line Scribe Torque Turn Method

CD,CTM125,035 -19-03APR00-1/1

Disassembling and Checking Rocker Arm Shaft



CD30799 —UN—05MAR01

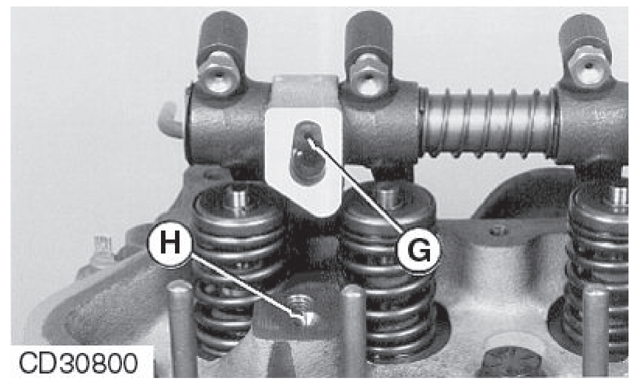
1. Remove plugs (C) and bowed washers (F) from rocker arm shaft.
2. Slide springs, rocker arms and supports off rocker arm shaft, identifying their sequence for reassembly in the same order.
3. Clean all parts with solvent and dry with compressed air.
4. Check all parts for good condition.

Rocker arm—Specification

Shaft—Diameter	19.99—20.02 mm (0.787—0.788 in.)
Wear tolerance	19.94 mm (0.785 in.)
Bore—Diameter	20.07—20.12 mm (0.790—0.792 in.)
Wear tolerance	20.17 mm (0.784 in.)
Spring—Load at 46 mm (1.81 in.) compressed length	18—27 N (4—6 lb.)

5. Replace parts as necessary.

NOTE: If the rocker arm has been damaged by a valve failure, replace it together with the corresponding push rod, valve rotator and keepers.

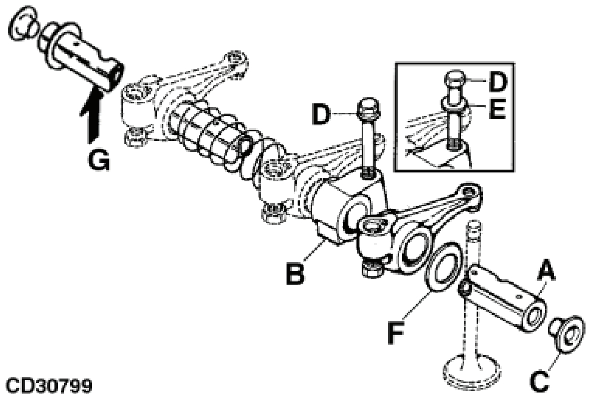


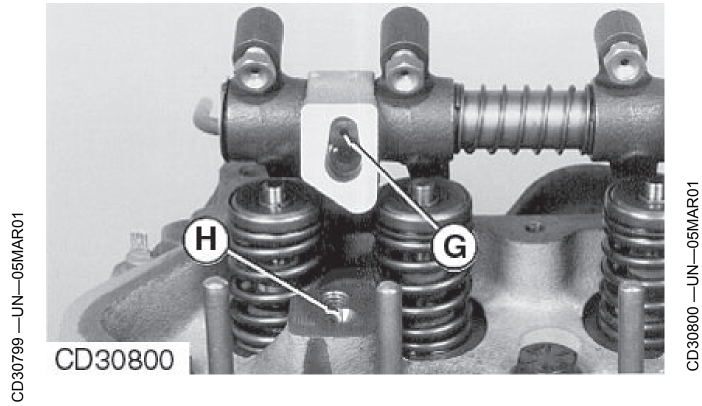
CD30800 —UN—05MAR01

A—Rocker arm shaft
B—Support
C—Plug
D—Cap screw
E—Washer
F—Bowed washer
G—Oil supply hole in rocker arm shaft
H—Oil supply hole in cylinder head

CD,3274,G05,56 -19-05JAN01-1/1

Reassembling Rocker Arm Shaft





A—Rocker arm shaft
B—Support
C—Plug
D—Cap screw
E—Washer
F—Bowed washer
G—Oil supply hole in rocker arm shaft
H—Oil supply hole in cylinder head

NOTE: Effective with following engine serial numbers, shaft (A) and cap screw (D) with washer (E) have been replaced by a new shaft and flanged head cap screws.

Saran engines

394179CD (Non-Certified engines)

563950CD (Certified engines

Torreon engines

22965PE

These parts are not interchangeable except when using a conversion kit including shaft (A) + support (B) + plug (C) + R504813 flanged head cap screws (D). Refer to appropriate Parts Catalog for more details.

Some engines built after above engine serial numbers may have been assembled with the previous 19H3031 cap screws (non-flanged) and R42729 washers (E). In this case, when re-assembling this engine, use the R504813 flanged head cap screws (without washer).

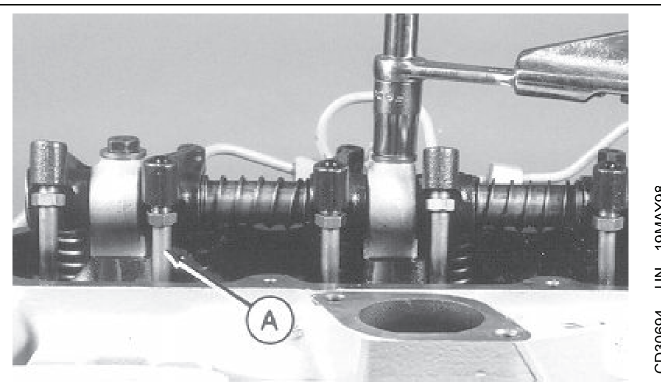
1. Lubricate shaft, bores of rocker arms and supports.
2. Slide springs, rocker arms and supports onto shaft. Assemble in the same order in which they were removed during disassembly.

IMPORTANT: The hole (G) in the shaft must be in line with the oil supply hole (H) of cylinder head.

3. Install bowed washers (F) and new plugs (C) on shaft.

CD03523,00000E4 -19-08JAN01-1/1

Install Rocker Arm Assembly



1. Install push rods (A) in same location from which they were removed.

NOTE: Valve stem tips are specially hardened, wear caps are not required.

2. Position rocker arm assembly on engine.
3. Lubricate the rocker arms with engine oil.
4. Tighten attaching cap screws to specifications.

Specification

Rocker arm support cap screw—Torque.. 50 N·m (35 lb-ft)

CD,CTM125,033 -19-08JAN01-1/1

Valve Clearance

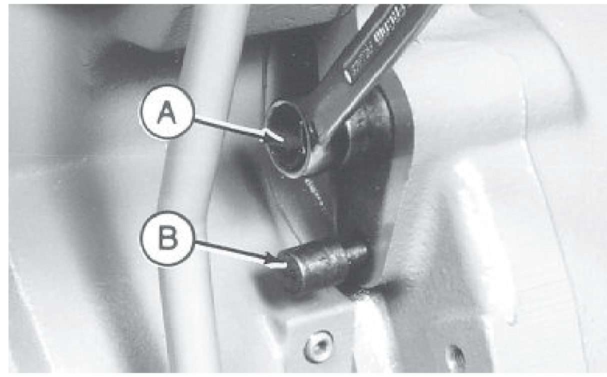
The valve clearance must be adjusted when engine is cold.

Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No.1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDE81-4 or JDG1571 (B) into flywheel bore.

NOTE: When No. 1 piston is at TDC on compression stroke, valve springs of No. 1 cylinder are not under tension.

Specification

Intake Valve—Clearance .... 0.35 mm (0.014 in.)
Exhaust Valve—Clearance .... 0.45 mm (0.018 in.)

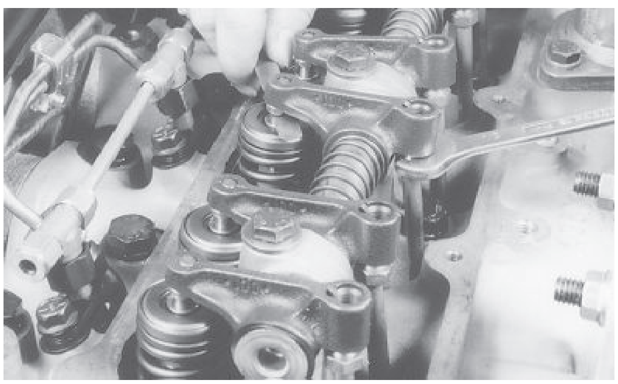


CD30544 —UN—19MAY98

Adjust valve clearance as directed in the following block.

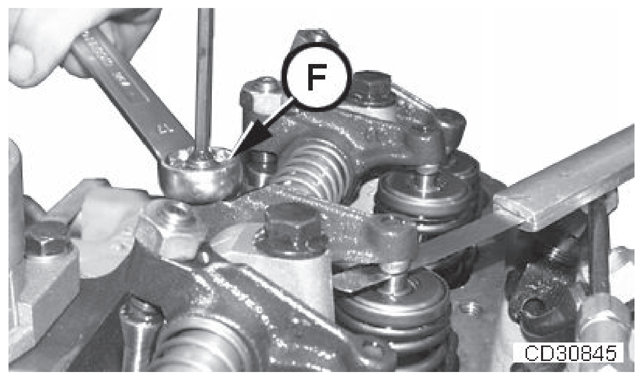
CD,CTM125,036 -19-09JUL04-1/1

Valve Adjustment Sequence



CD30545 —UN—19MAY98

Earlier design



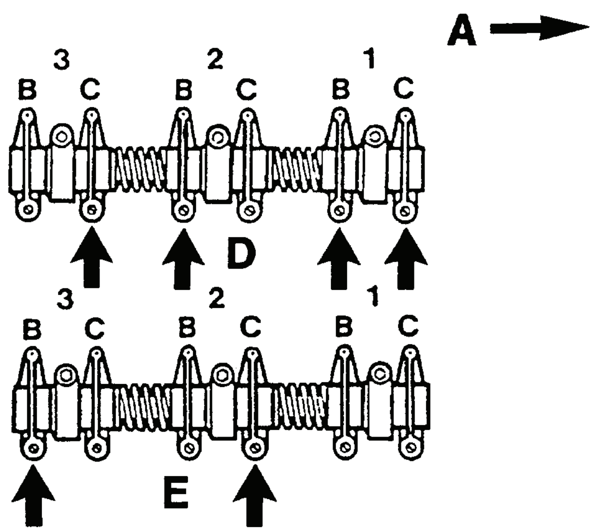
CD30845 —UN—28SEP04

later design

1. Adjust valve clearance on No. 1 and 2 exhaust valves and No. 1 and 3 intake valves.
2. Turn crankshaft 360° and reinsert timing pin.
3. Adjust valve clearance on No. 3 exhaust valve and No. 2 intake valve.

Specification

Valve clearance —Firing order 1-2-3
Rocker arm adjustment screw jam nut (Later design)-Torque .... 30 N·m (25 lb-ft)

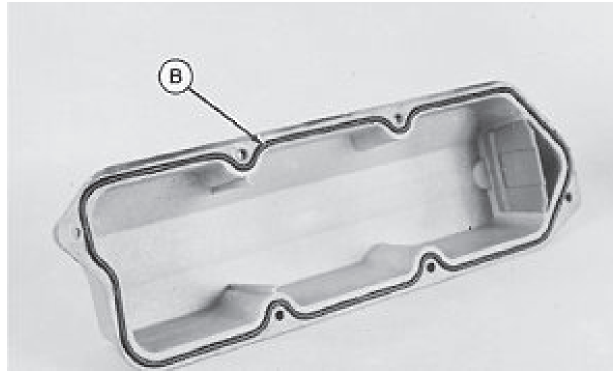


CD30549 —UN—16JUN98

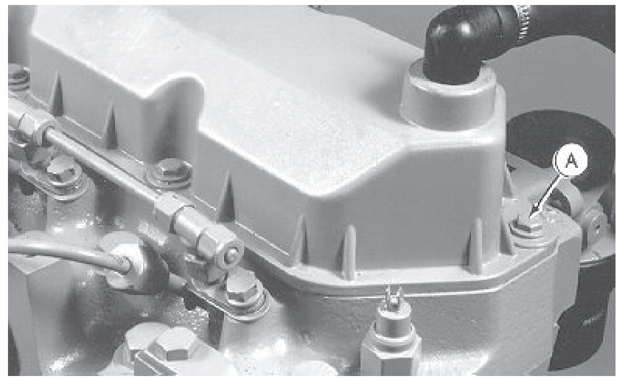
A—Front of engine
B—Exhaust valve
C—Intake valve
D—No. 1 piston at TDC compression stroke
E—No. 1 piston at TDC exhaust stroke
F—Rocker arm adjustment screw jam nut

CD,CTM125,037 -19-09JUL04-1/1

Install Rocker Arm Cover



RG6322 —UN—03AUG92



CD30546 —UN—04MAY98

1. Install rocker arm cover with built-in sealing ring (without sealant).
2. Install the cap screws by hand and tighten to specifications, starting from center and moving towards both front and rear ends of the cover.

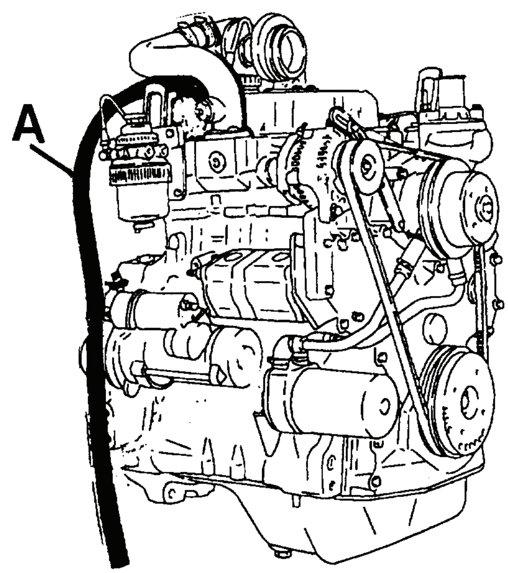
Specification

Rocker arm cover cap screw—Torque.. 10 N·m (7 lb-ft)

3. The sealing ring is reusable. In case of leak, proceed as follows:
   a. Remove sealing ring.
   b. Clean cover sealing ring groove with acetone and dry with compressed air.
   c. Install new sealing ring with grease in cover groove.
   d. Cut the sealing ring slightly longer than necessary.
   e. Put the sealing ring ends edge to edge then press the sealing ring all along the groove to ensure proper installation.

CD,CTM125,038 -19-08JAN01-1/1

Final Work



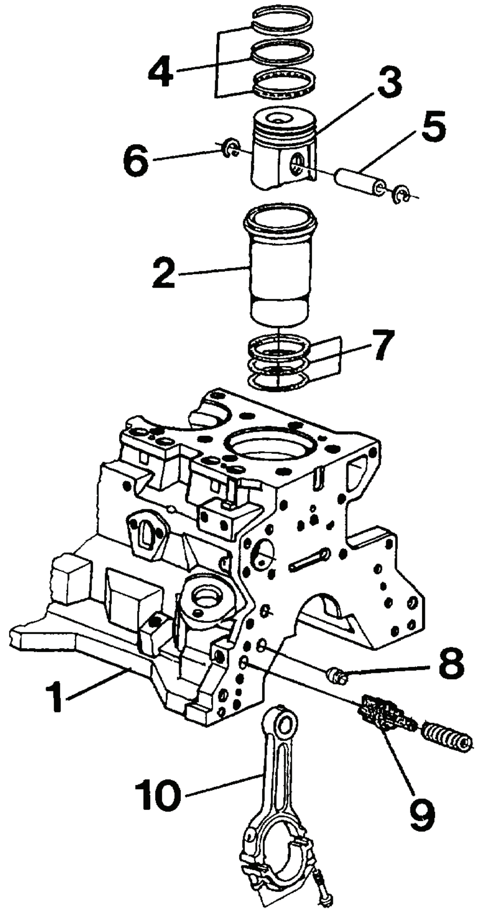
CD30547 —UN—17JUN98

1. Re-install parts previously removed.
2. Check crankcase vent tube hose (A) for proper condition. Replace if necessary. When re-installing, be sure that the hose is not pinched.
3. Perform engine break-in.
4. Recheck valve clearances and readjust when necessary.

NOTE: Retorque of cylinder head bolts is not required.

CD,CTM125,039 -19-08JAN01-1/1

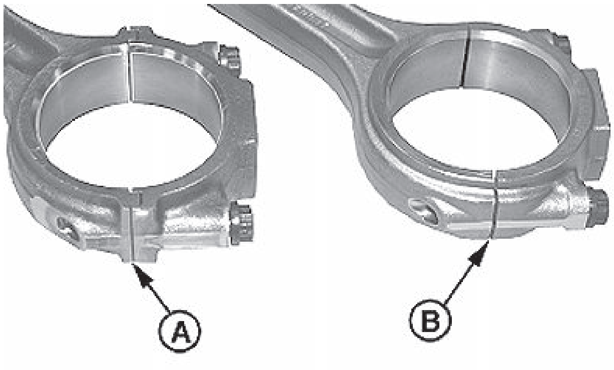
Exploded View



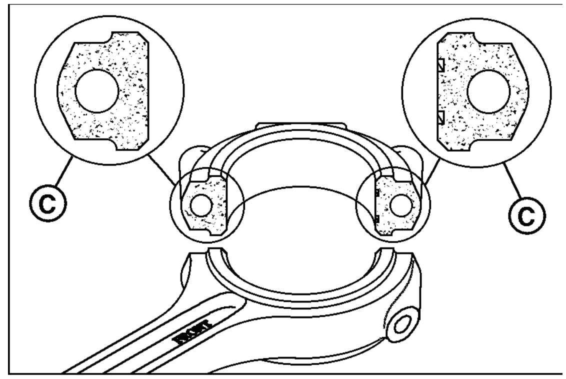
1— Cylinder block
2— Cylinder liner
3— Piston
4— Piston rings
5— Piston pin
6— Snap ring
7— Liner seals
8— Oil pressure regulating valve seat
9— Oil by-pass valve
10— Connecting rod

CD,CTM125,045 -19-01DEC97-1/1

Connecting Rods - General Information



RG9447 —UN—27JUL98



RG9556 —UN—02JUL98

A—Tongue-and-Groove Rod (early engines)
B—PRECISION JOINT Rod (later engines)
C—PRECISION JOINT detail

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

PRECISION JOINT™ connecting rods have been introduced as follows:

Saran-built engines (Non-Certified)	
3029D	(407484CD-)
3029T	(407824CD-)
Saran-built engines (Certified)	
3029D	(584319CD-)
3029T	(590351CD-)
Torreon-built engines	
3029D	(107271PE-)
3029T	(105304PE-)

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 body at the joints (C).

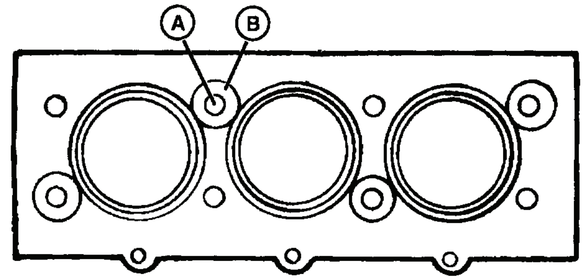
PRECISION JOINT is a trademark of Deere & Company

- Care must be exercised when inspecting and handling the precision joint connecting rods. Do not nick the joint surfaces. Never scrape these surfaces with a wire brush or other tool. Cap MUST BE kept with the parent rod.
- Due to the machining process, PRECISION JOINT™ rod and cap have two grooves each, while the bearing inserts have a single tang. The extra grooves are not used. Install cap and rod with tangs to same side.
- As with the tongue-and-groove style of connecting rod, never use connecting rod bolts more than once for final engine assembly. Once bolts have been tightened to final torque, they must not be reused. Bolts for PRECISION JOINT™ connecting rod are 3 mm (0.118 in.) shorter than conventional rod bolts (61 mm/2.40 in. instead of 64 mm/2.61 in.). Do not mix hardware. Torque procedure is identical to the conventional connecting rod.
- Both types of connecting rods can be used within the same engine.

CD03523,00000ED -19-17NOV04-1/1

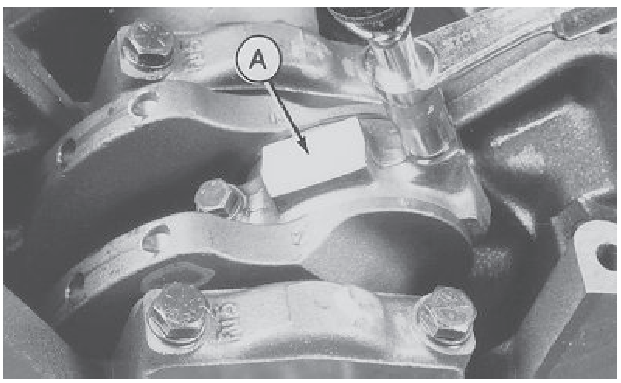
Remove Pistons and Connecting Rods

1. Remove cylinder head, oil pan and oil pump.
2. Install large flat washers (A) with 1/2-13 UNC cap screws (B) to hold cylinder liners down.
3. Decarbonize cylinder liners.

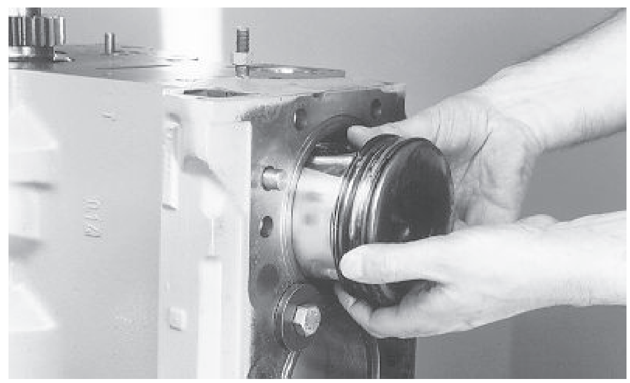


CD30552 —UN—16JUN98

CD,CTM125,048 -19-01DEC97-1/3



CD30553 —UN—19MAY98



CD30554 —UN—04MAY98

4. Mark rods, pistons and caps to insure correct assembly in same location.
5. Remove rod cap screws and caps (A).
6. Remove connecting rod and piston assembly through the cylinder liner.

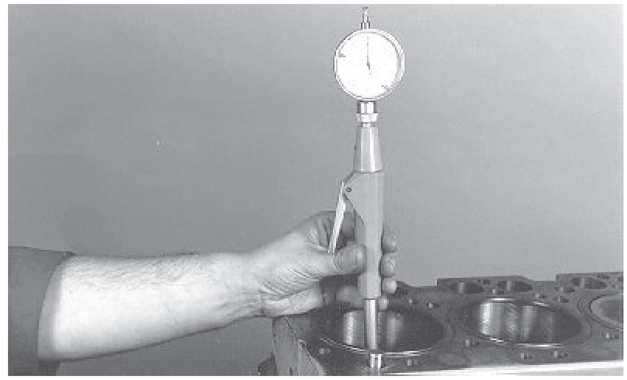
CD,CTM125,048 -19-01DEC97-2/3

7. Remove and discard piston pin snap rings.
8. Press piston pin out of bore and separate piston and rod.

RG7464 —UN—23NOV97

CD,CTM125,048 -19-01DEC97-3/3

Measure Cylinder Liner Bore


CD30556 —UN—04MAY98

1. Measure liner bore at four points of ring travel.

Specification

Cylinder Liner Bore—Diameter	106.49—106.52 mm (4.1925—4.1937 in.)
Maximum wear	0.25 mm (0.01 in.)
Maximum taper	0.05 mm (0.002 in.)
Maximum out-of-round	0.05 mm (0.002 in.)

2. Compare liner measurements with piston skirt diameter.

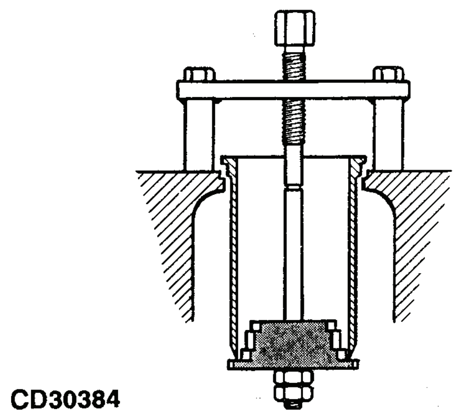
Specification

Piston-to-cylinder liner—Clearance, measured at bottom of skirt	0.09—0.14 mm (0.0035—0.0055 in.)

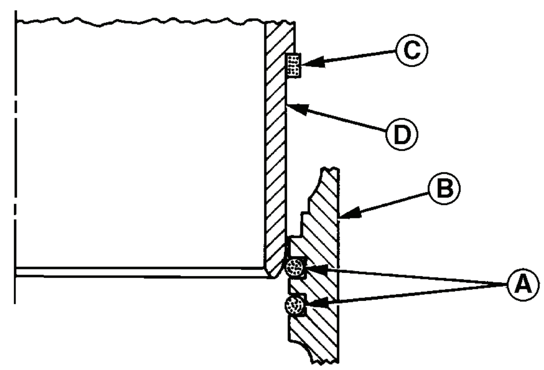
NOTE: Oversize liners do not exist. Install a complete set including standard liner and piston.

CD,CTM125,049 -19-01DEC97-1/1

Remove Cylinder Liners



CD30384 —UN—10MAY95



RG4745 —UN—31OCT97

A—O-rings
B—Cylinder block
C—Packing
D—Cylinder liner

1. Mark liners and cylinder block then pull liners out of cylinder block using KCD10001 puller.
2. Remove O-rings (A) from groove in cylinder block (B). Also remove packing (C) from liner (D).

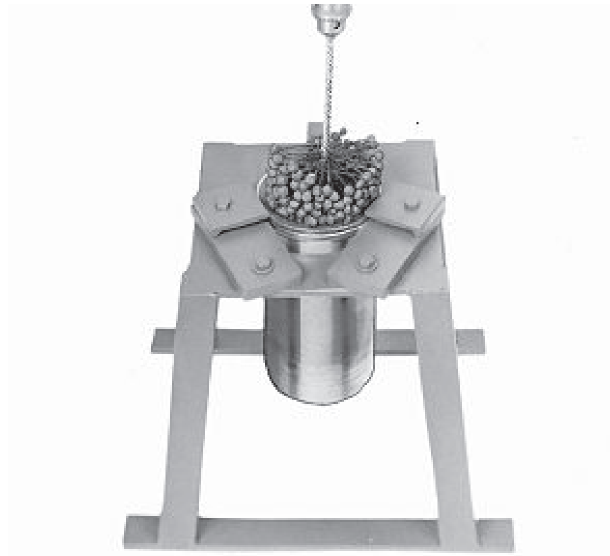
CD,CTM125,056 -19-12JAN01-1/1

Cylinder Liner Deglazing

1. Place cylinder liners in a suitable clamping device.
2. Use D17004BR Flex-Hone to deglaze liner. Follow instructions supplied with tool to obtain 45 degree crosshatch pattern.

IMPORTANT: Do NOT use gasoline, kerosene or commercial solvents to clean liners.

NOTE: After deglazing, clean cylinder liner bore with a mixture of warm water and soap. Rinse with clear water until rinse water is clear. Dry with clean towels and coat bore with clean engine oil.

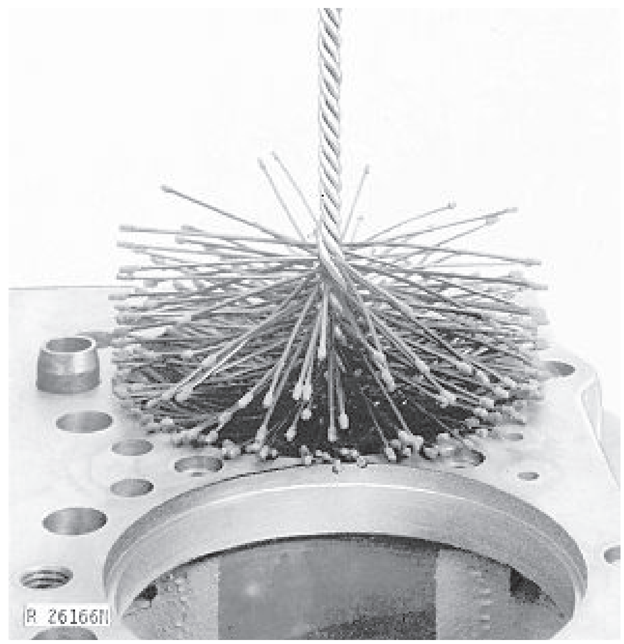


R26164 —UN—13DEC88

CD,3274,G10,20 -19-12JAN01-1/1

Cylinder Block Cleaning

1. Remove liner O-rings from cylinder block. Clean block with cleaning solvent or pressure steam.
2. Make sure all passages and openings are free from sludge, rust and grease.
3. Use D17015BR cleaning brush to clean liner O-ring grooves.



R26166 —UN—13DEC88

CD,3274,G10,21 -19-12JAN01-1/1

Check Piston Cooling Jets

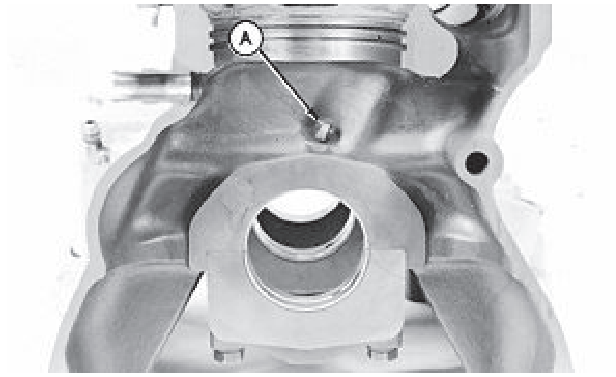
1. Check each piston cooling jet (A) for plugging or damage.

NOTE: A cooling jet failure could cause damage to pistons, piston pins, rod pin bushings and liners.

2. Reinstall jets and tighten to specifications.

Specification

Piston cooling jet—Torque .... 10 N·m (7.5 lb-ft)
Flow Rate (each) .... 1.5 L/min (1/4 qt/min)



RG6426 —UN—17SEP92

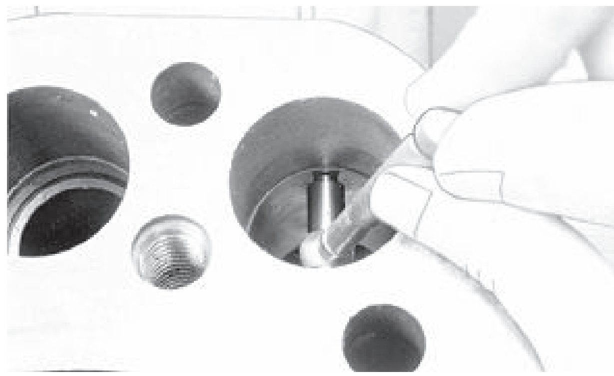
CD,CTM125,053 -19-12JAN01-1/1

Cam Follower Bore Measure

Specification

Cam Follower Bore—Diameter .... 31.70—31.75 mm (1.248—1.250 in.)
Maximum clearance .... 0.13 mm (0.005 in.)

If diameter is more than specified, install a new cylinder block. Service bushings are not available through service parts.



T81656 —UN—01NOV98

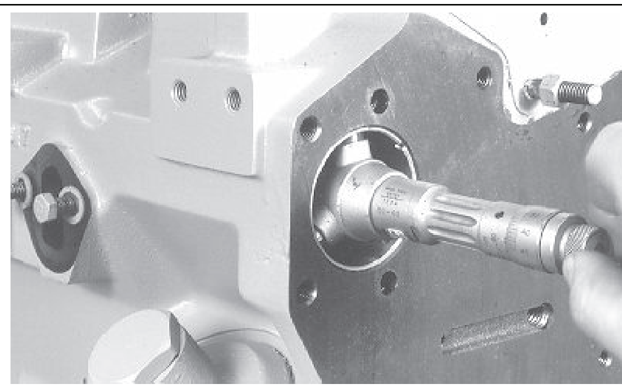
CD,3274,G10,35 -19-12JAN01-1/1

Measure Camshaft Bore

Camshaft bore—Specification

Without bushing—Diameter .... 55.98—56.01 mm (2.204—2.205 in.)
For bushing installation (No.1 only)—Diameter .... 59.96—59.99 mm (2.361—2.362 in.)
With bushing installed (No.1 only)—Diameter .... 55.96—55.99 mm (2.203—2.204 in.)

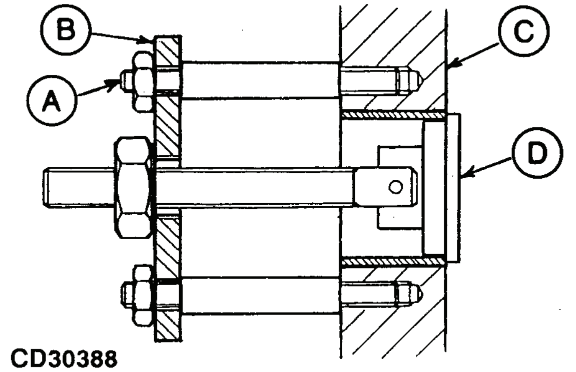
If only diameter of No.1 camshaft bore with bushing is more than specified, replace the bushing. In other cases, install a new cylinder block.



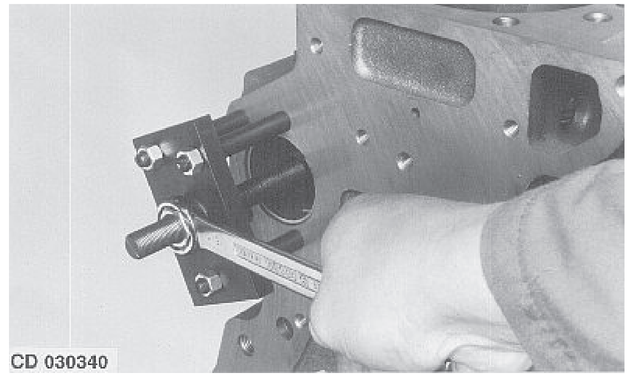
CD30557 —UN—04MAY98

CD,CTM125,050 -19-12JAN01-1/1

Remove Camshaft Bushing



CD30388 —UN—10MAY95



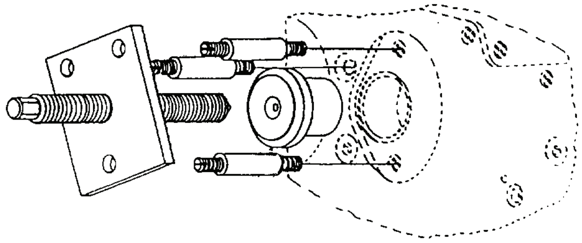
CD30340 —UN—17FEB95

Extract camshaft bushing using JDG739B tool as follows:

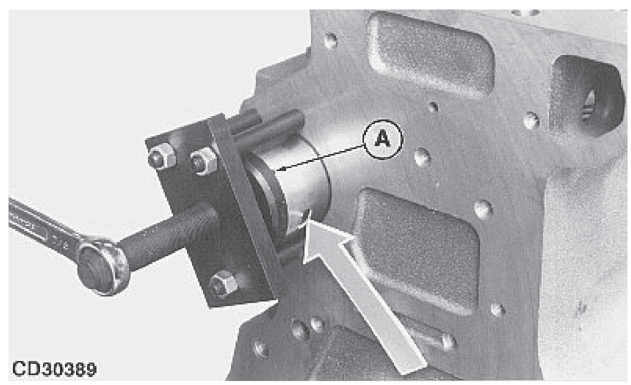
1. Assemble threaded spacers (A) and forcing plate (B) to cylinder block (C).
2. Insert bushing puller (D) into camshaft bushing bore.
3. Tighten hex. nut until bushing is free of block bore.

CD,CTM125,051 -19-12JAN01-1/1

Install Camshaft Bushing



CD30558 —UN—16JUN98



CD30389 —UN—10MAY95

Install camshaft bushing using JDG739B as follows:

1. Apply TY6333 grease[1] to internal diameter and outside diameter of bushing.
2. Slide bushing onto driver so notched end (A) of bushing will be toward front end of engine when installed.

[1]*Available as service part.*

IMPORTANT: Bushing must be installed so oil supply hole (arrow) aligns with oil drilling in block bore.

3. Tighten forcing screw until flange of driver bottoms against face of block.

CD,CTM125,052 -19-01DEC97-1/1

Measure Crankshaft Bore

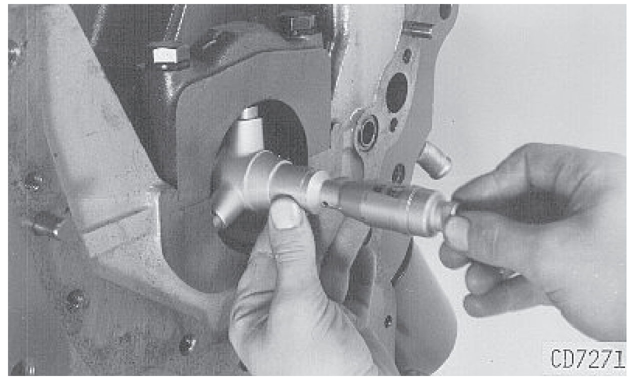
Specification

Crankshaft
Bore—Diameter.............................84.46—84.48 mm (3.325—3.326 in.)

NOTE: Before measuring, the cap screws must be tightened to 135 N·m (100 lb-ft).

If diameter is more than specified or bearing cap is damaged, replace all caps and line bore to specifications.

NOTE: Service bearing caps are not available for more recent cylinder blocks.



CD7271 —UN—07MAR95

CD,CTM125,054 -19-13SEP04-1/1

Replace Crankshaft Bearing Caps

NOTE: Service bearing caps are not available for more recent cylinder blocks.

1. Install replacement cap in block and tighten cap screws to 135 N·m (100 lb-ft).

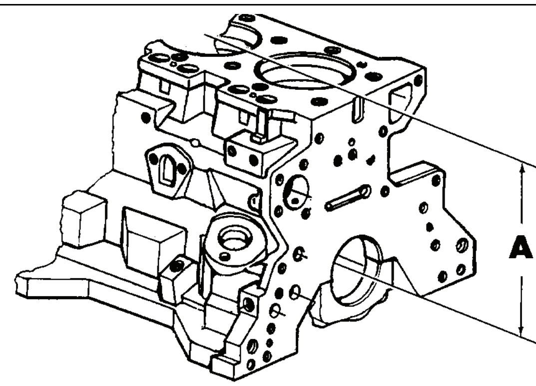
NOTE: Service bearing caps are supplied with unfinished bore (undersized radius 41.4 mm / 1.63 in.).

2. After having positioned block on a boring machine, bore new bearing caps to below specified diameter. Take care to remain within the specified dimension (A) (crankshaft bore center line to block top face).

Specification

Crankshaft main bearing
bores—Diameter...........................84.45—84.48 mm (3.325—3.326 in.)
Distance with block top
face (A)..................................301.98—302.11 mm (11.889—11.894 in.)

IMPORTANT: Make sure all crankshaft bearing bores are in alignment.



CD30559 —UN—17JUN98

A—Distance between crankshaft bore center line and block top face

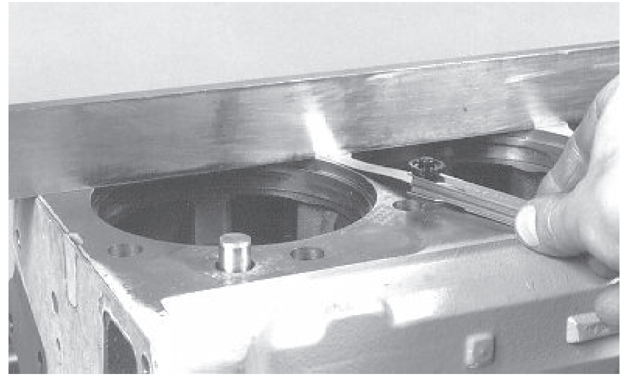
CD,CTM125,078 -19-13SEP04-1/1

Cylinder Block Top Desk Flatness

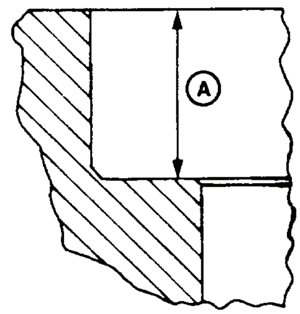
Measure cylinder block top desk flatness using a precision straightedge. If flatness is not as specified, resurface cylinder block according to specifications below:

Specification

Top Desk —Out-of Flat for every 150 mm (5.90 in.) length or width	0.025 mm (0.001 in.)
Surface finish (CLA)	0.8—3.2 micron (32—128 micro-in)
Maximum wave deep	8 micron (320 micro-in)
Crankshaft bore centerline-to-top desk—Distance	301.98—302.11 mm (11.889—11.894 in.)
Liner counter-bore—Depth (A)	5.95—5.99 mm (0.234—0.236 in.)



CD30560 —UN—04MAY98



CD30561 —UN—16JUN98

CD,CTM125,055 -19-12JAN01-1/1

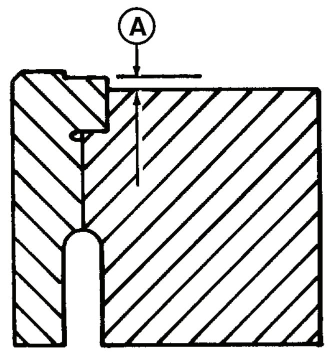
Measure Cylinder Liner Protrusion

1. Install liner without packing or O-rings. If liner does not rotate smoothy by hand, remove liner and polish lower pilot bore in block with emery cloth or D17015BR brush.
2. Align liner and cylinder block marks, then secure at four points with cap screws and thick washers (appro. 3 mm - 0.118 in.). Tighten to 100 N·m (74 lb-ft).
3. Using KJD10123 Gauge, measure liner protrusion (A) at four points.

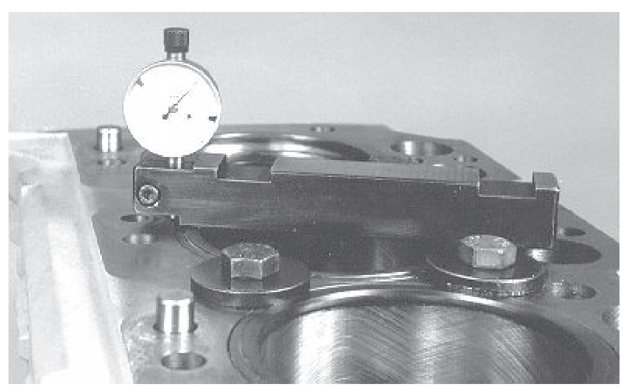
Specification

Liner—Protrusion	0.01—0.10 mm (0.0004—0.004 in.)
Maximum permissible difference between adjacent cylinders	0.03 mm (0.001 in.)

A—Liner protrusion



RG6439 —UN—03NOV97



CD30563 —UN—04MAY98

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CD,CTM125,058 -19-12JAN01-1/2

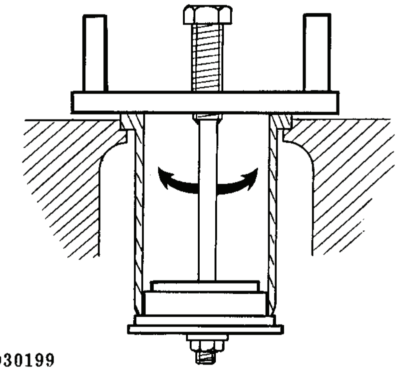
4. If liner protrusion or permissible difference is above specifications, apply lapping compound to liner flange shoulder in the block. Install liner then, using KCD10001 special tool, turn to left and right to rub off enough material to seat liner as necessary.

5. If protrusion is below specifications, install one liner shim (A) under liner flange. Two sizes of shims are available as specified.

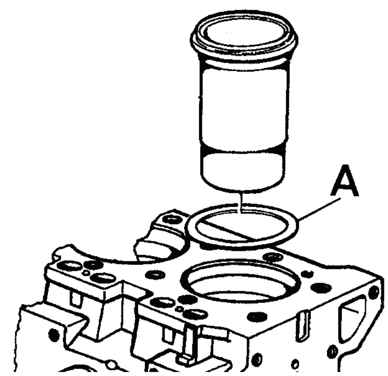
Specification

CD15466 Liner shim—Thickness....................0.05 mm (0.002 in.)
R65833 Liner shim—Thickness....................0.10 mm (0.004 in.)

IMPORTANT: ONLY ONE SHIM IS ALLOWED PER CYLINDER. If liner requires more than one shim, install either a new liner or cylinder block.



CD30199 —UN—07MAR95



CD30564 —UN—16JUN98

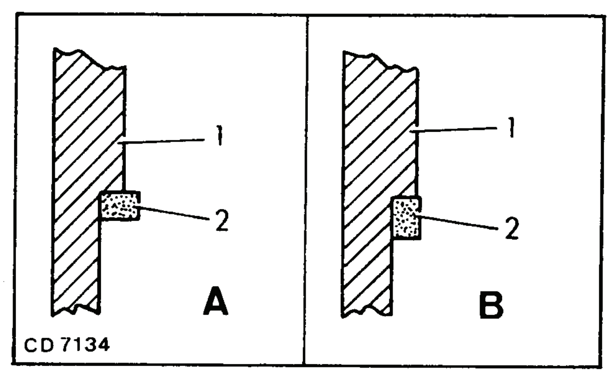
CD,CTM125,058 -19-12JAN01-2/2

Liner Packing Installation

Apply lubricating soap to new packing and install over liner until it contacts liner shoulder. Liner packing must be compressed to the minimum specified.

Specification

Liner packing—Minimum dimension for proper compression....................0.13 mm (0.005 in.)



CD7134 —UN—07MAR95

1— Cylinder liner
2— Packing

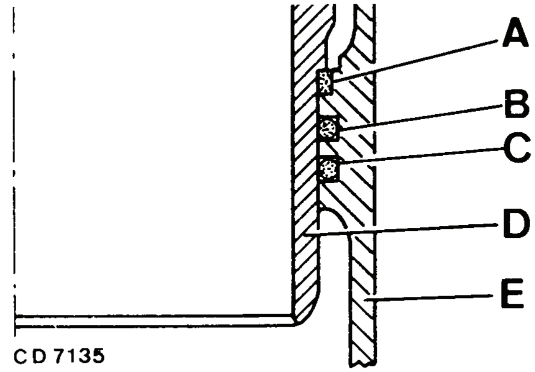
A—Improper installation
B—Proper installation

CD,3274,G10,27 -19-12JAN01-1/1

Liner O-Ring Installation

Apply lubricating soap to new O-rings. Install O-rings in respective grooves.

A—Rectangular section packing
B—Red or white O-ring
C—Black O-ring
D—Cylinder liner
E—Cylinder block



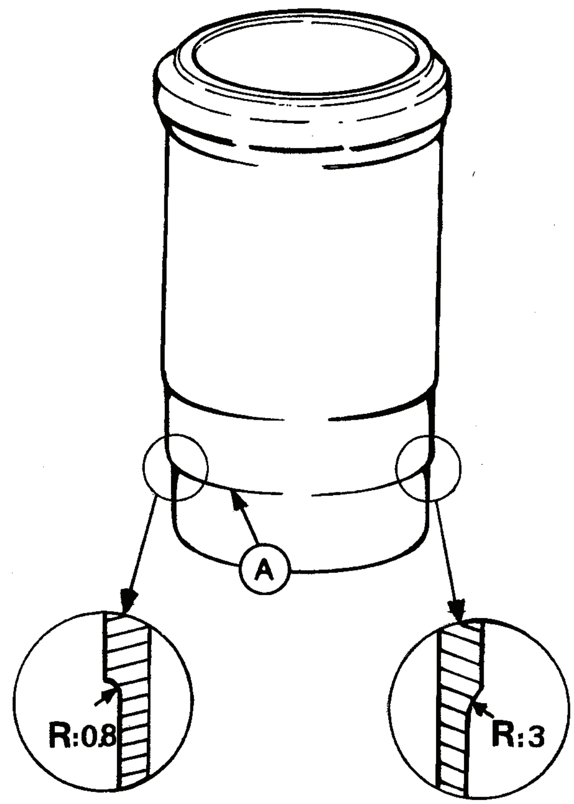
CD7135 —UN—07MAR95

CD,3274,G10,28 -19-18FEB92-1/1

Install Cylinder Liners

NOTE: Recent cylinder liners are machined with a shoulder on the lower guiding diameter (A). Liners, up to machining code "848M" stamped on the outside have a shoulder radius of 0.8 mm (0.03 in.) which may cause damage to liner seals during installation. The 0.8 mm (0.03 in.) radius has been changed then to 3 mm (0.13 in.) allowing proper installation when using KCD10001 tool.

1. On liners with 0.8 mm (0.03 in.) radius blunt the sharp edge with a honing stone or emery cloth.
2. Slide liner together with shim (when needed) and packing into its bore in cylinder block.



CD30707 —UN—22FEB99

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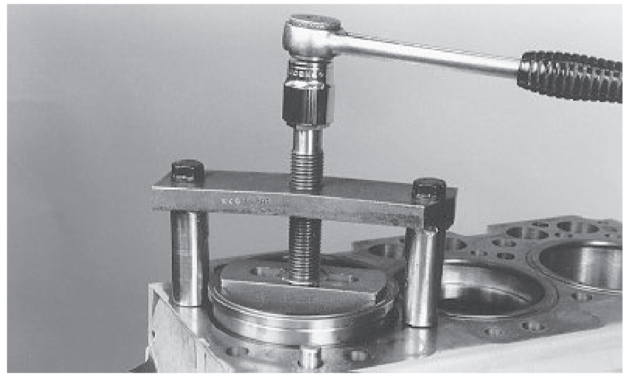
CD,CTM125,059 -19-12JAN01-1/2

3. Seat liners using KCD10001 special tool.
4. Secure liners by means of large washers and cap screws.

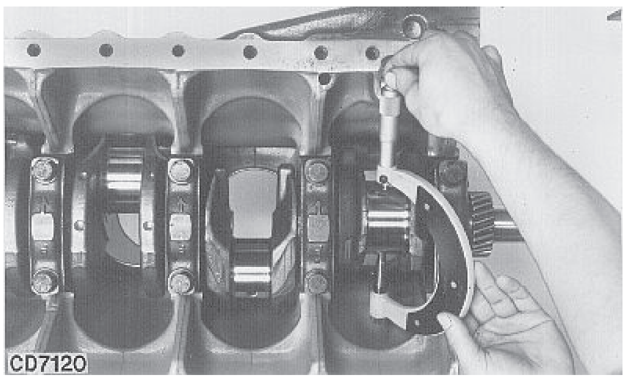


CD30565 —UN—04MAY98

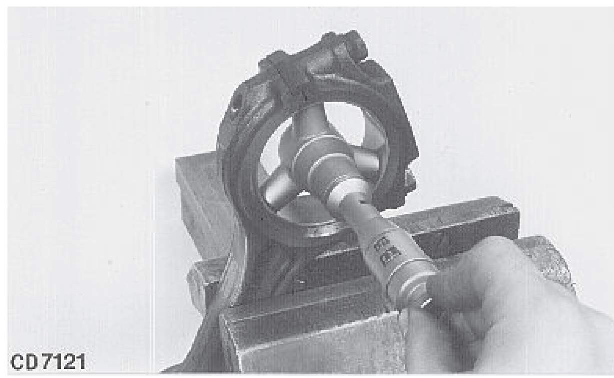
Installation with KCD10001

CD,CTM125,059 -19-12JAN01-2/2

Measure Connecting Rod Bearing



CD7120 —UN—07MAR95



CD7121 —UN—07MAR95

NOTE: Before measuring, connecting rod cap screws must be tightened according to specifications.

Specification

Connecting rod cap screw—Torque... 56 N·m (40 lb-ft)
Torque Turn .... 90—100 °

1. Measure diameters then compare with specifications.

Specification

Connecting rod bearing (assembled)—Diameter
....69.848—69.898 mm (2.7499—2.7519 in.)
Crankshaft journal—Diameter......................69.799—69.825 mm (2.748—2.749 in.)
Maximum permissible clearance... 0.16 mm (0.006 in.)

2. If clearance is not within specifications, grind crankshaft journals to match undersized bearings specified.

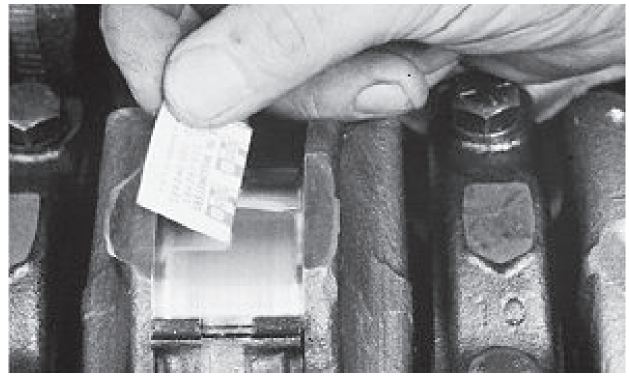
Specification

Undersized connecting rod bearing—1st Size.. 0.25 mm (0.01 in.)

NOTE: Undersized crankshafts may be also available through the regular service parts channel.

CD,CTM125,060 -19-12JAN01-1/1

Rod Bearing Clearance



Remove connecting rod cap. Place a piece of PLASTIGAGE® in the center of the bearing. Install cap and tighten cap screws according to specifications.

Remove cap and compare the width of PLASTIGAGE® with scale provided on the side of package to determine clearance.

Max. permissible clearance: 0.16 mm (0.006 in.).

PLASTIGAGE is a trademark of DANA Corp.

CD,3274,G10,1 -19-01FEB94-1/1

Measure Connecting Rod Bushing

Straight Pin-End Connecting Rod

Tapered Pin-End Connecting Rod

If diameter or oil clearance are more than specified, replace bushing.

Connecting rod bushing—Specification

Straight Pin-End—Bore diameter................................32.010—32.036 mm (1.2602—1.2612 in.)
Pin to bushing oil clearance..................................0.010—0.042 mm (0.0004—0.0016 in.)
Wear tolerance ....0.10 mm (0.004 in.)

Tapered Pin-End—Bore diameter....................................41.300—41.326 mm (1.626—1.627 in.)
Pin to bushing oil clearance..................................0.007—0.043 mm (0.0003—0.0017 in.)
Wear tolerance ....0.10 mm (0.004 in.)

CD,CTM125,061 -19-10APR12-1/1

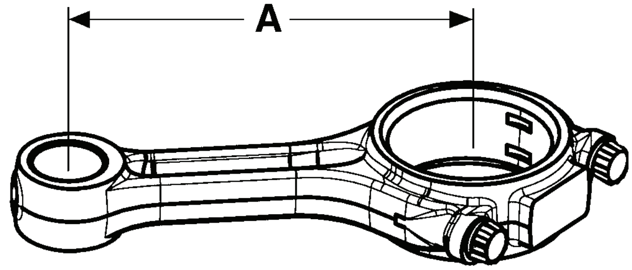
Replace Connecting Rod Bushing (Straight Pin-End)

NOTE: Service bushing bore is not at its final size.

When bushing need to be replaced, bring connecting rod, pin and the new bushing to a specialized workshop for replacing and boring bushing to obtain the specified oil clearance and positioning.

Specification

Connecting rod bushing
—Bore diameter....................32.010—32.036 mm (1.2602—1.2612 in.)
Oil clearance.............................0.010—0.042 mm (0.0004—0.0016 in.)
Bore-to-bore Distance
(A)..180.975—181.025 (7.125—7.127 in.)



CD30801

CD30801 —UN—13MAR01

CD03523,00000EE -19-21JUN12-1/1

Replace Connecting Rod Bushing (Tapered Pin-End)

NOTE: Service bushing bore is not at its final size.

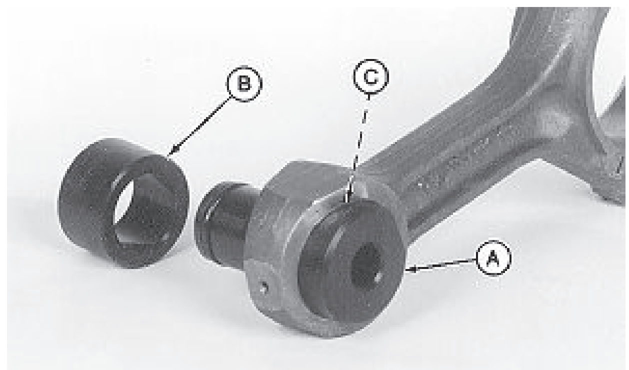
Using JDG738 Connecting Rod Bushing Service Set, proceed as follows.

1. Slide driver JDG738-1 (A) into one side of rod bushing (C). Turn driver until taper on driver flange matches up with taper on bushing.
2. Install receiver cup JDG738-3 onto opposite side of rod bushing.

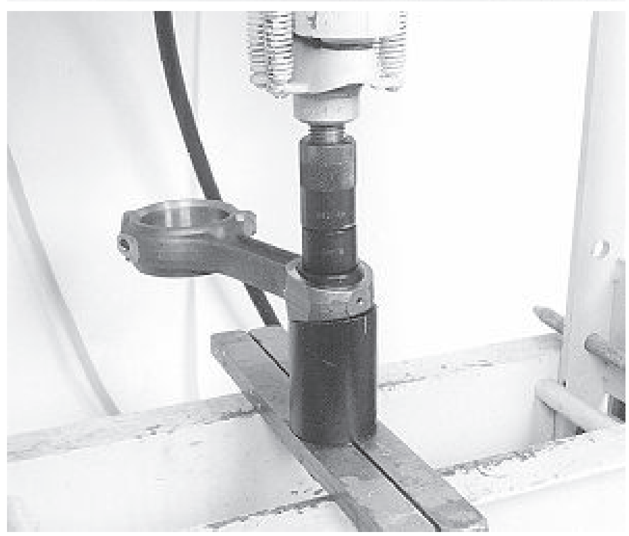
NOTE: Stud in cup keeps rod properly located on the cup. Use JDG738-2 pilot ring (B) as a hollow spacer when pressing bushing out of rod.

3. Using hydraulic press, push bushing out of rod until driver and bushing fall into receiver cup.

A—JDG738-1 or JDG738-4 Driver
B—JDG738-2 or JDG738-5 Pilot ring
C—Rod bushing



RG7130 —UN—10OCT94



RG7131 —UN—10OCT94

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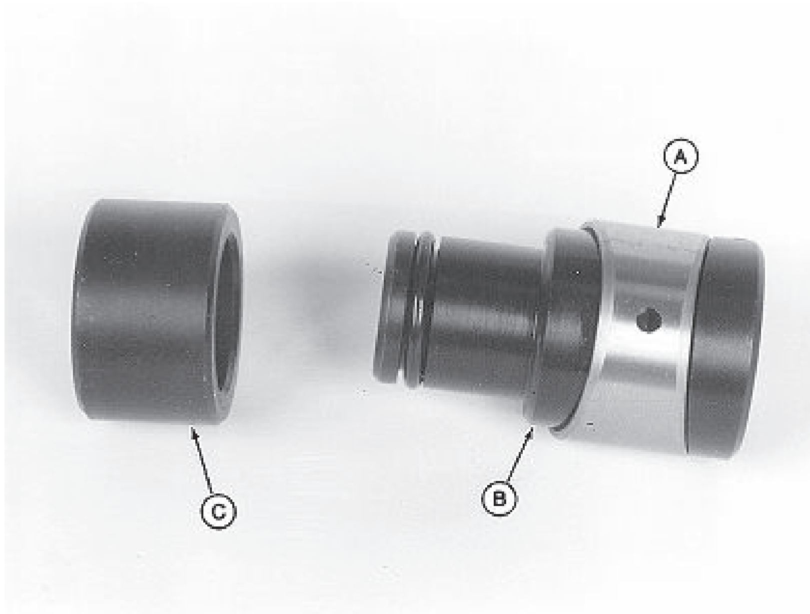


A—Rod bushing
B—JDG738-1 or JDG738-4 Driver
C—JDG738-2 or JDG738-5 Pilot ring

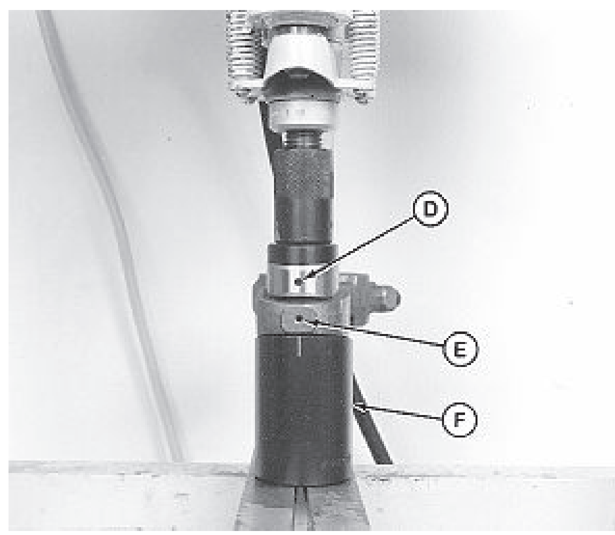
4. Slide bushing (A) onto JDG738-1 driver (B) and install JDG738-2 pilot ring (C) onto O-ring end of driver.
5. Apply TY6333 grease[1] to:

- Outside diameter of bushing
- Outside diameter of pilot ring
- Inside diameter of rod pin bore

[1]*Available as service part.*

CD,CTM125,063 -19-21JUN12-2/4

6. Insert driver into rod pin bore so pilot ring pilots in rod bore and bushing taper aligns with taper on driver flange. Align oil hole in bushing (D) with oil hole in end of rod (E).
7. Install JDG738-3 receiver cup (F) onto opposite side of rod so taper on rod aligns with taper on receiver cup.
8. Press bushing into rod until edge of bushing is flush machined surface on connecting rod face.



D—Oil hole in bushing
E—Oil hole in rod
F—JDG738-3 or JDG738-6 Receiver cup

Continued on next page

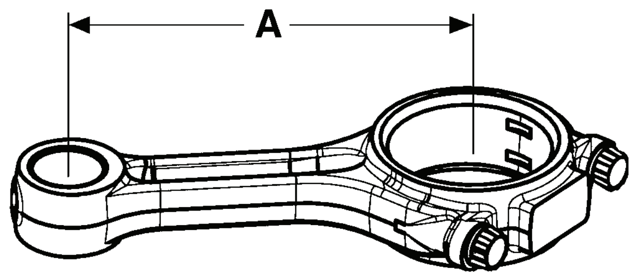
CD,CTM125,063 -19-21JUN12-3/4

IMPORTANT: Oil holes MUST be aligned. If holes are not aligned, remove and discard bushing then re-install a NEW bushing. DO NOT attempt to reuse a bushing.

9. Have the new bushing reamed by a specialized workshop to obtain the specified oil clearance and positioning.

Specification

Connecting rod bushing
—Bore diameter.........................41.300—41.326 mm (1.626—1.627 in.)
Oil clearance..............................0.007—0.043 mm (0.0003—0.0017 in.)
Bore-to-bore Distance
(A)...180.975—181.025 (7.125—7.127 in.)



CD30801

CD30801 —UN—13MAR01

CD,CTM125,063 -19-21JUN12-4/4

Measure Piston Pin

Piston pin—Specification

Straight Pin-End
—Diameter............................31.994—32.000 mm (1.2596—1.2598 in.)
Pin to bushing oil
clearance...................................0.010—0.042 mm (0.0004—0.0016 in.)
Wear tolerance ....0.10 mm (0.004 in.)
Tapered Pin-
End—Diameter..........................41.27—41.28 mm (1.6248—1.6252 in.)
Pin to bushing oil
clearance...................................0.007—0.043 mm (0.0003—0.0017 in.)
Wear tolerance ....0.10 mm (0.004 in.)

If diameter is less or clearance is more than specified, replace pin and bushing.

T81604 —UN—07NOV88

CD,CTM125,064 -19-22JUN12-1/1

Clean and Inspect Pistons

CAUTION: Follow manufacturer's instruction exactly. DO NOT ALLOW CHEMICAL TO COME INTO CONTACT WITH SKIN OR EYES; chemical contains creosols which can be very harmful.

Clean pistons, using a commercial cleaner and a jet rinse gun or glass bead blasting machine.

Check piston for cracks, excessive skirt wear or any other damages.

NOTE: Do not attempt to stamp top of piston. Distance from top of piston and top of first ring is 4 mm (0.16 in.) and therefore the top ring groove inserted in piston may be damaged.

CD,CTM125,068 -19-12JAN01-1/1

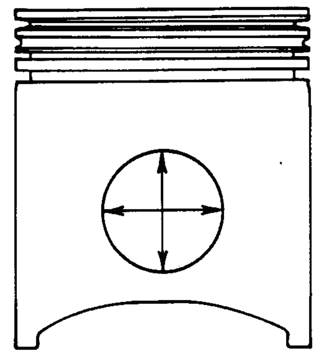
Measure Piston Pin Bore

Piston pin bore—Specification

Straight Pin-End—Diameter......................32.003—32.013 mm (1.2600—1.2603 in.)
Tapered Pin-End—Diameter......................41.285—41.295 mm (1.6254—1.6258 in.)

NOTE: Some piston pin bores are elliptical, the width being 0.038 mm (0.0015 in.) larger than the bore specifications.

If bore is not within specifications, replace piston/liner set.



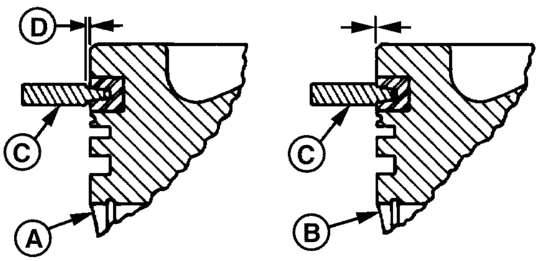
RG6283 —UN—03AUG92

CD,CTM125,065 -19-10APR12-1/1

Piston Top Ring Groove

Use JDG957 wear gauge to check wear of top compression ring groove.

A—Piston can be used again
B—Discard piston and replace
C—JDG957 Gauge
D—Tool shoulder-to-ring land clearance



RG4746 —UN—31OCT97

CD,CTM125,066 -19-12JAN01-1/1

Second and Third Piston Ring Grooves

Use a new piston ring and feeler gauge. Ring groove clearance must not exceed specifications.

Specification

2nd and 3rd Piston ring groove—Clearance...0.20 mm (0.008 in.) maxi

If clearance exceeds specification, install a new piston.

RG5625 —UN—28MAR90

CD,3274,G10,7 -19-12JAN01-1/1

Piston Head and Skirt Checking

CD30391 —UN—10MAY95

Check piston for scuffing, scoring, or signs of overheating.

Measure piston diameter 11 mm (0.43 in.) from bottom of skirt and 90° from piston pin.

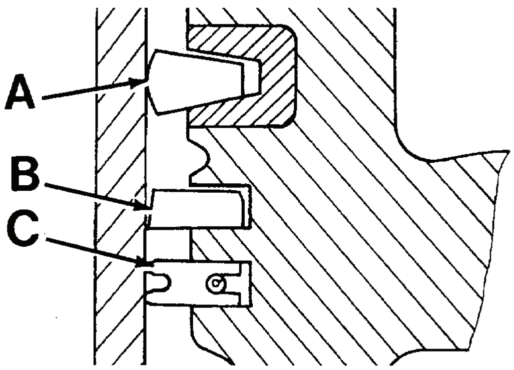
Compare measurement with “Specifications”.

Specification

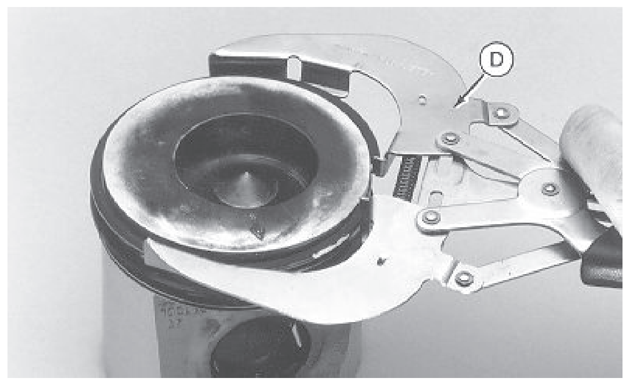
Piston skirt—Diameter at 11 mm (0.43 in.) from bottom................................106.381—106.399 mm (4.1882—4.1890 in.)
Piston-to-cylinder liner—Clearance............................0.09—0.14 mm (0.0035—0.0055 in.)

CD,3274,G10,8 -19-01FEB94-1/1

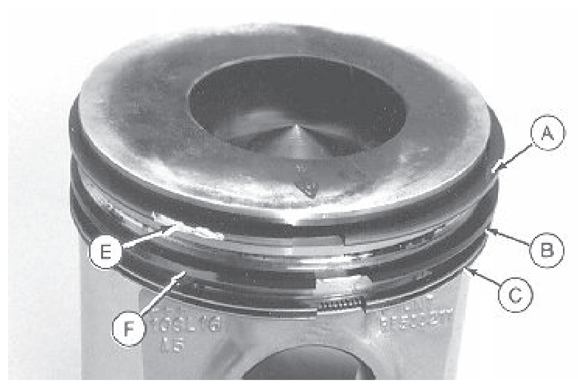
Install Piston Rings



CD30568 —UN—16JUN98



CD30569 —UN—04MAY98



CD30570 —UN—04MAY98

Use KJD10140 or any other suitable piston ring expander for a proper installation and to prevent any damage to the piston.

1. Install oil control ring (C) in bottom ring groove over ring expander. Be sure that the ring expander and the wire are correctly fitted.
2. Install second ring (B) in center ring groove. Second ring can be identified by a yellow paint mark (F). Proper installation is obtained when this mark is at 7 o'clock when end gap is at 6 o'clock.
3. Install top ring (A) in top ring groove. Top ring can be identified by a blue paint mark (E). Proper installation is obtained when this mark is as 7 o'clock like for second ring.

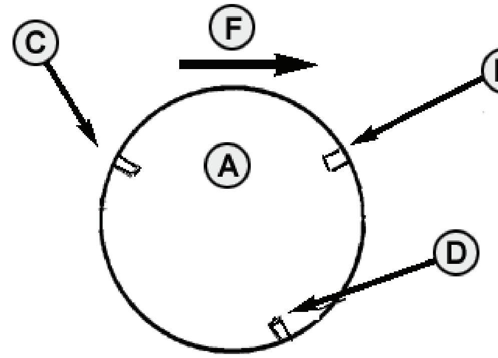
A—Top ring
B—Second ring
C—Oil control ring
D—KJD10140 Piston Ring Expander
E—Blue mark
F—Yellow mark

CD,CTM125,067 -19-12JAN01-1/1

Piston Rings Staggering

Stagger piston rings as shown opposite.

A—Piston head
B—Top compression ring gap
C—Bottom compression ring gap
D—Oil control ring gap
F—Front of engine



PY1750 —UN—07NOV03

CD,3274,G10,15 -19-23JUL04-1/1

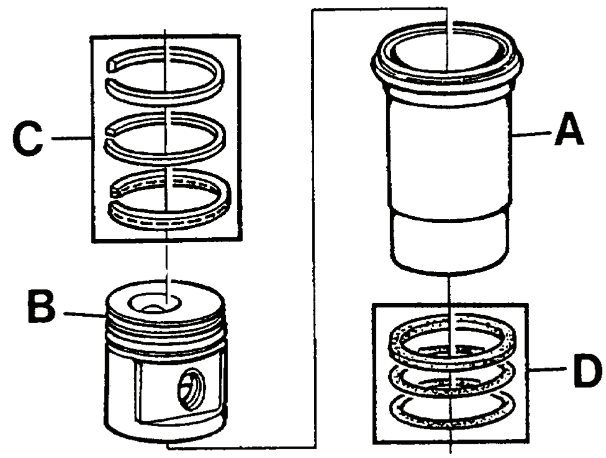
Piston/Liner Set Information

Service piston is available only as an assembly including:

- Liner (A)
- Piston (B)
- Piston ring set (C)
- Liner seal set (D)

NOTE: Liner, piston ring set and liner seal set are available separately.

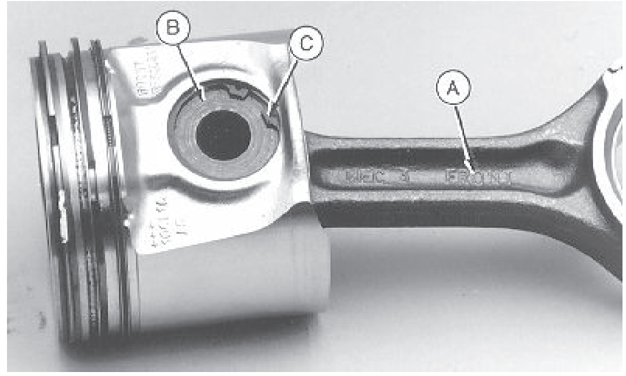
Piston/Liner sets may be packaged in an anti-corrosion bag and therefore are not coated with oil or grease. Before to open the bag, be sure that the parts will be installed immediately to prevent any risk of getting corroded parts.



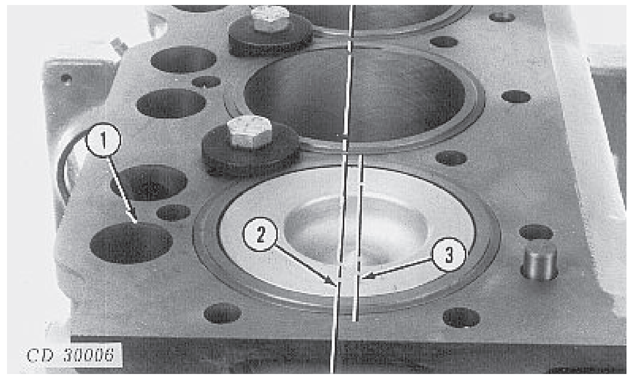
CD30579 —UN—16JUN98

CD,CTM125,080 -19-01DEC97-1/1

Assemble Piston and Connecting Rod



CD30571 —UN—04MAY98



CD30006 —UN—18JAN95

NOTE: Pistons must be installed on connecting rods from which they were removed. If a new piston/liner set is to be install, DO NOT remove piston from liner. Push piston out of liner bottom only far enough to install piston pin.

1. Assemble pistons and connecting rods, making sure the word “FRONT” on piston and on connecting rod (A) is on the same side.

NOTE: If “FRONT” is not visible on side or top of piston, install piston on rod so that offset in combustion bowl of piston (3) is opposite camshaft side of engine (1). The long side of the connecting rod should face camshaft side of block.

2. Coat piston pin (B) with engine oil and insert it through piston and connecting rod bores. Install NEW piston pin retaining rings (C) with sharp edge of ring facing away from piston pin. Make sure retaining rings are seated correctly in their grooves.

1— Camshaft side
2— Centerline of liner bore
3— Combustion chamber offset

CD,CTM125,069 -19-12JAN01-1/1

Install Piston and Connecting Rod

CD30572 —UN—04MAY98

NOTE: Pistons must be installed in the cylinder liner from which they were removed.

1. Coat pistons and rings with clean engine oil. Install pistons in liners, using JDE84 piston ring compressor.

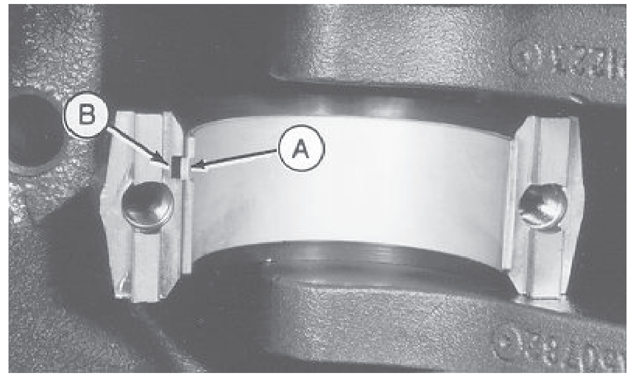
NOTE: Make sure that “FRONT” mark on the top of each piston faces toward front end of cylinder block.

2. Push piston down until top ring is in liner.

Continued on next page

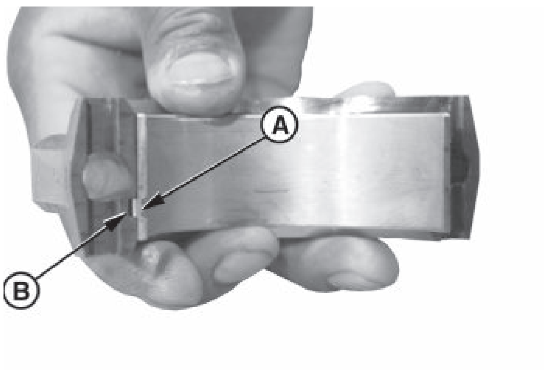
CD,CTM125,073 -19-15JAN01-1/5

3. Install bearing insert in connecting rod with tang (A) in groove (B).
4. Apply clean engine oil on insert and crankshaft journal. Carefully place connecting rod against crankshaft journal.



CD30573 —UN—19MAY98

CD,CTM125,073 -19-15JAN01-2/5



RG7504 —UN—04NOV97

Tongue-and-groove rod

RG9448 —UN—27JUL98

PRECISION-JOINT rod

A—Tang
B—Groove
C—Extra groove (not used)

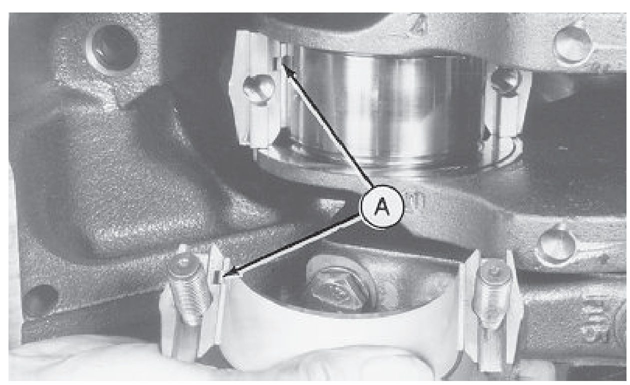
NOTE: Due to the manufacturing process, PRECISION JOINT™ rod and cap have two grooves each, while bearing inserts have a single tang. The extra grooves (C) are not used.

PRECISION JOINT is a trademark of Deere & Company

5. Install bearing insert in connecting rod cap with tang (A) in groove (B).

CD,CTM125,073 -19-15JAN01-3/5

6. Apply clean engine oil to bearing insert. Install cap on connecting rod with tangs (A) to same side. On PRECISION JOINT™ rods, make sure cap is properly aligned on rod with joint surfaces perfectly interlocked.



CD30574 —UN—19MAY98

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CD,CTM125,073 -19-15JAN01-4/5

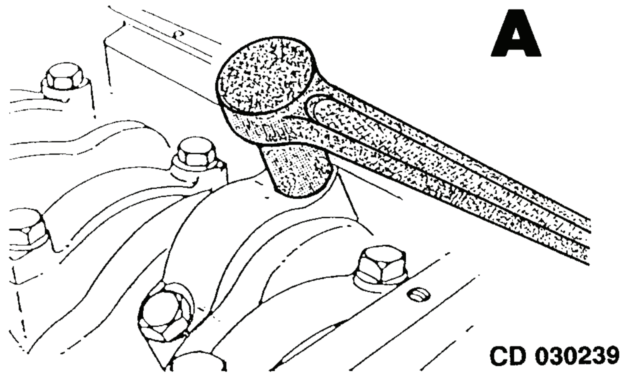
IMPORTANT: Never use connecting rod bolts more than once for final engine assembly. Once bolts have been tightened to final torque-turn specification, they must not be reused for another final assembly. Bolts for PRECISION JOINT™ connecting rods are 3 mm (0.118 in.) shorter than tongue-and-groove bolts. DO NOT mix hardware.

7. Dip NEW connecting rod bolts in clean oil and tighten them alternately to specified torques.

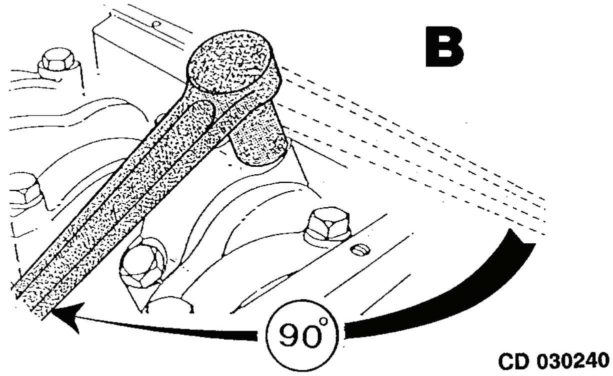
Specification

Connecting rod bolts—Torque	56 N·m (40 lb-ft)
Torque Turn	90—100 °

8. Torque-turn all bolts to specified angle as follows:
   - Position the wrench parallel to engine axis (A).
   - Tighten until the wrench is perpendicular to engine axis (B).
9. Check for proper side clearance in all rods. Each rod must have a slight side-to-side movement.



CD30239 —UN—08MAR95

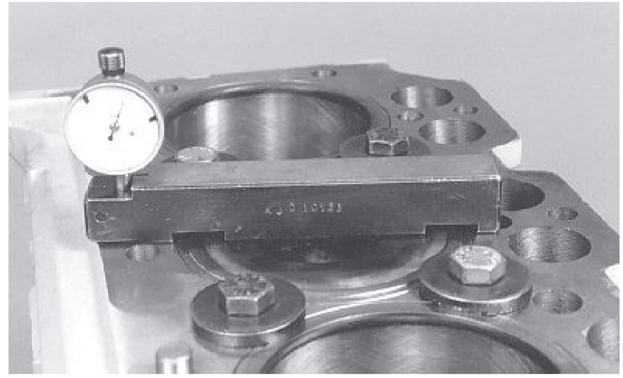


CD30240 —UN—08MAR95

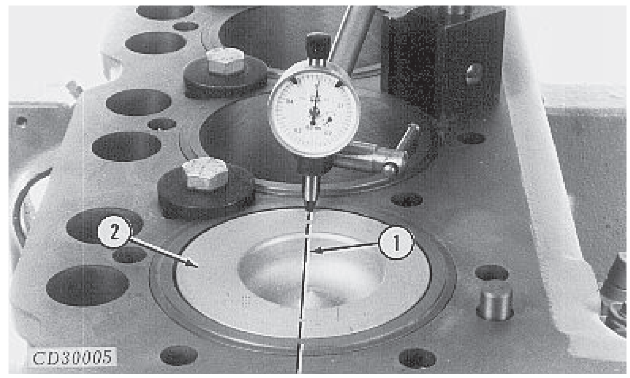
PRECISION JOINT is a trademark of Deere & Company

CD,CTM125,073 -19-15JAN01-5/5

Measure Piston Protrusion



CD30575 —UN—04MAY98



CD30005 —UN—07FEB95

NOTE: Press down on top of piston to remove clearances before measuring piston protrusion.

1. Place KJD10123 Gauge (with flat side up) on cylinder block so that indicator point rests on block surface.
2. Set dial indicator at “zero”.
3. While pressing gauge downward, turn crankshaft until piston is at “TDC” position.
4. Piston protrusion should not exceed 0.25 mm (0.010 in.) when KJD10123 is used.

Specification

Piston—Protrusion above block...0.08—0.35 mm (0.003—0.014 in.)

NOTE: If KJD10123 Gauge is not available, use a dial indicator. In this case, the piston protrusion should be between 0.08—0.35 mm (0.003--0.014 in.) as specified above.

5. If protrusion is out of specifications, check all concerned parts to determine the cause.

1— Centerline of cylinder liner bore **2— Piston at “TDC”**

CD,CTM125,074 -19-15JAN01-1/1

Complete Final Assembly

1. Re-install all components previously removed. Apply following recommendations then perform engine break-in.

2. Cylinder block has some orifices which are in relation either with the lubrication or coolant system. When re-assembling an engine, be sure that coolant lines are connected to corresponding coolant ports and oil lines to oil ports. Apply torques as indicated.

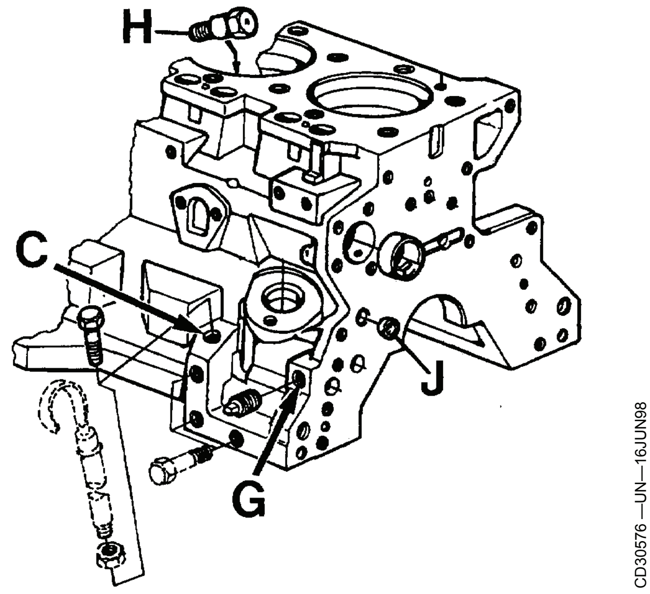
Cylinder block plugs and fittings—Specification

A—Coolant drain (1/4“)—Torque	17 N·m (13 lb-ft)
B—Turbocharger oil return (1/2”)—Torque	45 N·m (33 lb-ft)
C—1/2“ cyl. for dipstick tube—Torque	67 N·m (50 lb-ft)
D—Oil galleries (1/8”)—Torque	17 N·m (13 lb-ft)
E—1/4“ Coolant gallery (side)—Torque	17 N·m (13 lb-ft)
F—Rear Coolant gallery (1”)—Torque	45 N·m (33 lb-ft)
G—Oil gallery (3/8“)—Torque	45 N·m (33 lb-ft)
H—Piston cooling jet—Torque	10 N·m (7.5 lb-ft)

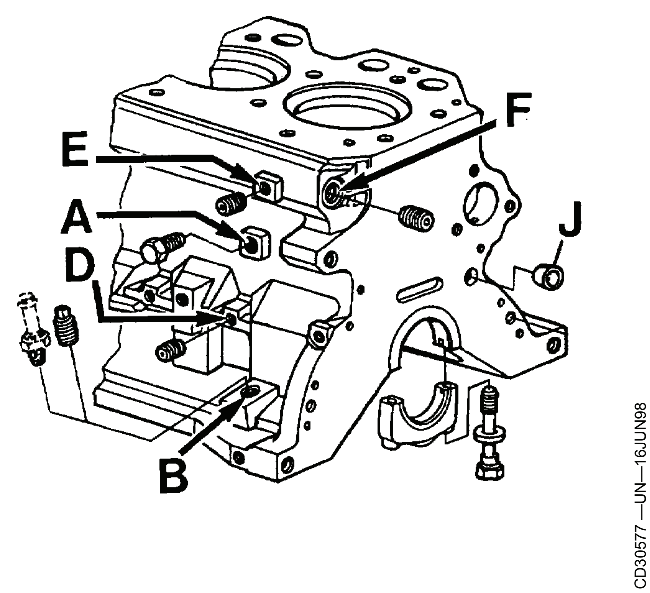
NOTE: Plugs for orifices (A) and (D) are coated with sealant and can be reused several times without addition of sealing compound.

3. Be sure that piston cooling jets (H) are installed.

4. Check that the steel cap (J) obturating the oil gallery, is installed at the front end for all engines, and at the rear end of engines which have no continuity of oil gallery through the flywheel housing.



Front right view



Rear left view

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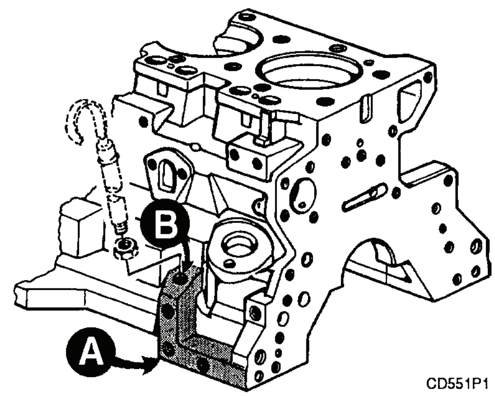
CD,CTM125,077 -19-01DEC97-1/3

5. Service cylinder block may have additional side mounting bosses (A). In case where these bosses interfere with the chassis or other machine components, grind concerned area.

IMPORTANT: Be sure, when grinding, that particles do not enter dipstick hole (B).



CD551P1 —UN—10DEC96

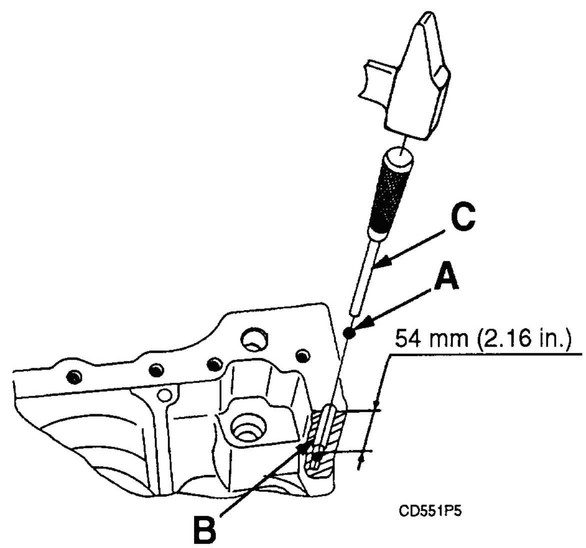
CD,CTM125,077 -19-01DEC97-2/3

6. Oil gallery ball (A) is provided with service cylinder block, but may not be installed. In this case, proceed as follows:

   a. Put ball (A) in oil passage (B).

   b. Drive in ball using an appropriate driver (C) until ball bottoms.

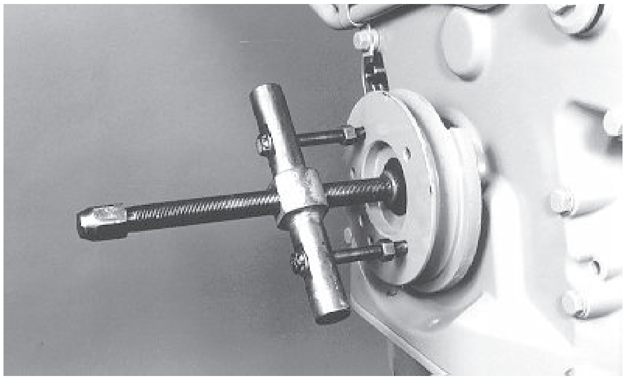
   c. Check for proper installation. The distance between pan rail and top of ball should be approximatively 54 mm (2.16 in.).



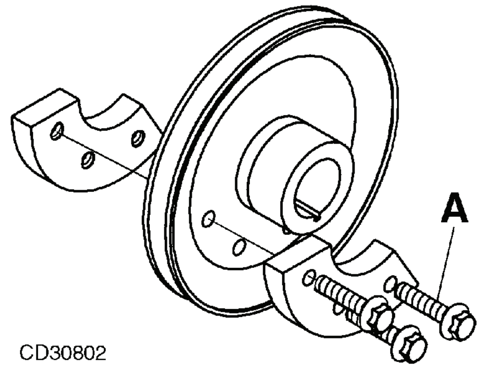
CD551P5 —UN—07NOV96

CD,CTM125,077 -19-01DEC97-3/3

Remove Crankshaft Pulley



CD30580 —UN—04MAY98



CD30802 —UN—20APR01

Crankshaft pulley with bolted weight

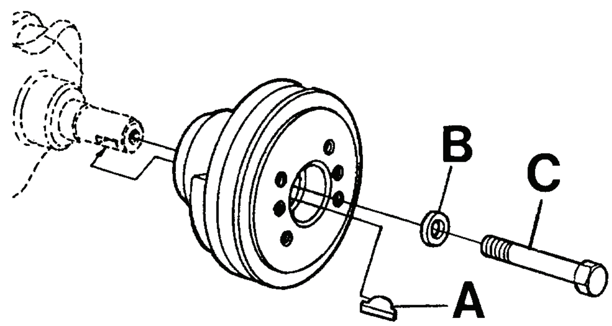
1. Remove pulley attaching cap screw.
2. Using JDG410 Puller or any other suitable puller, remove pulley from crankshaft.

IMPORTANT: Do not attempt to remove cap screws (A) holding the unbalancing weights. If a cap screw has been removed by accident, re-install it using LOCTITE®271 High Strength Thread Lock (also available under part number TY9371) and tighten to 50 N·m (35 lb-ft).

LOCTITE is a trademark of Loctite Corp.

CD,CTM125,083 -19-16JAN01-1/1

Install Crankshaft Pulley



CD30581 —UN—16JUN98

1. Install shaft key (A) on crankshaft.
2. Position pulley on crankshaft with washer (B) and cap screw (C).
3. Tighten to specification.

Specification

Pulley-to-crankshaft—Torque..150 N·m (110 lb-ft)

CD,CTM125,084 -19-16JAN01-1/1

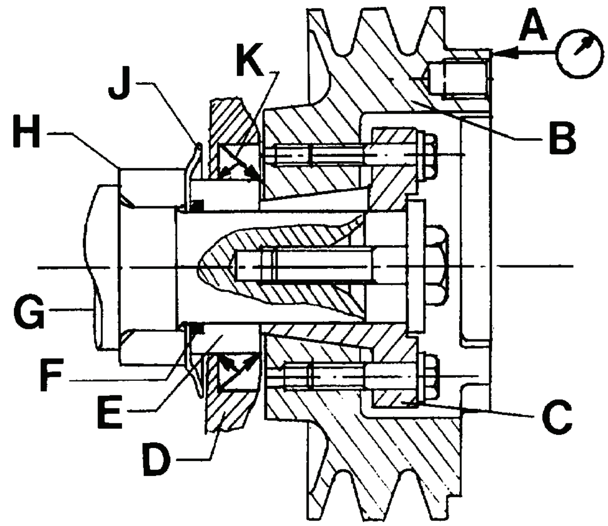
Check Pulley Wobble (Engine With Front PTO)

1. Prior to disassembly, check the following specification:

Specification

Crankshaft pulley—Max. wobble.......... 0.5 mm (0.02 in.)

2. If wobble (A) exceeds specification, it indicates improper mating of tapered surfaces due to uneven tightening of collet cap screws or damage to one or both the tapered surfaces.

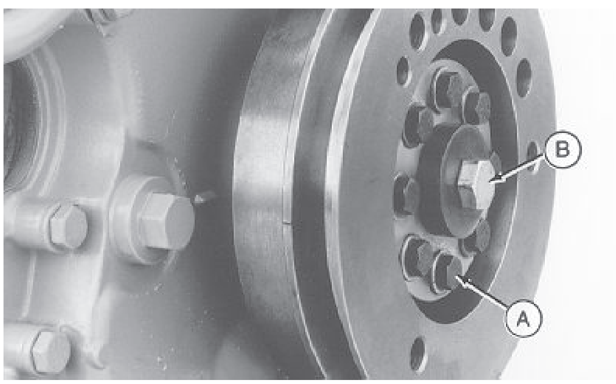


CD30582 —UN—16JUN98

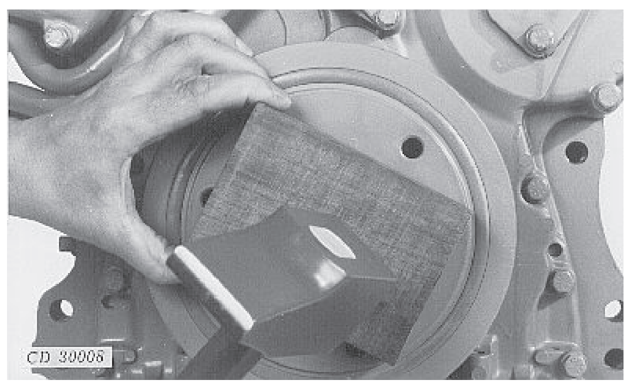
A—Wobble checking with dial indicator
B—Pulley
C—Collet drive
D—Timing gear cover
E—Wear sleeve
F—O'ring
G—Crankshaft
H—Gear
J—Oil deflector
K—Front oil seal

CD,CTM125,085 -19-16JAN01-1/1

Remove PTO Pulley



CD30583 —UN—19MAY98

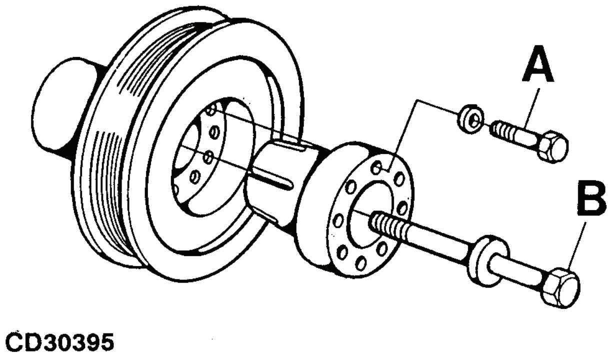


CD30008 —UN—05OCT94

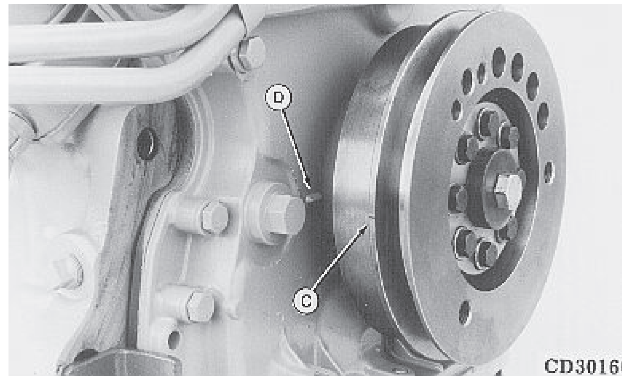
1. Remove the eight cap screws (A) attaching pulley to collet.
2. Using a wooden block and a hammer, tap on pulley until it loosens from conical seat of collet.
3. Remove collet attaching cap screw (B).
4. Remove collet and pulley.

CD,CTM125,086 -19-01DEC97-1/1

Install PTO Pulley



CD30395 —UN—10MAY95



CD30160 —UN—05OCT94

A—Pulley-to-collet bolt
B—Collet-to-crankshaft bolt
C—Pulley mark
D—Timing gear cover mark

1. Lightly oil tapered surfaces of collet and pulley.
2. Position collet in pulley. Install both cap screws (A) 180° apart to keep collet with the pulley.
3. Install collet/pulley assembly on the crankshaft with washer and cap screw (B).
4. Put cylinder No. 1 at TDC then turn pulley/collet assembly so that external groove mark (C) on pulley is aligned with TDC reference mark on timing cover (D).
5. Tighten collet retaining cap screw (B) as specified:

Specification

Pulley-to-
crankshaft—Torque..150 N·m (110 lb-ft)

6. Tighten the two collet cap screws (A) alternately and evenly to specification.
7. Install remaining six collet cap screws. Again alternately and evenly tighten the two cap screws 90° from the first two cap screws to specification. Tighten the remaining cap screws to specification. Always tighten collet cap screws in pairs opposite each other.
8. Repeat the collet cap screw tightening sequence until all the cap screws have been tightened to the specified torque.

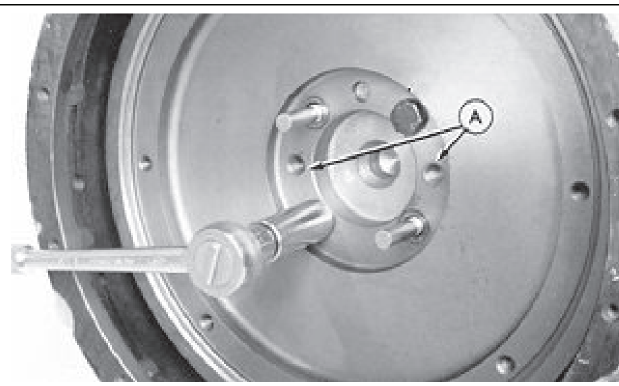
Specification

Crankshaft pulley-to-
Collet bolt—Torque... 35 N·m (25 lb-ft)

9. Check pulley wobble to ensure that tapered surfaces are mated correctly.

CD,CTM125,087 -19-16JAN01-1/1

Flywheel Removal



RG5632 —UN—02APR90

CAUTION: Flywheel is heavy. Plan a proper lifting procedure to avoid personal injury.

1. Remove two cap screws and install guide studs in their place (shown installed) then remove the other cap screws.
2. Install two 1/2-13UNC or M10 cap screws (length 100 mm/4 in.) into the threaded holes (A) to push flywheel off crankshaft and to facilitate flywheel handling.

NOTE: Flywheel may not have the handling threaded holes (A). In this case, install two cap screws into clutch system threaded holes then, using a soft hammer, gently tap on flywheel to unstick it.

CD,CTM125,088 -19-01DEC97-1/1

Flywheel Ring Gear Replacement

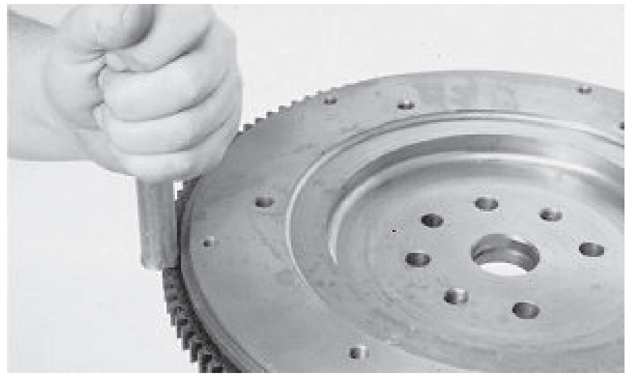
1. Drive ring gear off with a brass drift and hammer.

CAUTION: Oil fumes or oil can ignite above 190° C (380°F). When heating ring gear, use a thermometer and do not exceed 180°C (360°F). Heat the oil in a well ventilated area. Plan a safe handling procedure to avoid burns.

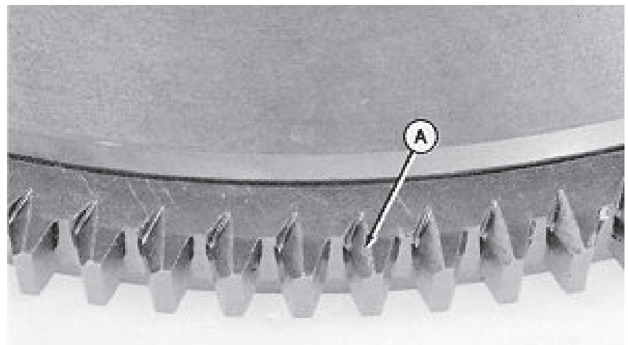
IMPORTANT: If flame is used to heat ring gear, be sure gear is heated uniformly around circumference.

2. Heat new ring gear to 150°C (300°F) using either heated oil, oven heat, or flame heat.
3. Tap heated ring gear into place against flywheel shoulder. Chamfered edge of teeth (A) must be toward engine.

NOTE: Be sure complete ring gear circumference is flush against shoulder of flywheel.



T90596 —UN—14OCT88



RG3838 —UN—14OCT88

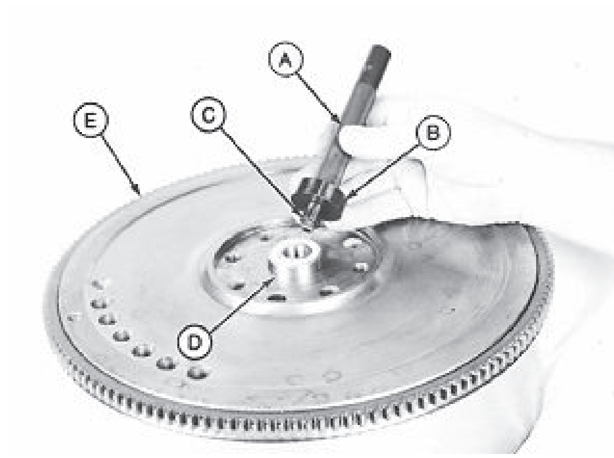
CD,3274,G15,8 -19-01MAR92-1/1

Install Ball Bearing

Some flywheels may have a ball bearing (D) to be installed with flywheel removed from engine.

Drive new ball bearing into engine side of flywheel using 27487 driver (A), 27508 disk (B) and 27493 disk (C) from D01045AA or other bearing driver set, until bearing bottoms in bore. Check bearing for smooth operation.

A—27487 Driver
B—27508 Disk
C—27493 Disk
D—Ball bearing
E—Flywheell



RG6345 —UN—03AUG92

CD,CTM125,089 -19-16JAN01-1/1

Install Flywheel

NOTE: Flywheels and crankshafts pulleys are unbalanced and therefore are not interchangeable with 4 or 6 cyl. engines. Several unbalance values are used, take care not to mix parts. Use relevant Parts Catalogs to order appropriate parts.

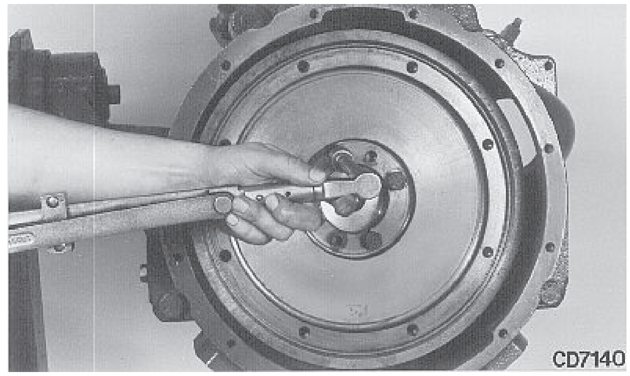
1. Install two guide studs in crankshaft.
2. Place flywheel on studs and slide into position against crankshaft.

IMPORTANT: Always replace flywheel cap screws when flywheel has been removed.

3. Install cap screws and washers if requested, then tighten crosswise to specification.

Specification

Flywheel bolt—Torque... 160 N·m (120 lb-ft)

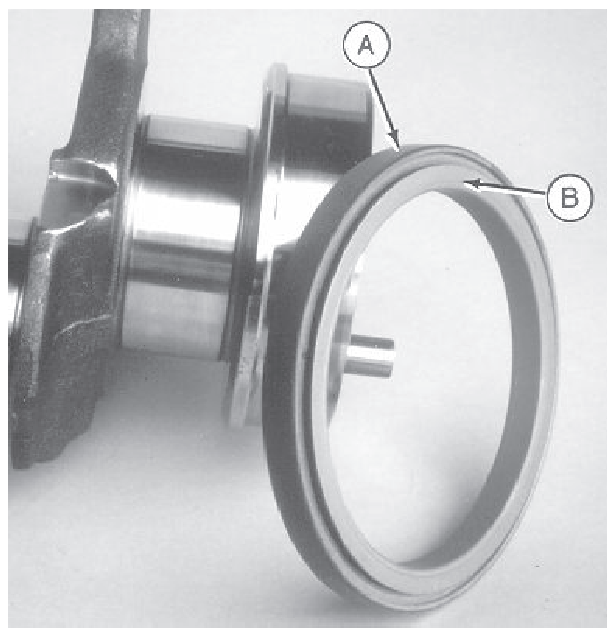


CD7140 —UN—07MAR95

CD,CTM125,090 -19-16JAN01-1/1

Remove Crankshaft Rear Oil Seal

The crankshaft rear oil seal (A) and the wear sleeve (B) composes a non-separable part. To remove this oil seal/wear sleeve assembly, the two following procedures can be used depending on special tool availability.



CD30584 —UN—04MAY98

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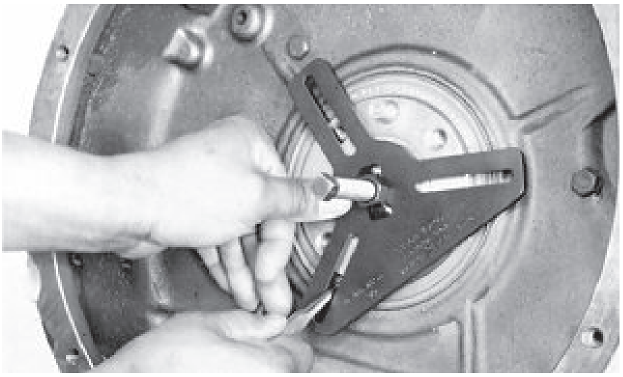
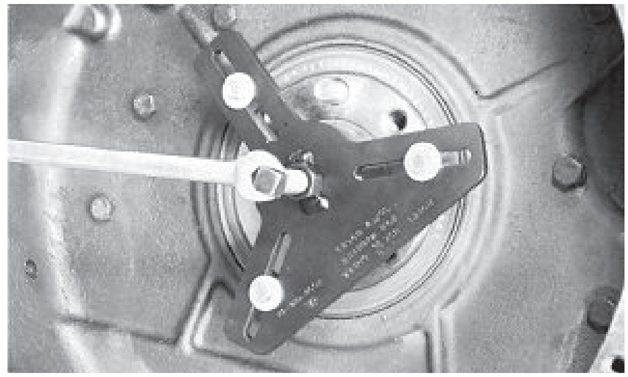
CD,CTM125,094 -19-01FEB13-1/4

Using JDG698A



RG5638 —UN—02APR90

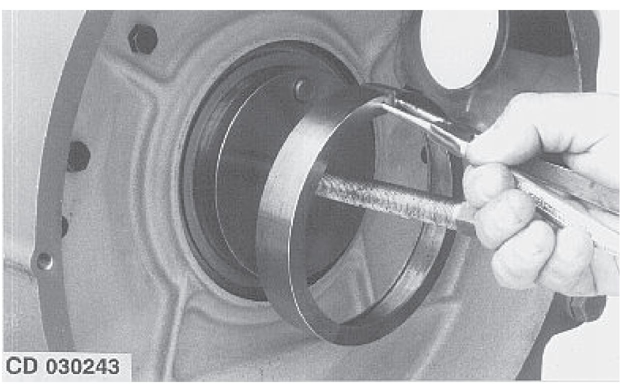


RG5639 —UN—02APR90

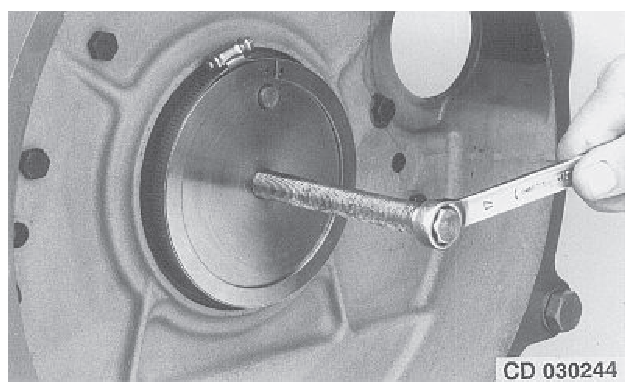
1. Adjust forcing screw on JDG698A tool and position screw so it centers tool on crankshaft flange.
2. Use the slots in JDG698A tool as a template, mark three locations on seal casing where screws should be installed for removal purposes. Remove tool from crankiest flange.
3. Drill a 3/16 in. hole through wear sleeve lip and seal casing at the three marked locations.
4. Position JDG698A on end of crankshaft then install three 2-1/2 in. sheet metal screws with washers into slots. Evenly tighten screws until plate is flush with rear face of crankshaft.
5. Tighten forcing screw until seal and wear sleeve assembly is removed from engine.

CD,CTM125,094 -19-01FEB13-2/4

Using JDG645 (or JDG645E)[1]



CD30243 —UN—06MAR95



CD30244 —UN—06MAR95

1. Place and center JDG645 (or JDG645E)[1] cap screws and driver plate assembly onto crankshaft rear face. Then, using snap ring pliers, set the thinner shoulder of ring tool between sleeve flange and seal case.
2. Secure the assembly with a clamp then gradually tighten the screw until wear sleeve is extracted.

[1] *Order JDG645E when tool is ordered from European Parts Distribution Center (EPDC).*

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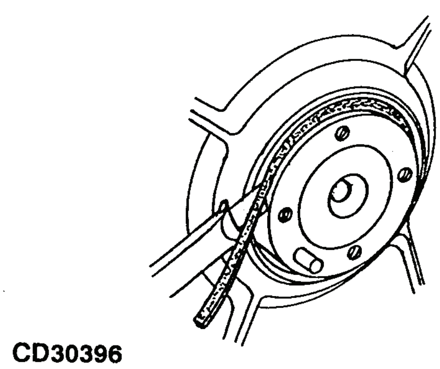
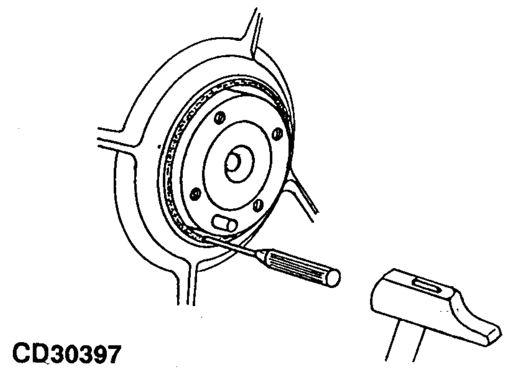
CD,CTM125,094 -19-01FEB13-3/4

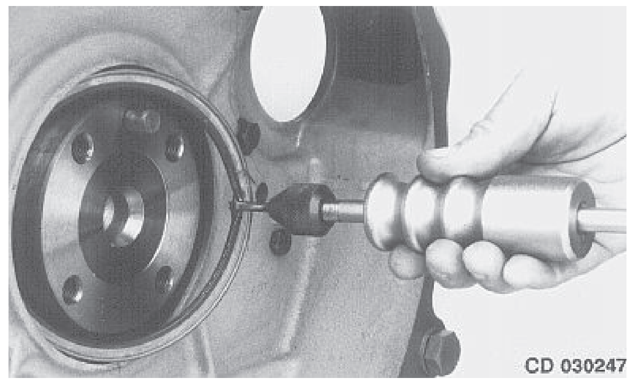


CD30396 —UN—10MAY95



CD30397 —UN—10MAY95

3. Cut the rubber lip now accessible and remove it.
4. Using a punch and a hammer, tap the seal case toward engine at any location until seal case pivots.
5. Using JDG22 Slide Hammer Puller, extract seal case.



CD30247 —UN—06MAR95

CD,CTM125,094 -19-01FEB13-4/4

Flywheel Housing Replacement

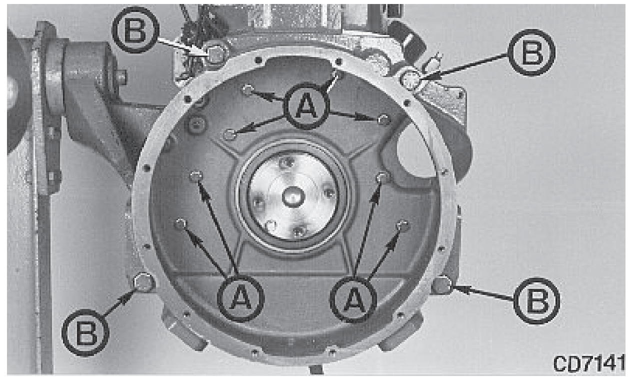
CAUTION: Flywheel housing weighs 20 to 40 kg (43 to 86 lb.).

1. Remove flywheel and oil pan.
2. Remove the four cap screws (B) and the eight 3/8 in. cap screws (A), then remove flywheel housing.
3. Clean mating surfaces and install new gasket (C).
4. Install flywheel housing and cap screws. Tighten as specified.

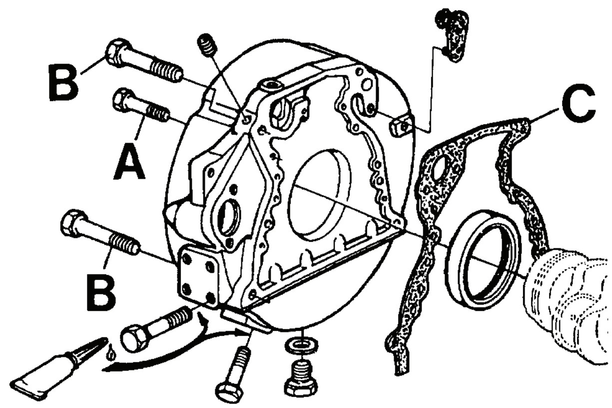
Specification

Specification	
3/8 in. cap screw—Torque (1st stage)	30 N·m (23 lb-ft)
Torque (2nd stage)	50 N·m (35 lb-ft)
5/8 in. cap screw—Torque	230 N·m (170 lb-ft)

NOTE: On certain applications, the open holes need to be obturated. Apply sealing compound on threads of cap screws.



CD7141 —UN—23MAY95

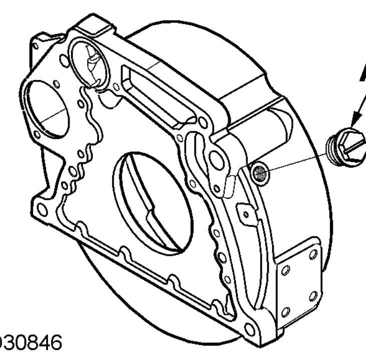


CD30585 —UN—16JUN98

A—3/8 in. Cap screw
B—5/8 in. Cap screw
C—Gasket

CD,CTM125,095 -19-30JUL04-1/2

NOTE: Certain applications may be equipped with a magnetic tachometer drive in relation with flywheel ring gear teeth. This option being installed by the equipment manufacturer, a plug (A) is installed by the factory.



CD30846

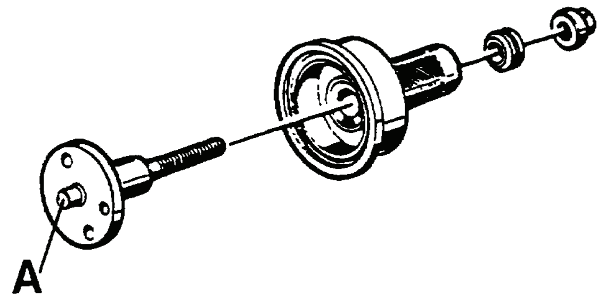
CD30846 —UN—27SEP04

Magnetic Tachometer Drive Installation

CD,CTM125,095 -19-30JUL04-2/2

Install Oil Seal/Wear Sleeve

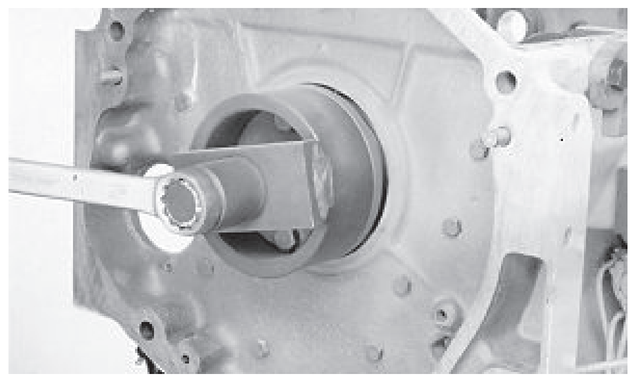
NOTE: Due to a diameter change of the crankshaft bore, it may be necessary to suppress the pilot pin (A) from KCD10002 or JT30040 tool. With this modification KCD10002 and JT30040 become respectively KCD10002A and JT30040B.



CD30586 —UN—16JUN98

CD,CTM125,097 -19-13SEP04-1/2

T81204 —UN—01NOV88



T81205 —UN—07NOV88

1. Position the guide plate from JT30040B or KCD10002A tool over dowel with two cap screws. Finger tighten both cap screws until they contact the pilot.
2. Using the oil seal/wear sleeve assembly with open side toward engine, center the guide plate and tighten cap screws.
3. Slide driver onto guide and gradually tighten the cap screw or nut until driver bottoms.

CD,CTM125,097 -19-13SEP04-2/2

Crankshaft End Play Measure

NOTE: It is recommended to measure crankshaft end play prior to removing crankshaft to determine condition of thrust bearings.

Check crankshaft end play using a dial indicator and compare with specifications.

Crankshaft—Specification

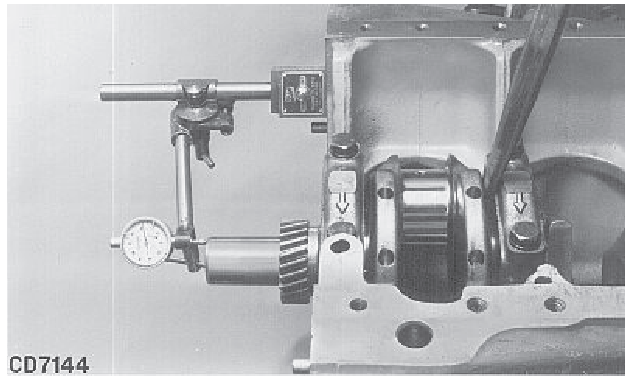
2-piece thrust bearing—End Play............................0.13—0.40 mm (0.005—0.016 in.)
Wear tolerance ....0.50 mm (0.02 in.)
5/6-piece thrust bearing—End Play............................0.03—0.35 mm (0.001—0.014 in.)
Wear tolerance ....0.50 mm (0.02 in.)

If end play is still not within specification with new standard 2-piece or 6-piece thrust bearings, install a 5-piece thrust bearing with oversized thrust washers.

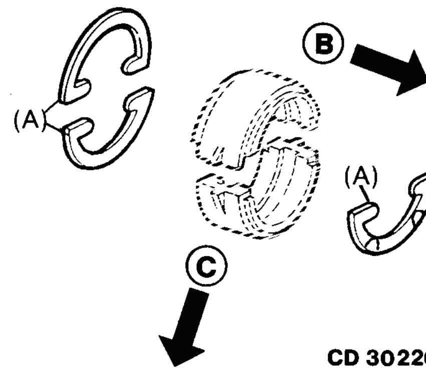
Specification

Oversized crankshaft thrust washer—Thickness...+ 0.18 mm (0.007 in.)

NOTE: Oversized thrust bearing set contains three 0.18 mm (0.007 in.) oversized thrust washers to be installed as shown.



CD7144 —UN—07MAR95



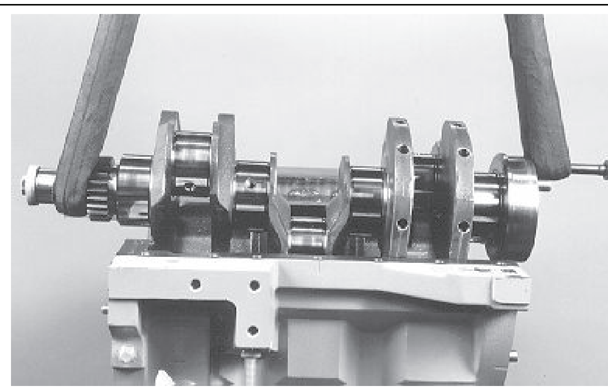
CD30220 —UN—07MAR95

A—Oversized thrust washers
B—Front of engine
C—Rear bearing cap side

CD,CTM125,098 -19-16JAN01-1/1

Remove Crankshaft

1. Identify main bearing caps to assure correct placement during reassembly.
2. Attach nylon slings (or other suitable lifting slings) to crankshaft.
3. Carefully lift crankshaft out of cylinder block.

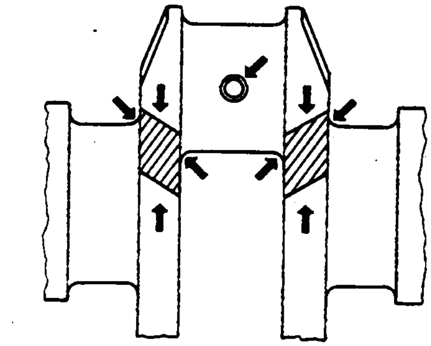


CD30587 —UN—04MAY98

CD,CTM125,099 -19-01DEC97-1/1

Crankshaft Inspection

1. Clean crankshaft thoroughly, especially oil passages from crankshaft bearings to connecting rod bearings.
2. Check crankshaft for cracks or signs of load stress (see illustration for critical areas of load stress in a crankshaft).
3. Inspect both shoulders of thrust bearing journal for scores or unevenness.



CD7147 —UN—23FEB89

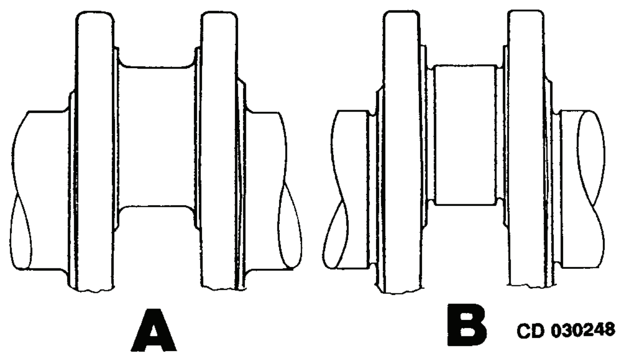
CD,3274,G15,19 -19-01MAR92-1/1

Crankshaft Identification

Crankshaft can be made of steel with machined fillet radii (A) or cast iron with rolled grooves (B).

NOTE: Saran (CD) and Torreon (PE) engines use cast iron crankshafts while L & T - John Deere (PY) engines use steel crankshafts.

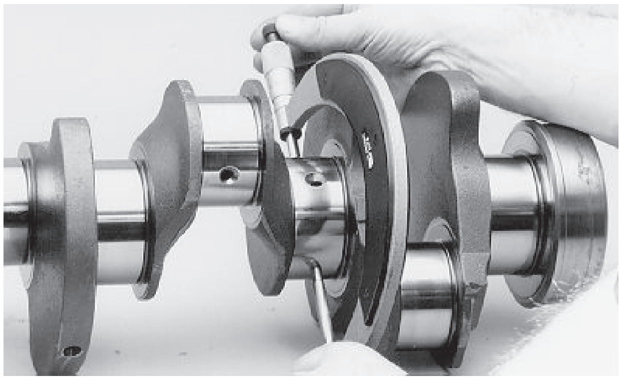
A—Steel crankshaft with fillet radii
B—Cast iron crankshaft with rolled grooves



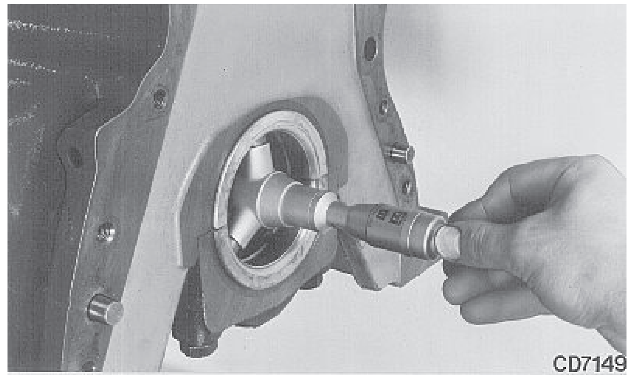
CD30248 —UN—08MAR95

CD03523,000012E -19-28JUL04-1/1

Check Crankshaft Journal Diameter



CD30588 —UN—04MAY98



CD7149 —UN—07MAR95

1. Measure diameter of all crankshaft journals at several points around journal and compare with specifications.

Specification

Crankshaft main journal—Diameter (Standard).................................79.324—79.350 mm (3.123—3.124 in.)
Crankshaft rod journal—Diameter (Standard).................................69.799—69.825 mm (2.748—2.749 in.)
Crankshaft main or rod Journal—Maximum taper..0.03 mm (0.0012 in.)
Maximum out-of-roundness...0.075 mm (0.003 in.)

2. Install main bearing inserts and caps then tighten cap screws to 135 N·m (100 lb-ft), then measure diameter of main bearing (assembled) and compare with specification.

Specification

Crankshaft main bearings assembled—Diameter...............79.396—79.440 mm (3.126—3.127 in.)
Crankshaft main bearing-to-journal—Oil clearance.................................. 0.046—0.116 mm (0.0018—0.0046 in.)
Maximum wear ....0.15 mm (0.006 in.)

NOTE: The crankshaft main bearing-to-journal oil clearance can also be determined using PLASTIGAGE®.

If engine had a previous major overhaul and undersized bearing inserts were used, diameters listed above may not be the same as those recorded. However, the bearing clearance should be within specifications.

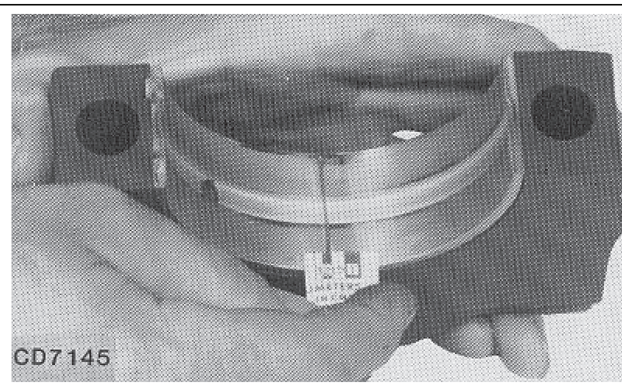
3. If crankshaft journal diameter or clearance are not within specifications, replace crankshaft or regrind journals to match undersize bearings (See “Regrind Crankshaft” in this Group).

NOTE: Undersize crankshafts may be also available through regular service parts channel.

PLASTIGAGE is a trademark of DANA Corp.

CD,CTM125,100 -19-16JAN01-1/1

Determine Crankshaft Main Bearing Clearance Using PLASTIGAGE®



CD7145 —UN—23MAY95

1. Place a strip of PLASTIGAGE® in the center of the bearing.
2. Install cap and tighten cap screws to 135 N·m (100 lb-ft).
3. Remove cap and compare the width of PLASTIGAGE® with scale provided on side of package to determine clearance.
4. Maximum permissible clearance is 0.15 mm (0.006 mm).

PLASTIGAGE is a trademark of DANA Corp.

CD,CTM125,101 -19-16JAN01-1/1

Regrind Crankshaft

If journals are worn, tapered, out-of-round, scored or damaged, the crankshaft journals can be reground and correct undersize bearing inserts installed.

Specification	
Undersized crankshaft	
main bearing—1st Size	0.25 mm (0.01 in.)
2nd Size	0.50 mm (0.02 in.)
3rd Size	0.76 mm (0.03 in.)

IMPORTANT: Crankshaft grinding should be carried out ONLY by experienced personnel on equipment capable of maintaining crankshaft size and finish specifications.

NOTE: This cast iron crankshaft can be reground only once to 0.25 mm (0.01 in.) under standard size. Crankshaft must be lapped afterwards according to the micro-finishing specifications given in this group.

CD,CTM125,102 -19-16JAN01-1/1

Crankshaft Regrinding Guidelines

If the crankshaft is to be reground, use the following recommended guidelines:

1. Determine the size to which the journals are to be reground according to the measures taken during inspections.
2. If one or more main or connecting rod journals require grinding, then grind all of the main journals or all of the connecting rod journals to the same required size. Grind clockwise (as viewed from nose of crankshaft).
3. Care must be taken to avoid localized heating which often produces grinding cracks. Use coolant generously to cool the crankshaft while grinding. Do not crowd the grinding wheel into the work.
4. Polish or lap (clockwise) the ground surfaces to the specified finish (see “MICRO-FINISHING SPECIFICATIONS” in this group). The reground journals will be subject to excessive wear unless polished smooth.

NOTE: When thrust surfaces are reground and an oversize washer is used, crankshaft end play specification must be maintained.

5. If the thrust surfaces of the crankshaft are worn or grooved excessively, they must be reground and polished. An oversize thrust washer set is available.
6. Stone the edge of all oil holes in the journal surfaces smooth to provide a radius of approximately 1.50 mm (0.060 in.).
7. After grinding has been completed, inspect the crankshaft by the fluorescent magnetic particle method, or other similar method to determine if cracks have originated due to the grinding operation.
8. De-magnetize the crankshaft.
9. Thoroughly clean the crankshaft and oil passages with solvent. Dry with compressed air.

CD,CTM125,103 -19-01DEC97-1/1

Micro-Finishing Specifications

The following specifications are required when cast iron crankshafts have to be reground:

	Specification
Crankshaft Micro-Finishing specifications—Center Line Average (C.L.A.)	0.2 micron (8 micro-in.) or better
Skewness parameter (Sk)	Negative
Bearing ratio (Tp) with 1% Tp reference line at a depth of 0.22 micron (8.8 micro-in.)	Tp more than 20%
Bearing ratio (Tp) with 1% Tp reference line at a depth of 0.38 micron (15.2 micro-in.)	Tp more than 80%
Bearing ratio (Tp) with 1% Tp reference line at a depth of 0.64 micron (25.6 micro-in.)	Tp more than 90%

Final journal finishing operation must be done in clockwise direction (as viewed from nose of crankshaft).

IMPORTANT: DO NOT attempt to regrind cast iron crankshafts if above specifications cannot be obtained.

CD,3274,G15,37 -19-16JAN01-1/1

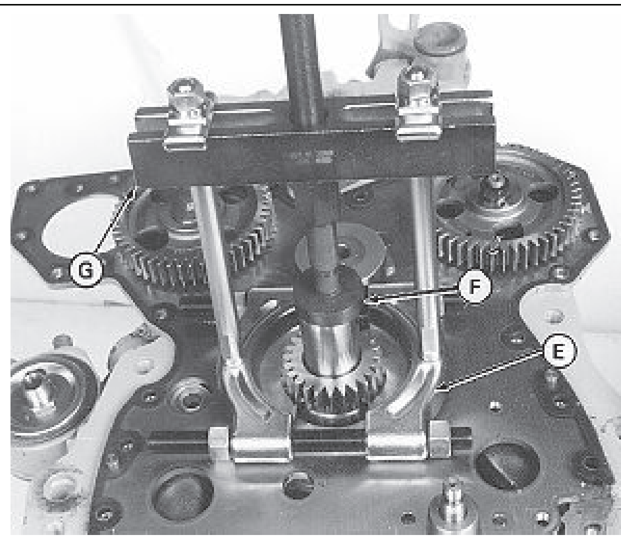
Replace Crankshaft Gear

NOTE: Gear can be replaced with crankshaft not removed from engine.

1. Pull gear using D01200AA Push Puller and D01218AA Pulling Attachment or any other suitable puller.
2. Remove Woodruff key from crankshaft and remove any burrs from gear journal.
3. Install a new Woodruff key in crankshaft keyway.

CAUTION: Oil fumes or oil can ignite above 190°C (380°F). Use a thermometer to ensure that a temperature of 180°C (360°F) is not exceeded. Do not allow a flame or heating element to come into direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

4. Heat new gear to 180°C (360°F).



RG7238 —UN—10OCT94

E—D01218AA Pulling attachment
F—Disc
G—D01200AA Push Puller

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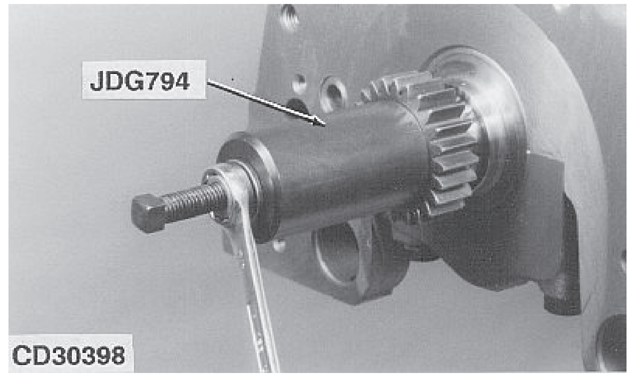
CD,CTM125,104 -19-16JAN01-1/2

5. Drive gear, with chamfered side toward engine, onto crankshaft using JDG794A driver (formerly JDH7 or JDG794).



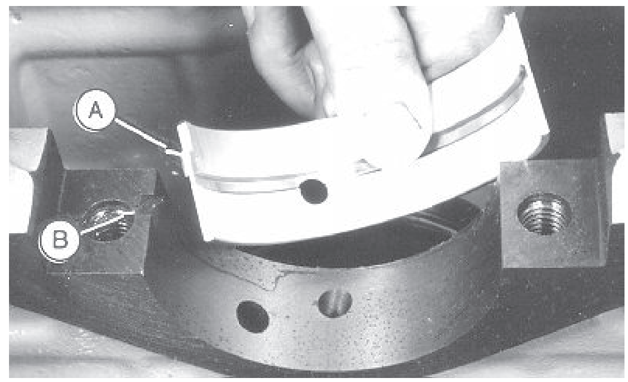
CD30398 —UN—10MAY95

CD,CTM125,104 -19-16JAN01-2/2

Install Main Bearing Inserts

Install main bearing inserts, making sure that tang (A) on the inserts engages in slot (B) in cylinder block and main bearing caps. Also ensure that oil bores of bearing inserts are aligned with oil passages in cylinder block.

A—Bearing insert tang **B—Cylinder block slot**

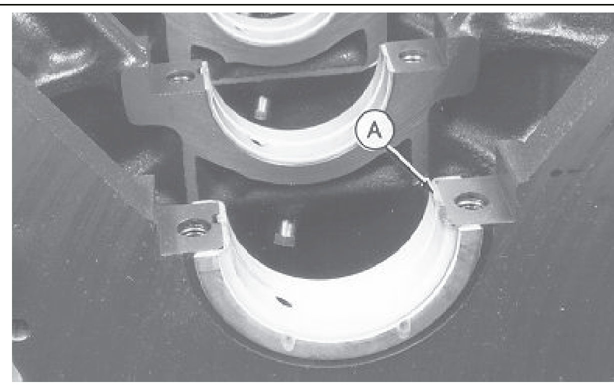


CD30589 —UN—19MAY98

CD,CTM125,105 -19-01DEC97-1/1

Install 2-Piece Thrust Bearing

Install one thrust bearing (A) from 2-piece thrust bearing set in rear web of cylinder block and the other in rear bearing cap.



CD30590 —UN—04MAY98

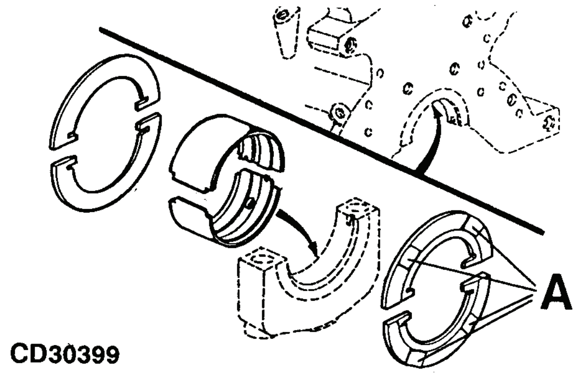
CD,CTM125,106 -19-01DEC97-1/1

Install 6-Piece Thrust Bearing

Install two thrust washers in the block and two on bearing cap. The oil grooves (A) must face towards crankshaft thrust surfaces.

NOTE: Engine may be equipped with a 5-piece thrust bearing from the factory. If this 5-piece thrust bearing is re-installed, place two thrust washers on bearing cap and the last one on rear face of cylinder block.

A—Oil grooves



CD30399 —UN—10MAY95

CD,CTM125,107 -19-01DEC97-1/1

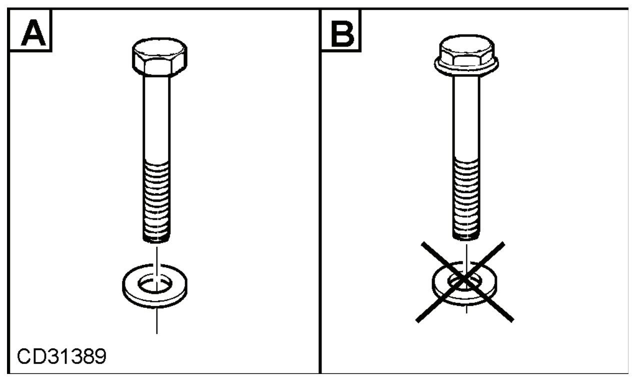
Crankshaft Installation

NOTE: Two types of cap screws can be used to attach the main bearings to cylinder block:

- *Type A = Standard cap screw WITH washer*
- *Type B = Flanged cap screw (WITHOUT washer)*

Each type of cap screw has a different torque specification.

A—T23474 Cap Screw + T20168 Washer **B—R528387 Flanged Cap Screw**



Main Bearing Cap Screws

CD31389 —UN—23FEB12

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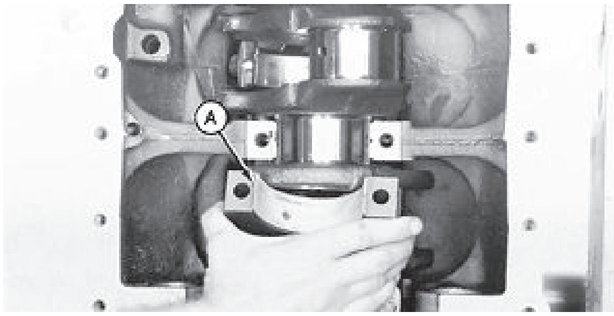
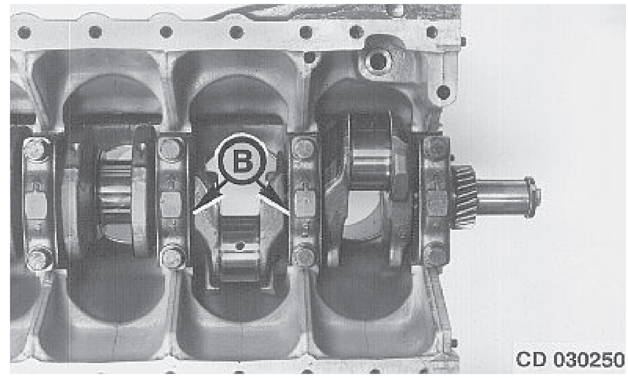
CD,CTM125,108 -19-23FEB12-1/2



T88557 —UN—14OCT88



CD30250 —UN—06MAR95

1. Apply a liberal coating of clean engine oil to bearing surfaces and crankshaft journals and install crankshaft.
2. Dip entire main bearing cap screws in clean engine oil and allow excess oil to drip off.
3. Install all bearing caps (B) according to the identification marks stamped on them, and so that tangs (A) of both bearing halves are on the same side. Install all cap screws finger-tight.

IMPORTANT: Do not use pneumatic wrench to install main bearing cap screws, as damage may occur to threads.

4. Tighten all main bearing cap screws to initial specifications except rear main (thrust) bearing cap screws.

Specification

Crankshaft Main Bearing Cap Screws —Initial Torque.. 20 N·m (15 lb.-ft.)

5. Using a soft-face hammer, move crankshaft first towards the rear and then towards the front to align the rear thrust washers.
6. Tighten rear main (thrust) bearing cap screws to initial specified torque.

Specification

Crankshaft Rear Main (Thrust) Bearing Cap Screw—Initial Torque.. 20 N·m (15 lb.-ft.)

7. Check crankshaft for specified end play.

Specification

Crankshaft—End Play.......................0.03—0.36 mm (0.001—0.014 in.)

8. Turn crankshaft by hand. If crankshaft does not turn easily, disassemble parts and determine the cause.
9. Tighten all cap screws to final torque according to the cap screw type.

Crankshaft Main Bearing—Specification

Standard Cap screw + Washer (Type A)—Final Torque.. 135 N·m (100 lb.-ft.)

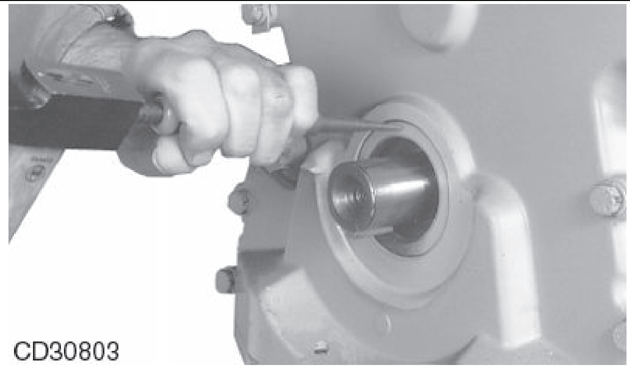
Crankshaft Main Bearing—Specification

Flanged Cap screw (Type B)—Torque Turn.................... 40 N·m (30 lb.-ft.) plus additional 60° turn

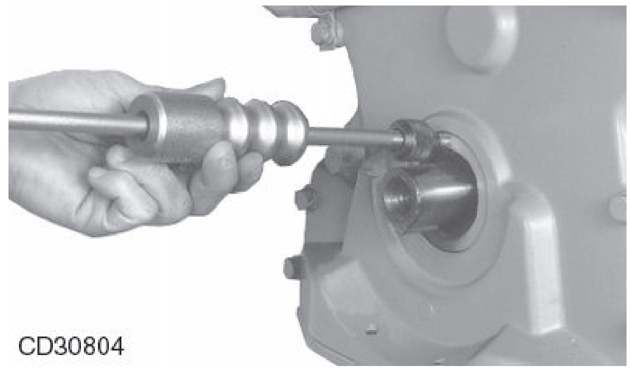
CD,CTM125,108 -19-23FEB12-2/2

Remove Crankshaft Front Oil Seal

1. Remove crankshaft pulley.
2. Make a hole on outer case of oil seal using a punch (or a nail).
3. Using JDG22 Slide Hammer Puller with a self-thread screw, pull off oil seal.
4. If necessary, repeat this operation at 120° apart.



CD30803 —UN—17APR01

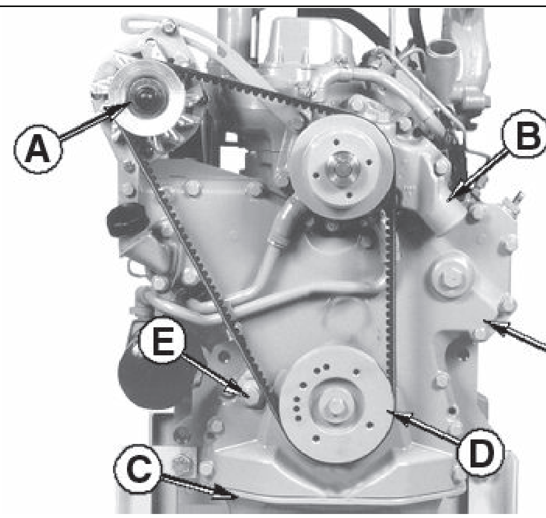


CD30804 —UN—17APR01

CD03523,00000F7 -19-17JAN01-1/1

Remove Timing Gear Cover

1. Remove alternator (A).
2. Remove water pump (B).
3. Remove oil pan (C).
4. Remove crankshaft pulley (D).
5. Remove oil pressure regulating valve (E).
6. Remove timing gear cover (F).
7. If not yet done, remove oil seal from timing gear cover.



CD30805 —UN—12MAR01

A—Alternator
B—Water pump
C—Oil pan
D—Crankshaft pulley
E—Oil pressure regulating valve
F—Timing gear cover

CD03523,00000F8 -19-17JAN01-1/1

Measure Timing Gear Backlash

Measure backlash between gears using a dial indicator and compare with specifications.

Helical timing gear—Specification

Upper idler/crankshaft gear—Backlash.................................0.07—0.30 mm (0.003—0.012 in.)
Wear tolerance ....0.40 mm (0.016 in.)
Upper idler/camshaft gear—Backlash.................................0.07—0.35 mm (0.003—0.014 in.)
Wear tolerance ....0.51 mm (0.020 in.)
Upper idler/injection pump gear—Backlash.......................0.07—0.35 mm (0.003—0.014 in.)
Wear tolerance ....0.51 mm (0.020 in.)
Lower idler/crankshaft gear—Backlash.................................0.07—0.35 mm (0.003—0.014 in.)
Wear tolerance ....0.51 mm (0.020 in.)
Lower idler/oil pump gear—Backlash...............................0.04—0.38 mm (0.0016—0.015 in.)
Wear tolerance ....0.40 mm (0.016 in.)

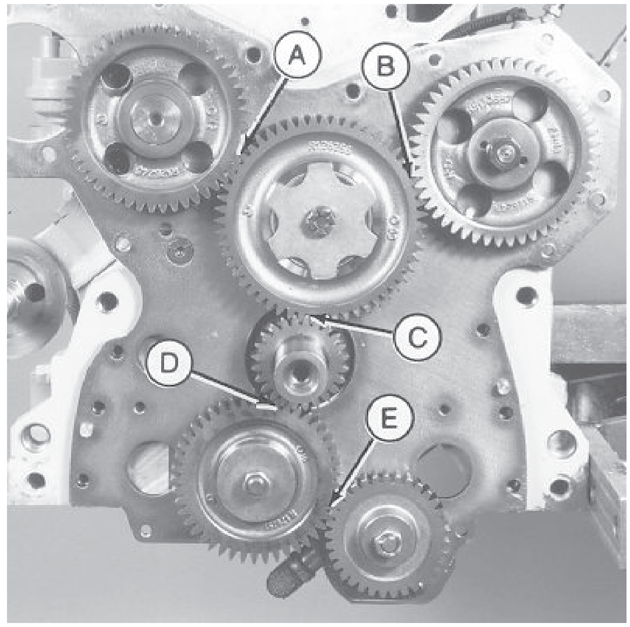
Spur timing gear
Engines for 5300/5300N Tractors (-242551CD)
All other Engines (-270818CD)
—Specification

Upper idler/crankshaft gear—Backlash...............................0.04—0.35 mm (0.0016—0.014 in.)
Wear tolerance ....0.60 mm (0.024 in.)
Upper idler/camshaft gear—Backlash.................................0.08—0.45 mm (0.003—0.018 in.)
Wear tolerance ....0.85 mm (0.033 in.)
Upper idler/injection pump gear—Backlash.......................0.08—0.45 mm (0.003—0.018 in.)
Wear tolerance ....0.85 mm (0.033 in.)
Lower idler/crankshaft gear—Backlash...............................0.04—0.35 mm (0.0016—0.014 in.)
Wear tolerance ....0.65 mm (0.025 in.)
Lower idler/oil pump gear—Backlash.................................0.08—0.40 mm (0.003—0.016 in.)
Wear tolerance ....0.75 mm (0.030 in.)
Camshaft/aux. drive gear—Backlash...............................0.09—1.24 mm (0.0035—0.049 in.)
Wear tolerance ....1.34 mm (0.053 in.)

Spur timing gear
Engines for 5300/5300N Tractors (242552CD-)
All other Engines (270819CD-)
—Specification

Upper idler/crankshaft gear—Backlash...............................0.01—0.49 mm (0.0004—0.019 in.)
Upper idler/camshaft gear—Backlash...............................0.01—0.52 mm (0.0004—0.020 in.)
Upper idler/injection pump gear—Backlash.....................0.01—0.52 mm (0.0004—0.020 in.)
Lower idler/crankshaft gear—Backlash...............................0.01—0.46 mm (0.0004—0.018 in.)
Lower idler/oil pump gear—Backlash...............................0.01—0.49 mm (0.0004—0.019 in.)
Camshaft/aux. drive gear—Backlash...............................0.01—0.54 mm (0.0004—0.021 in.)

If backlash is not correct, install new gears.



CD30591 —UN—04MAY98

A—Camshaft/upper idler gear
B—Injection pump/upper idler gear
C—Upper idler/crankshaft gear
D—Crankshaft/lower idler gear
E—Oil pump/lower idler gear

CD,CTM125,112 -19-17JAN01-1/1

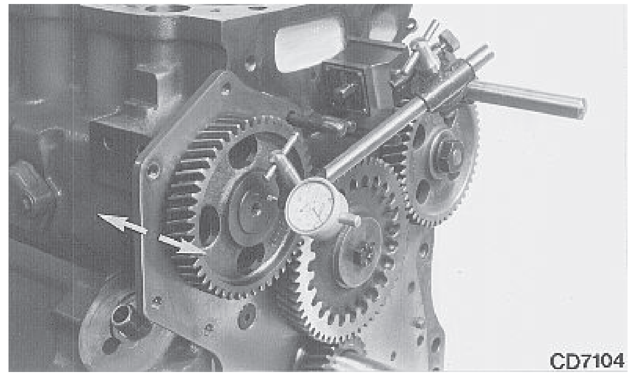
Camshaft End Play Measure

Using a dial indicator, check camshaft end play.

Specification

Camshaft—End play .... 0.08—0.23 mm (0.003—0.009 in.)
Maximum wear .... 0.38 mm (0.015 in.)
Thrust Plate—Thickness .... 3.935—3.985 mm (0.155—0.157 in.)
Maximum wear .... 3.8 mm (0.15 in.)

NOTE: If end play exceeds specifications then check thickness of thrust plate as this determines end play.



CD7104 —UN—07MAR95

CD,3274,G20,6 -19-17JAN01-1/1

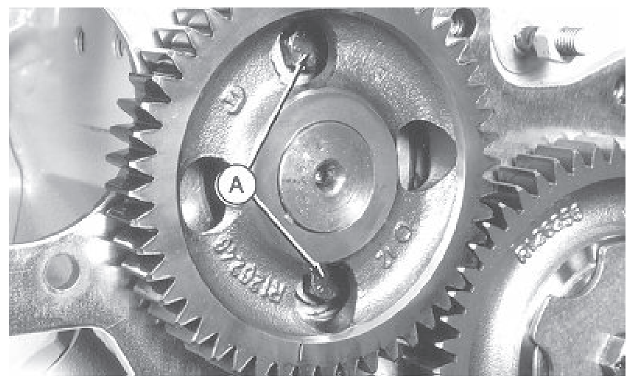
Remove Camshaft

NOTE: Mark parts so that they can be reinstalled in their original positions.

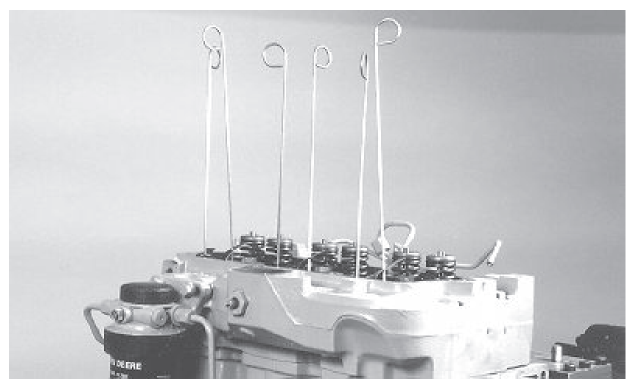
1. Remove cylinder head, cam followers and fuel pump.
2. Remove cap screws (A) and pull camshaft straight out.

IMPORTANT: When removing camshaft, be careful that lobes do not damage the bearing surfaces in bores.

NOTE: Camshaft can be removed from engine without removing cylinder head by holding cam followers away from camshaft lobes with D15001NU Magnetic Holding Set.



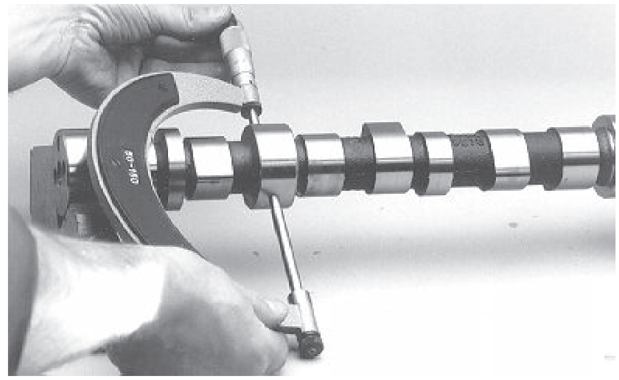
CD30592 —UN—19MAY98



CD30593 —UN—04MAY98

CD,CTM125,113 -19-01DEC97-1/1

Measure Camshaft Journal



CD30594 —UN—04MAY98

Specification

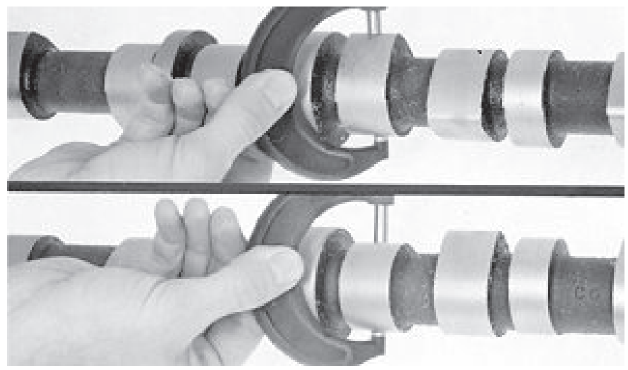
Camshaft
Journal—Diameter.................55.872—55.898 mm (2.1997—2.2007 in.)
Maximum wear .... 55.85 mm (2.199 in.)
Camshaft Journal-to-
bore—Max. clearance.. 0.18 mm (0.007 in.)

If diameter or clearance are not within specifications, replace camshaft.

IMPORTANT: To keep the initial working condition between cam lobes and cam followers, always replace cam followers when installing a new camshaft.

CD,CTM125,114 -19-17JAN01-1/1

Measure Height of Cam Lobe



T81262 —UN—01NOV88

Measure longest and shortest diameter of each cam. Subtract shorter diameter from longer diameter to find the height of the cam lobe. If any lobe is not of the correct height, install a new camshaft.

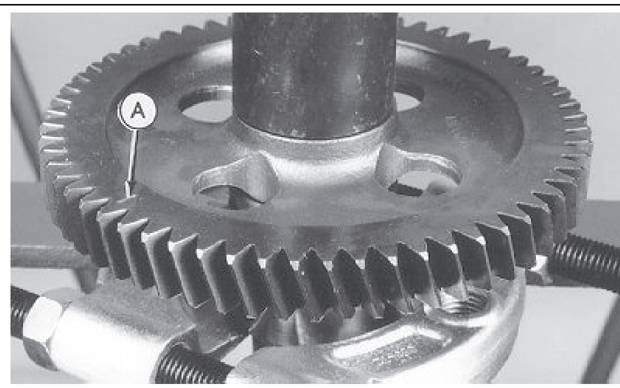
Specification

Camshaft Intake
Lobe—Height.....................................6.93—7.42 mm (0.273—0.292 in.)
Maximum wear .... 6.68 mm (0.263 in.)
Camshaft Exhaust
Lobe—Height.....................................6.76—7.26 mm (0.266—0.286 in.)
Maximum wear .... 6.50 mm (0.256 in.)

IMPORTANT: To keep the initial working condition between cam lobes and cam followers, always replace cam followers when installing a new camshaft.

CD,3274,G20,9 -19-17JAN01-1/1

Replace Camshaft Gear



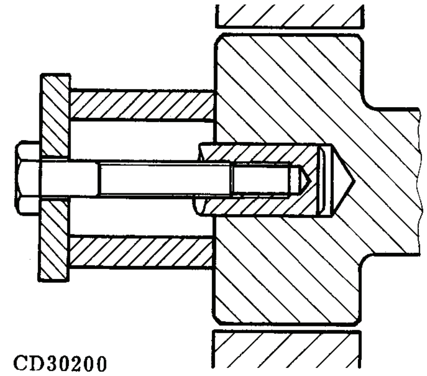
CD30595 —UN—19MAY98

1. Remove gear from camshaft using a press.
2. Install shaft key on camshaft nose.
3. Install gear with timing mark (A) away from camshaft.
4. Press gear on shaft until flush with shoulder on camshaft.

CD,CTM125,115 -19-01DEC97-1/1

Tachometer Pick-Up Pin Removal

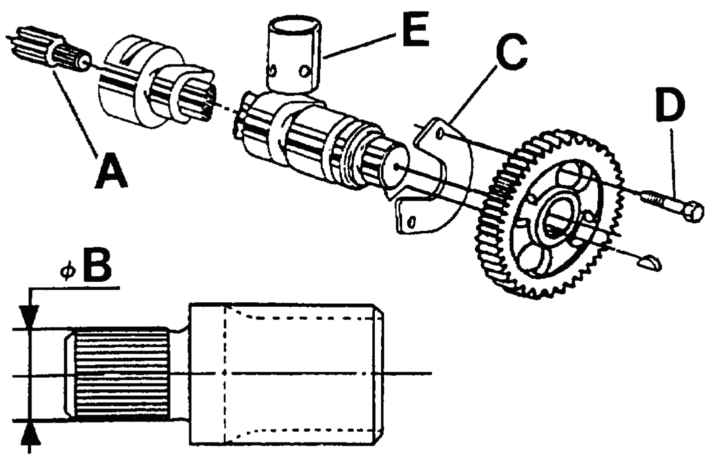
1. Drill and tap an extraction hole of approx. 6 mm (0.250 in.) diameter and 12 mm (0.500 in.) depth in center of pin.
2. Using a self-made puller (spacer, washer, screw), pull out the tachometer pick-up pin.



CD30200 —UN—07MAR95

CD,3274,G20,11 -19-10MAR92-1/1

Install Camshaft



CD30596 —UN—16JUN98

1. Before installation of the tachometer drive shaft (A), check the diameter of the knurled shaft area (B). If diameter exceeds 12.92 mm (0.5087 in.), rework shaft to 12.88—12.92 mm (0.5071—0.5087 in.).
2. Coat camshaft with clean engine oil. On engines with camshaft bushing, lubricate the inner circumference of bushing with TY6333[1] grease.
3. Install camshaft and thrust plate (C) in cylinder block.
4. Install cap screws (D) and tighten to specification.

Specification

Camshaft thrust plate cap screws—Torque.. 50 N·m (35 lb-ft)

IMPORTANT: To keep the initial working condition between cam lobes and cam followers, always replace cam followers (E) when installing a new camshaft.

[1] *Available as service part.*

CD,CTM125,116 -19-17JAN01-1/1

Check Cam Follower

Measure cam follower diameter and compare with specification.

Specification

Cam Follower—diameter..31.62—31.64 mm (1.124—1.246 in.)
Cam Follower-to-Bore—Clearance................................0.06—0.13 mm (0.002—0.005 in.)

If diameter or clearance are not within specifications or if the follower face is flat or concave, replace cam follower.

RG6324 —UN—23NOV97

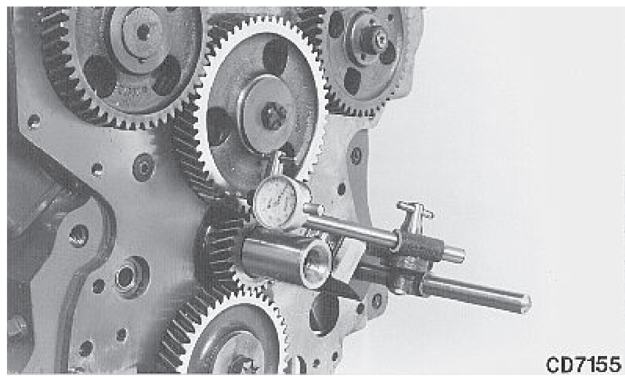
CD,CTM125,117 -19-17JAN01-1/1

Idler Gear End Play Measure

Using a dial indicator, check end play of upper and lower idler gears.

Specification

Upper and lower idler gear—End play..................................0.14—0.29 mm (0.006—0.012 in.)
Maximum wear ....0.40 mm (0.016 in.)



CD7155 —UN—23MAY95

CD,3274,G20,20 -19-17JAN01-1/1

Remove Front Plate

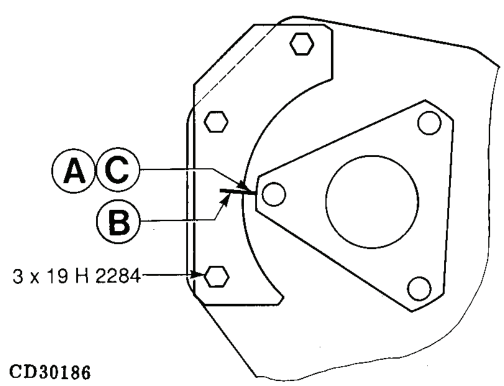
1. Proceed as follows in case of front plate replacement:

IMPORTANT: Replacement front plates do not have any injection pump timing marks. It is extremely important that the timing be accurately transferred from original front plate to the replacement plate in the exact location for proper injection pump timing.

a. Build an aluminum template as shown under "Self-manufactured tool".

b. Attach template to previous front plate using three 3/8 in. cap screws and transfer timing mark from previous front plate (A) to template (B) with a pencil.

c. Attach template to new front plate and transfer timing mark to the new front plate (C) using a scriber.



CD30186 —UN—07MAR95

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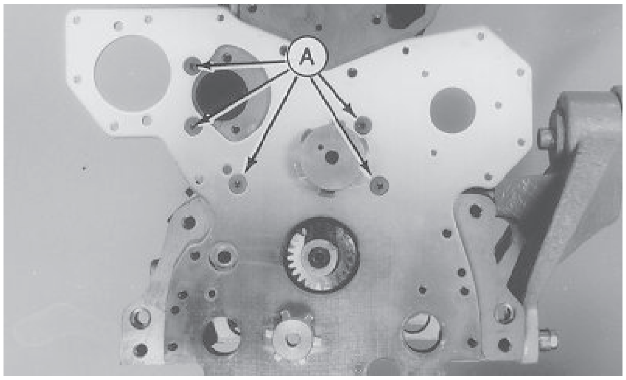
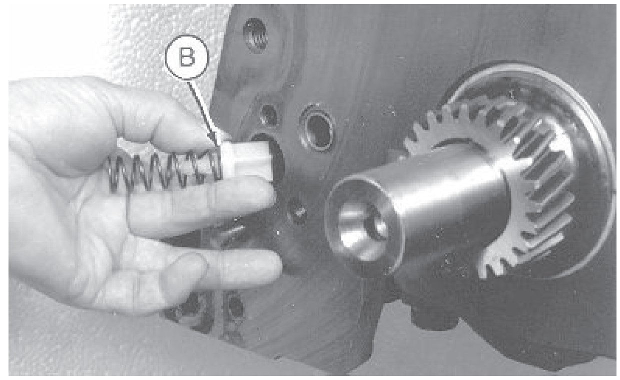
CD,CTM125,118 -19-17JAN01-1/2



CD30597 —UN—19MAY98



CD30598 —UN—04MAY98

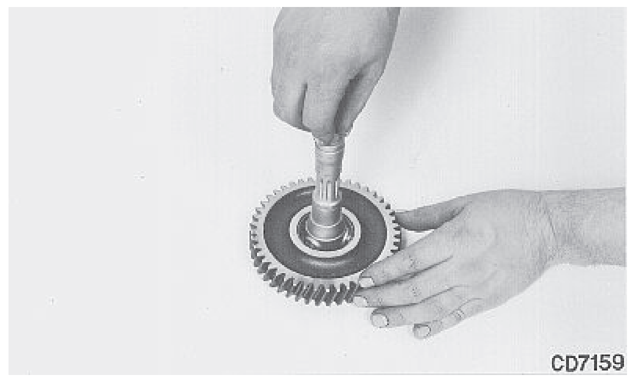
2. Remove upper and lower idler gears.
3. Remove camshaft, fuel injection pump and oil pump.
4. Remove countersunk screws (A) and lift off front plate.
5. Remove oil by-pass valve and spring (B).

CD,CTM125,118 -19-17JAN01-2/2

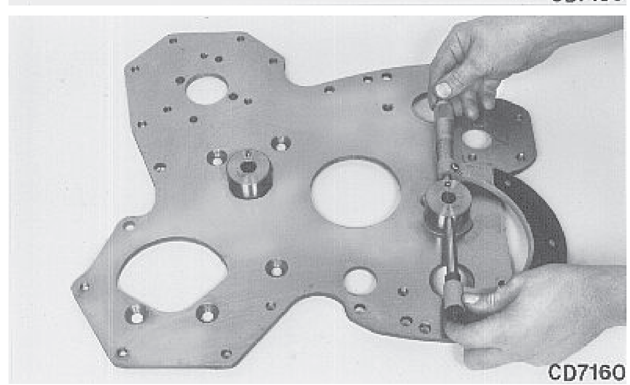
Idler Gear Bushing and Shaft Measure

Specification

Upper idler gear shaft (helical gear)—Diameter....................44.437—44.463 mm (1.7495—1.7505 in.)
Lower idler gear shaft (helical and spur gear)—Diameter....................44.437—44.463 mm (1.7495—1.7505 in.)
Upper idler gear shaft (spur gear)—Diameter.............69.759—69.775 mm (2.7464—2.747 in.)
Upper idler gear bushing (helical gear)—Diameter........................44.501—44.527 mm (1.752—1.753 in.)
Lower idler gear bushing (helical and spur gear)—Diameter........................44.501—44.527 mm (1.752—1.753 in.)
Upper idler gear bushing (spur gear)—Diameter...........69.827—69.857 mm (2.7491—2.7503 in.)
Upper idler gear bushing-to-shaft (helical gear)—Clearance........................0.038—0.09 mm (0.0015—0.0035 in.)
Maximum wear .... 0.15 mm (0.006 in.)
Lower idler gear bushing-to-shaft (helical and spur gear)—Clearance........................0.038—0.09 mm (0.0015—0.0035 in.)
Maximum wear .... 0.15 mm (0.006 in.)
Upper idler gear bushing-to-shaft (spur gear)—Clearance........................0.052—0.098 mm (0.002—0.0038 in.)
Maximum wear .... 0.15 mm (0.006 in.)



CD7159 —UN—07MAR95



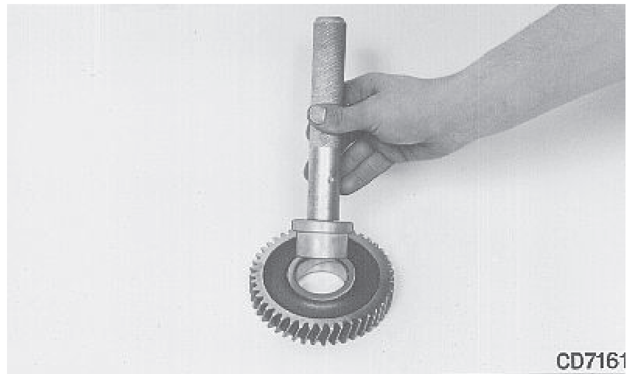
CD7160 —UN—07MAR95

If clearance is more than specified, replace worn parts with new ones.

CD,3274,G20,22 -19-01FEB94-1/1

Idler Gear Bushing Replacement

NOTE: Bushing for spur upper idler gear is not available separately. Install a new idler gear/bushing assembly.



CD7161 —UN—07MAR95

1. Press worn idler gear bushing out of gear.

IMPORTANT: The upper and lower idler gears require different bushings.

UPPER IDLER GEAR: Being pressure lubricated, this gear is specified with a smooth-bore bushing.

LOWER IDLER GEAR: Being splash lubricated, this gear is specified with a lube-groove fitted bushing.

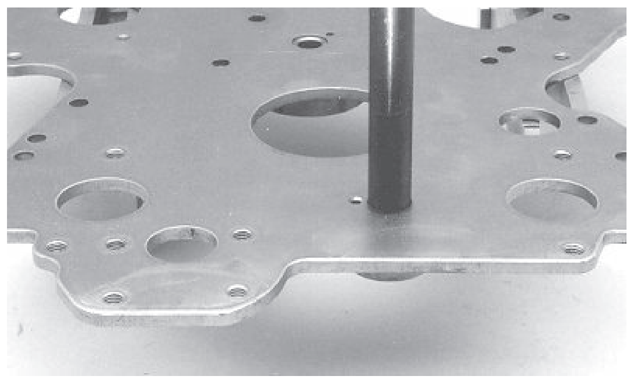
2. Press in new bushing with JD252 (JD-252)[1] Driver and JDG537 Handle so that it is flush with one side of the gear.

[1]Order JD-252 when tool is ordered from European Parts Distribution Center (EPDC).

CD,3274,G20,23 -19-26AUG04-1/1

Remove Idler Shaft

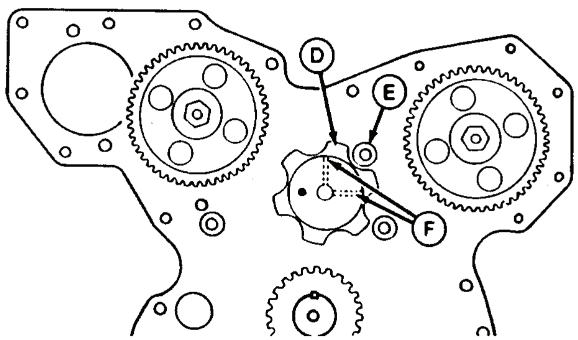
Remove upper or lower idler shaft by driving shaft out of the front plate. Remove thrust washer.



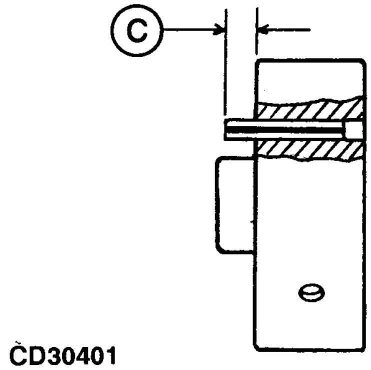
CD30599 —UN—04MAY98

CD,CTM125,119 -19-01DEC97-1/1

Install Idler Shaft Spring Pin



RG6459 —UN—26OCT92



CD30401 —UN—10MAY95

C—Pin protrusion
D—Thrust washer ears
E—Countersunk screw
F—Shaft oil holes

NOTE: The upper idler shaft for engine with auxiliary drive (spur gear) has a spring pin to allow a proper orientation of the shaft oil holes (F) and of the thrust washer ears (D) to clear space around countersunk front plate screw (E).

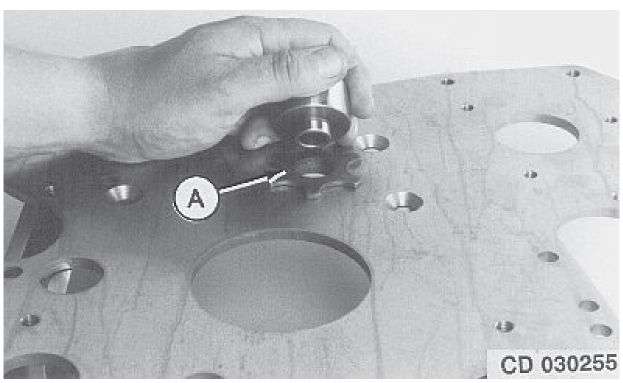
Press spring pin until protrusion (C) is obtained.

Specification

Upper shaft spring pin (spur gear)—Protrusion (C)..7.5—8.5 mm (0.295—0.335 in.)

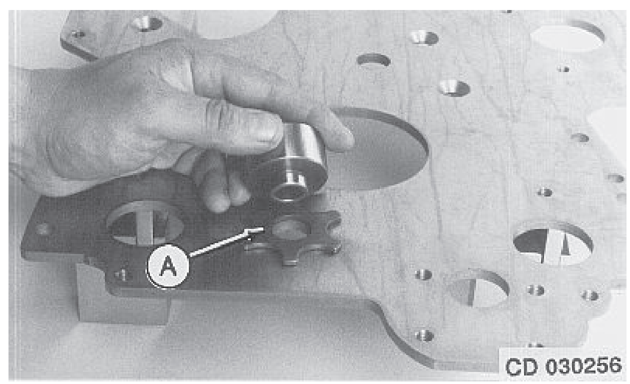
CD,CTM125,132 -19-17JAN01-1/1

Install Idler Shafts



CD30255 —UN—06MAR95

Upper idler shaft



CD30256 —UN—06MAR95

Lower idler shaft

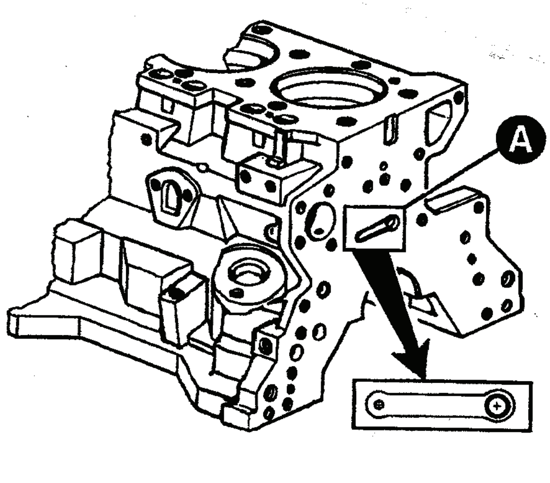
IMPORTANT: Oil hole in upper idler shaft must be properly indexed to provide adequate lubrication to idler gear bushing.

1. Install thrust washer with sharp edge toward front plate.
2. Place idler shaft in front plate bore with oil hole oriented between 10 and 11 o'clock position. On engine with auxiliary drive, make sure that spring pin of upper shaft is in line with thrust washer and front plate holes.
3. Press shaft into front plate until thrust washer is fully seated.

NOTE: Idler shaft is secured to front plate when gear bolt or nut are tightened.

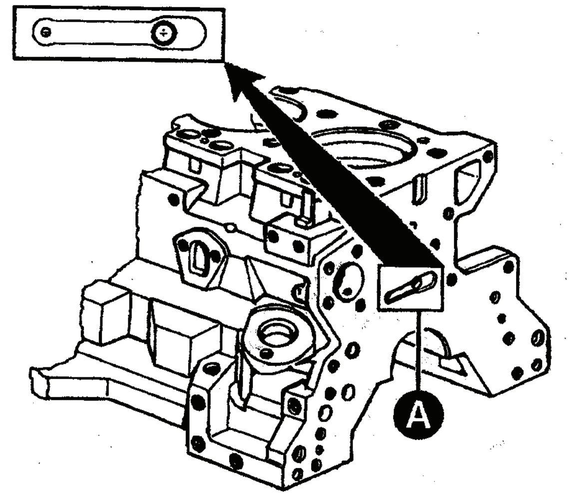
CD,CTM125,133 -19-01DEC97-1/1

Front Plate Gasket



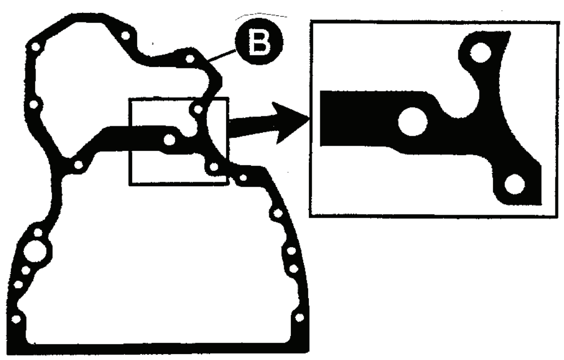
CD30712 —UN—22FEB99

Earlier engines (-291260CD)



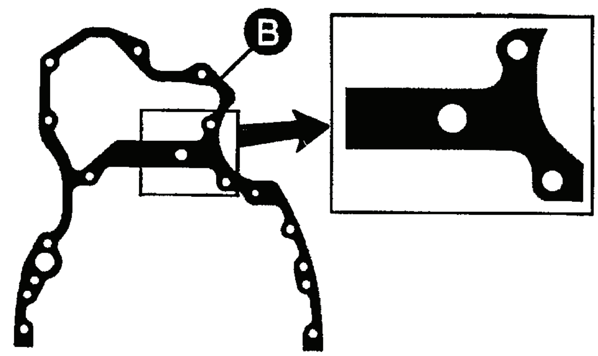
CD30713 —UN—22FEB99

Later engines (291261CD-)



CD30714 —UN—22FEB99

Gasket for engines (-291260CD)



CD30715 —UN—22FEB99

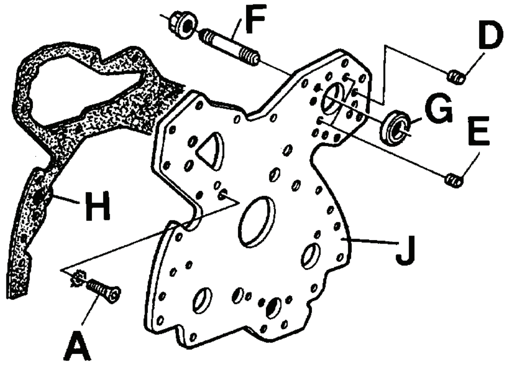
Gasket for ALL engines

The shape of the oil groove casting (A) used to lubricate the upper idler gear has been modified from engine serial number (291261CD-).

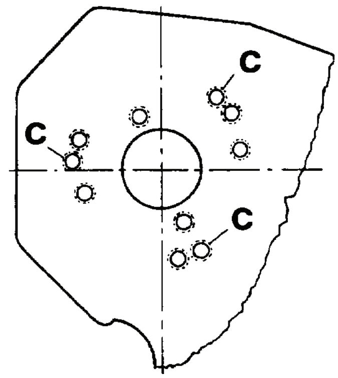
The front plate gasket designed for the new oil groove shape can be used on cylinder blocks with previous oil groove design while previous gasket cannot match the new cylinder block design.

CD03523,00000F9 -19-17JAN01-1/1

Install Front Plate



CD30600 —UN—16JUN98

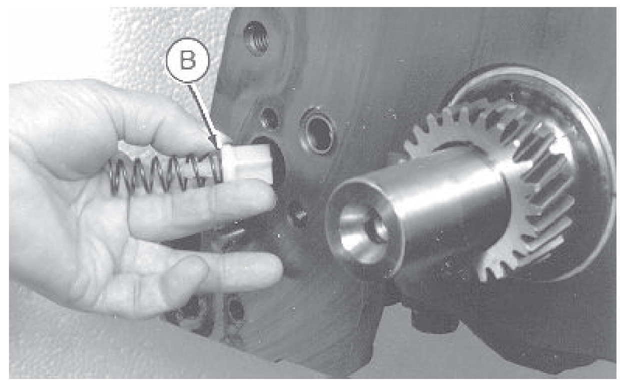


CD30695 —UN—16JUN98

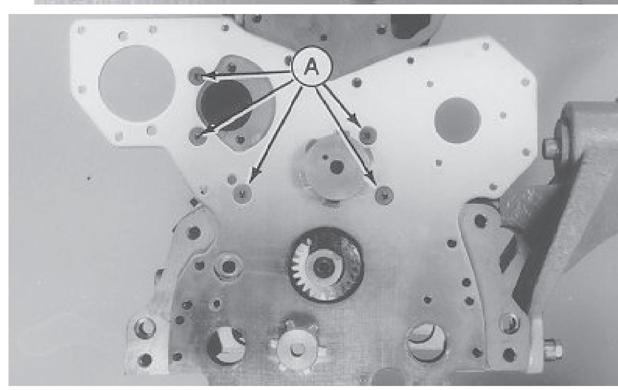
1. Install injection pump stud (F) on front plate using Loctite 271.

NOTE: Standard front plate (without auxiliary drive extension) have several injection pump stud locations. Use holes marked (C).

2. ON standard front plate only, install the 5/16“ plugs (D) and the 3/8” plugs (E) as shown. Bushing (G) is not required for this application.
3. Install oil by-pass valve (B) and spring in cylinder block.
4. Install gasket (H) and front plate. Place new external tooth washers onto countersunk screws (A) then tighten to specification.



CD30598 —UN—04MAY98



CD30597 —UN—19MAY98

Specification

Front plate countersunk screws—Torque.. 35 N·m (25 lb-ft)

IMPORTANT: Cut off protruding edge of gasket only after timing gear cover has been tightened.

A—Countersunk screw
B—Oil by-pass valve
C—Stud location
D—AT21191 Plug (5/16“) - Qty: 6
E—AT22919 Plug (3/8”) - Qty: 2
F—T23442 stud - Qty: 3
G—R79854 Bushing
H—Gasket
J—Front plate

CD,CTM125,120 -19-17JAN01-1/1

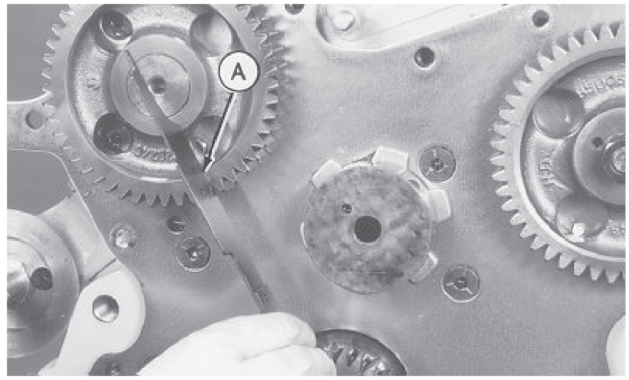
Install Upper Timing Gear Train

1. Adjust No. 1 piston to TDC using JDE83 or JDG820 (formerly JDE81-1) Flywheel Turning Tool and JDE81-4 Timing Pin.

NOTE: Use JDE83 on engines with a 142 tooth flywheel ring gear and a flywheel housing tool guide bore of 26.5 mm (1.04 in.) diameter.

Use JDG820 on engines with a 129 tooth flywheel ring gear and a flywheel housing tool guide bore of 29.9 mm (1.18 in.) diameter.

2. Install camshaft then, with JD254A (JD-254A) [1] Timing Tool on crankshaft nose and directed toward center of camshaft, turn camshaft until gear timing mark (A) aligns with timing tool.

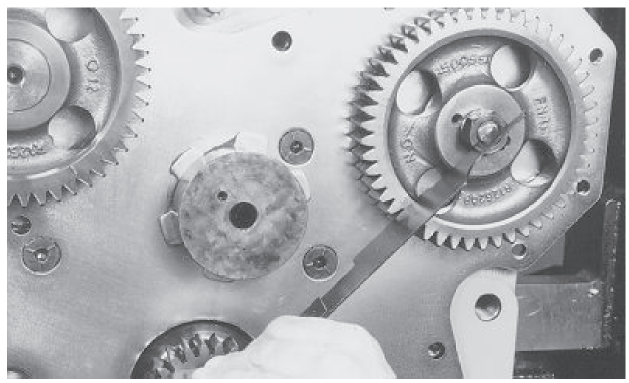


CD30601 —UN—19MAY98

[1]*Order JD-254A when tool is ordered from European Parts Distribution Center (EPDC).*

CD,CTM125,123 -19-30JUL04-1/3

3. Install fuel injection pump.
4. Using JD254A (JD-254A)[1] Timing Tool, align the timing mark “3” (for 3 cyl. engines) with the timing tool.



CD30602 —UN—19MAY98

[1]*Order JD-254A when tool is ordered from European Parts Distribution Center (EPDC).*

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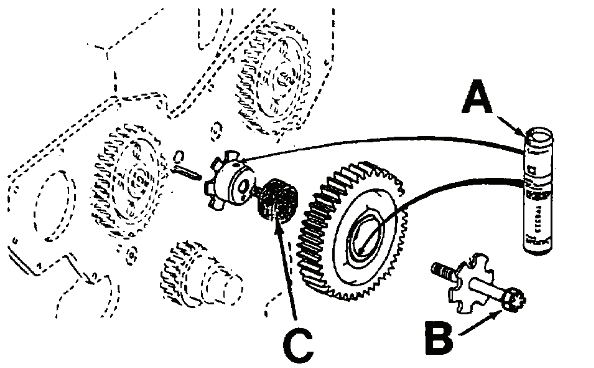
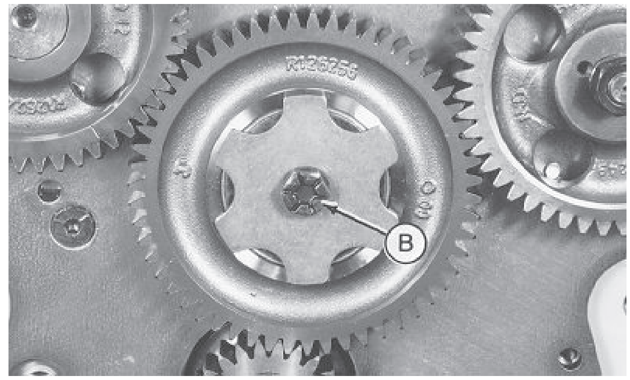
CD,CTM125,123 -19-30JUL04-2/3



CD30603 —UN—16JUN98



CD30604 —UN—19MAY98

5. Lubricate shaft and gear bushing with TY6333 grease[1] (A).
6. Install idler gear on shaft without turning camshaft gear or injection pump gear. On engine with spur gear, use JDG791A Pilot Tool (C) to guide gear onto shaft. Install upper idler gear with part number visible.

[1]*Available as service part.*

7. Install washer, with sharp edge toward timing cover, and bolt (B) then tighten to specification.

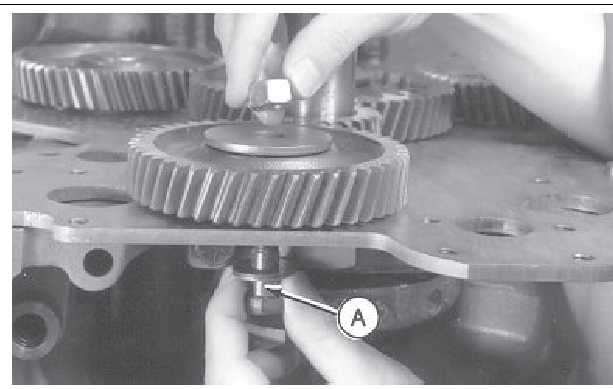
Specification

Upper idler gear cap screw—Torque...110 N·m (80 lb-ft).

8. Recheck gear timing to make sure it is correct.

CD,CTM125,123 -19-30JUL04-3/3

Install Lower Timing Gear Train



CD30605 —UN—04MAY98

1. Install oil pump and lower idler gear.
2. Install new bolt with washer (A) from oil pump side. Install thrust washer, with sharp edge toward timing cover, and new nut then tighten to specification.

Specification

Lower idler gear nut—Torque...110 N·m (80 lb-ft).

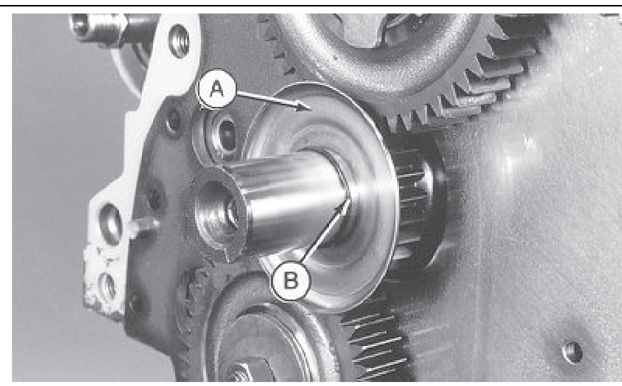
3. Install oil pump gear on pump shaft, tighten hex. nut to specification and secure with three center punch marks.

Specification

Oil pump drive gear nut—Torque.. 75 N·m (55 lb-ft)

CD,CTM125,124 -19-17JAN01-1/1

Install Oil Deflector

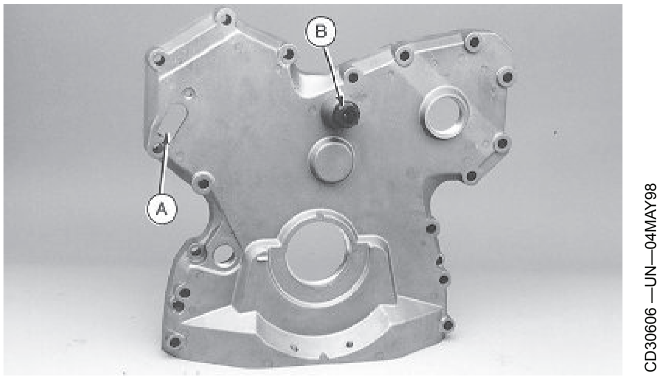


CD30608 —UN—04MAY98

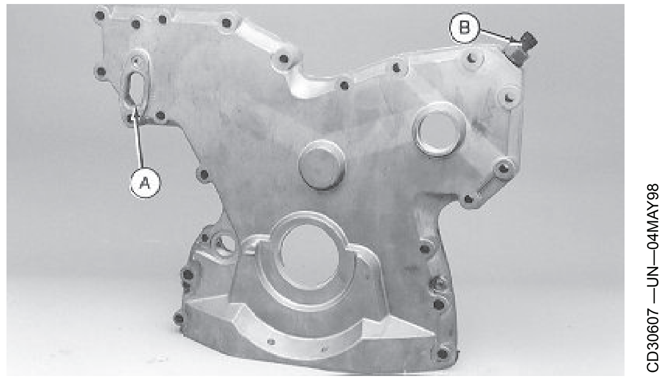
Install oil deflector (A) and O-ring (B) when equipped, on crankshaft nose.

CD,CTM125,126 -19-01DEC97-1/1

Timing Gear Cover Identification



Standard timing gear cover



Timing gear cover with auxiliary drive

Two types of timing gear covers are used:

Standard cover. Made of aluminum, it can receive the oil filler neck (A) and the tachometer sensor (B) in relation either with upper timing gear internal teeth or with injection pump drive gear teeth.

Cover for auxiliary drive. Made of aluminum. This cover has an extended area to cover the auxiliary drive gear and can receive a tachometer sensor (B) located on the side, in relation with injection pump drive gear teeth. This cover can also receive the oil filler neck (A).

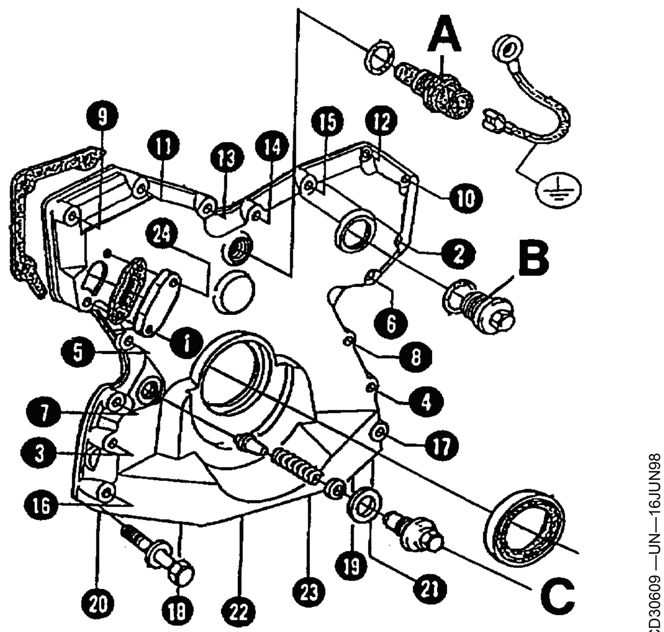
CD,CTM125,125 -19-01DEC97-1/1

Install Timing Gear Cover

1. Install new gasket on front plate.
2. Install cover on engine and apply the following torques in sequence.

Aluminum timing gear cover—Specification

Magnetic pick-up—Torque....................15 N·m (11 lb-ft)
Injection pump drive gear nut access plug torque—
Composite material plug.................... 30 N·m (22 lb-ft)
— Steel plug.................... 70 N·m (52 lb-ft)
Oil pan to timing gear cover, cap screws (18—23)—Torque.................... 50 N·m (35 lb-ft)
Timing gear cover to front plate, cap screws (1—17)—Torque.................... 50 N·m (35 lb-ft)
Oil pressure regulating valve plug—Torque.................... 95 N·m (70 lb-ft)



1...17— Timing gear cover-to-front plate cap screws (in sequence)
18...23—Oil pan-to-timing gear cover cap screws (in sequence)
A—Magnetic pick-up
B—Injection pump drive gear nut access plug
C—Oil pressure regulating valve plug

Continued on next page

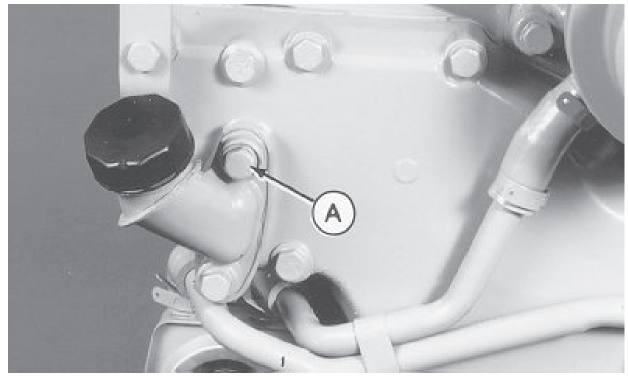
CD,CTM125,128 -19-30JUL04-1/2

3. Install oil filler neck or obturation plate then tighten cap screws (A) to specification.

Specification

Aluminium oil filler neck —Torque........ 50 N·m (35 lb-ft)
Composite oil filler neck—Torque........ 30 N·m (22 lb-ft)
Obturation plate for oil filler orifice—Torque........ 50 N·m (35 lb-ft)

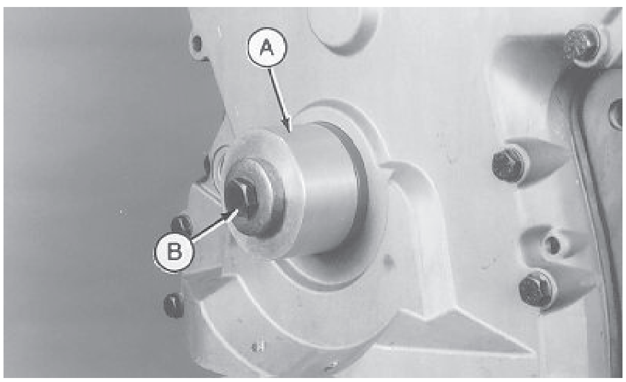
4. Cut off protruding edge of gasket.



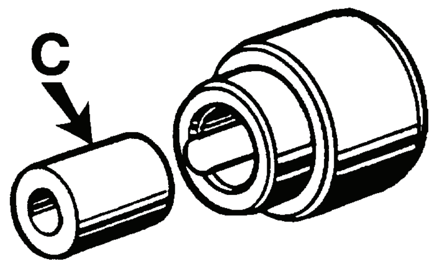
CD30610 —UN—04MAY98

CD,CTM125,128 -19-30JUL04-2/2

Install Crankshaft Front Oil Seal



CD30611 —UN—04MAY98



CD30698 —UN—16JUN98

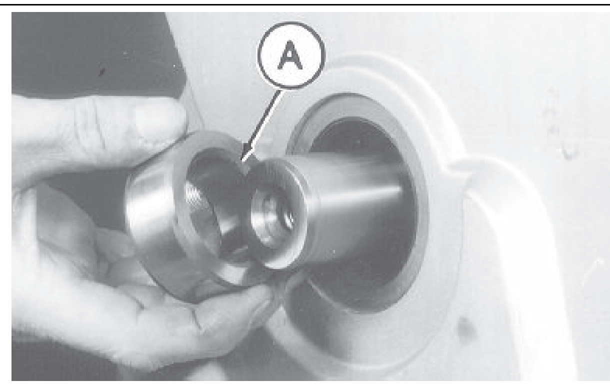
1. Place new seal onto KJD10164 Seal Installer (A) with open side toward engine, then slide the assembly onto crankshaft nose.
2. Install pulley cap screw with washer (B), then tighten until driver bottoms.

NOTE: KJD10164 tool set contains also a spacer (C) to be used only on old applications with short nose crankshaft (35 mm length).

CD,CTM125,129 -19-17JAN01-1/1

Install Wear Ring

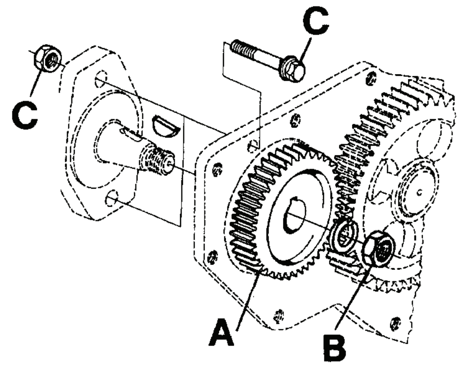
1. When equipped, install the wear ring with chamfered side (A) toward engine. Be sure that the O-ring is in place against the oil deflector.
2. Install shaft key.



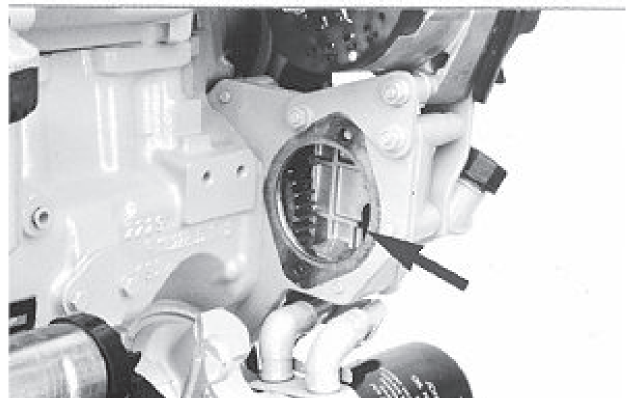
CD30612 —UN—04MAY98

CD,CTM125,130 -19-01DEC97-1/1

Install Auxiliary Equipment



CD30613 —UN—16JUN98



CD30354 —UN—03FEB93

A—Accessory gear
B—Nut
C—Cap screw or nut

1. Install shaft key and gear (A) onto accessory shaft. Tighten nut (B) to specification then, if equipped, bend tabs of washer up against nut.
2. Install accessory with gasket on engine (arrow).

NOTE: Recent engines do not have the recessing in front plate and require the use of a flat gasket instead of an O-ring seal. (Refer to the appropriate Parts Catalog).

3. Tighten the two fastening cap screws or nuts (C) to specification.

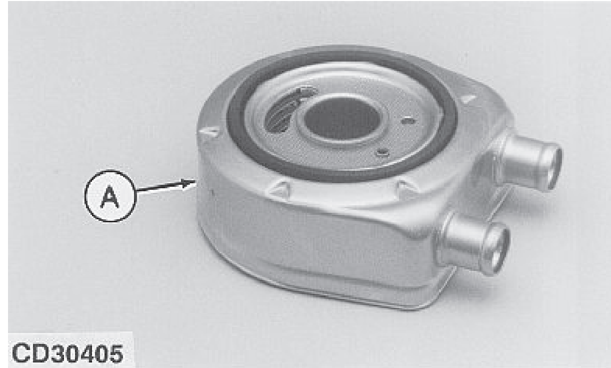
Auxiliary Equipment driven by camshaft gear —Specification

Accessory gear-to-shaft—Torque	55 N·m (41 lb-ft)
Auxiliary equipment-to-engine (cap screw or nut)—Torque	50 N·m (35 lb-ft)

CD,CTM125,131 -19-29JUL04-1/1

Oil Cooler Identification

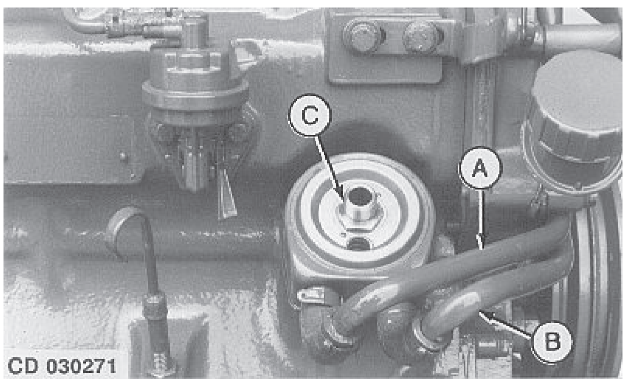
The oil cooler (A) is clamped between oil filter and cylinder block or adaptation housing.



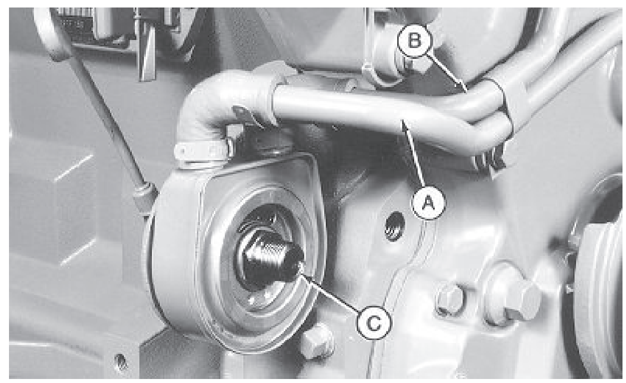
CD30405 —UN—10MAY95

CD,CTM125,152 -19-26AUG04-1/1

Remove Oil Cooler



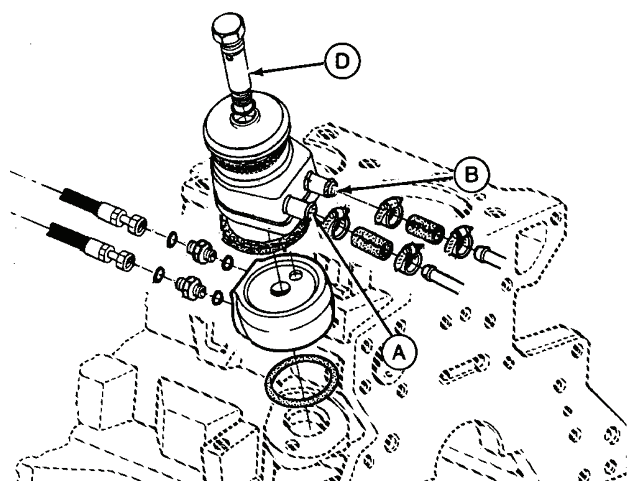
CD30271 —UN—06MAR95



CD30615 —UN—04MAY98

1. Disconnect inlet line (A) and outlet line (B) at oil cooler.
2. Remove nipple (C) or holding screw (D) and lift out oil cooler.
3. Discard packing.

A—Inlet line from water pump
B—Outlet line to water pump
C—Nipple
D—Holding screw

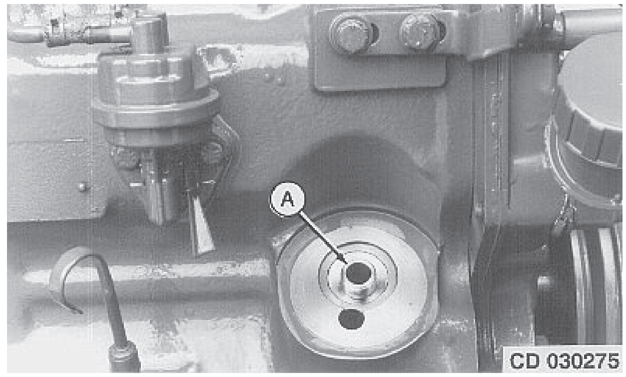


CD30616 —UN—24JUN98

CD,CTM125,137 -19-01DEC97-1/1

Replace Oil Cooler Nipple

1. Remove oil cooler nipple (A).
2. Press in new nipple so that threaded end faces outward (farthest point from cylinder block).



CD30275 —UN—06MAR95

CD,CTM125,138 -19-01DEC97-1/1

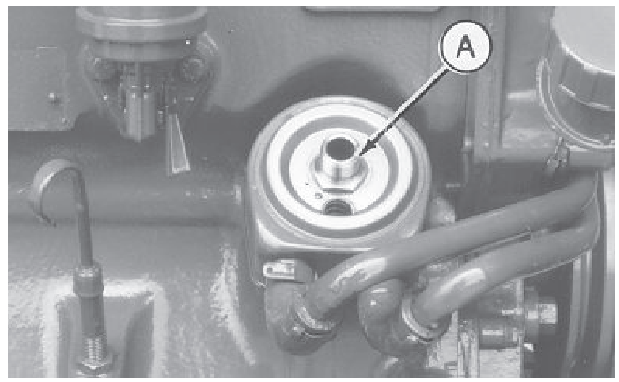
Install Oil Cooler on Standard Engine

1. Install new packing between oil cooler and cylinder block.
2. Attach oil cooler with nipple (A). Tighten to specification.

Specification

Oil cooler nipple—Torque.. 35 N·m (25 lb-ft)

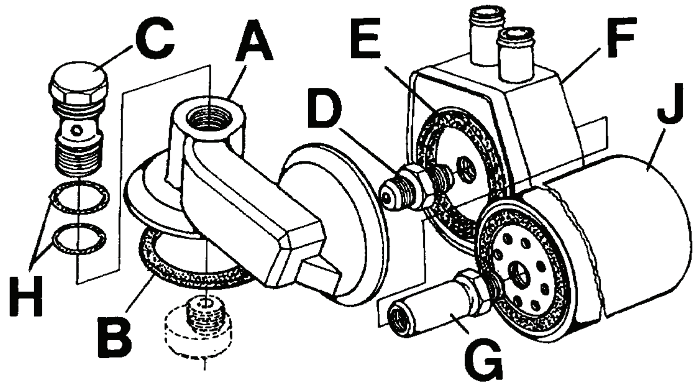
3. Connect coolant lines to oil cooler.
4. Install oil filter.



CD30617 —UN—04MAY98

CD,CTM125,139 -19-24JAN01-1/1

Replace Oil Cooler/Filter Bracket on Engine with Auxiliary Drive



A—Oil cooler/filter bracket
B—Packing
C—Holding screw
D—Fitting
E—Packing
F—Oil cooler
G—Nipple
H—O-ring
J—Oil filter

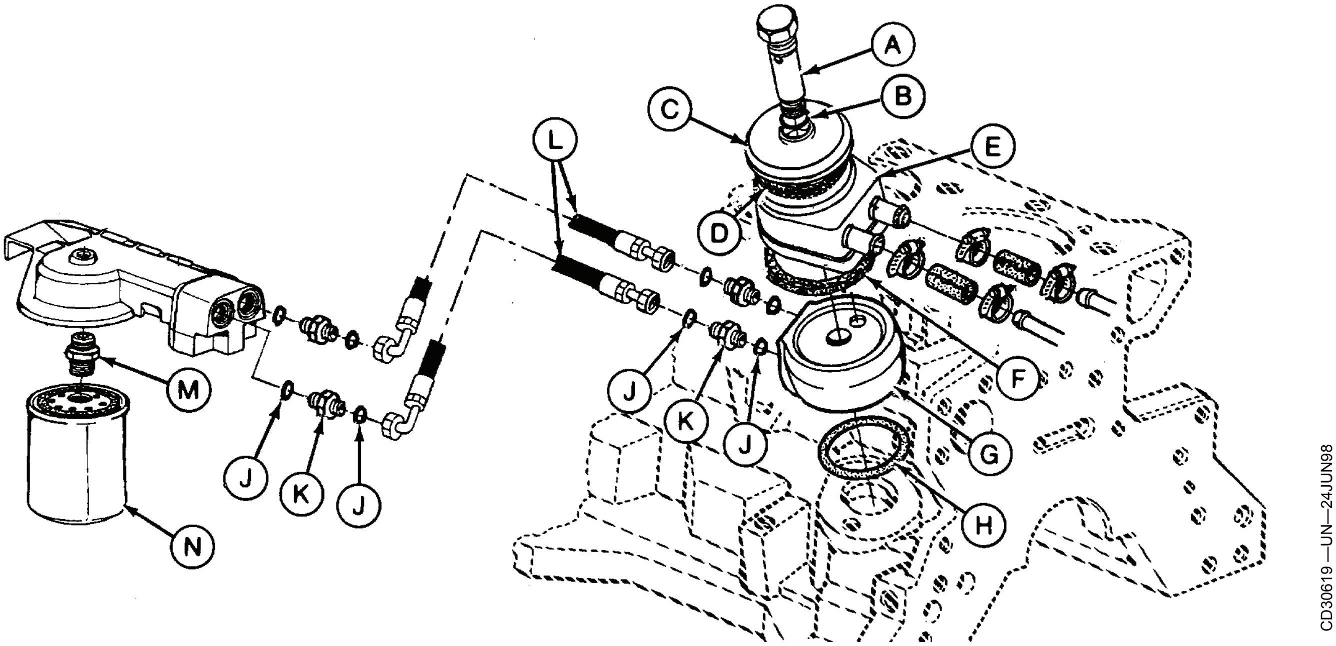
1. Remove oil cooler/filter bracket (A).
2. Clean and check parts.
3. Install bracket (A) with a new packing (B). Tighten holding screw (C) to specification.
4. Install fitting (D) onto bracket. Tighten to specification.
5. Install a new packing (E) between oil cooler (F) and bracket.
6. Attach oil cooler with nipple (G). Tighten to specification.
7. Connect coolant lines to oil cooler.
8. Install oil filter (J).

Standard oil cooler/Oil filter bracket on Engine with camshaft-gear-driven auxiliary drive—Specification

Oil cooler/filter bracket holding screw (C)—Torque.. 35 N·m (25 lb-ft)
Oil filter fitting (D)—Torque.. 45 N·m (33 lb-ft)
Oil cooler nipple (G)—Torque.. 35 N·m (25 lb-ft)

CD,CTM125,140 -19-24JAN01-1/1

Replace Oil Filter Adapter on Engine with Remote Oil Filter



A—Holding screw
B—O-ring
C—Cover
D—O-ring
E—Oil cooler
F—Packing
G—Oil filter adapter
H—O-ring
J—O-ring
K—Fitting
L—oil hose
M—Fitting
N—Oil filter

1. Remove special screw (A) holding both the oil cooler (E) and the oil filter adapter (G).
2. Disconnect oil hoses (L) from adapter.
3. Clean and check parts.
4. Install adapter with a new O-ring (H), then attach oil cooler with packing (F), cover (C) and O-rings (D) and (B). Tighten holding screw (A) to specification

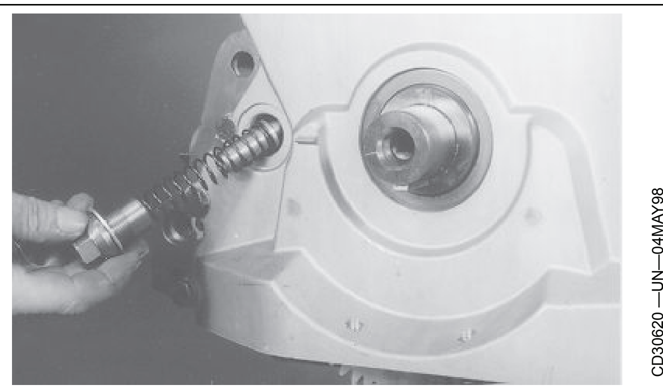
Specification

Oil filter adapter/oil cooler holding screw (remote oil filter)—Torque.. 35 N·m (25 lb-ft)

5. Reconnect oil hoses to adapter and coolant lines to oil cooler.

CD,CTM125,141 -19-24JAN01-1/1

Remove Oil Pressure Regulating Valve



Remove oil pressure regulating valve plug. Check spring load and valve cone for excessive wear and damaged sealing face.

Specification

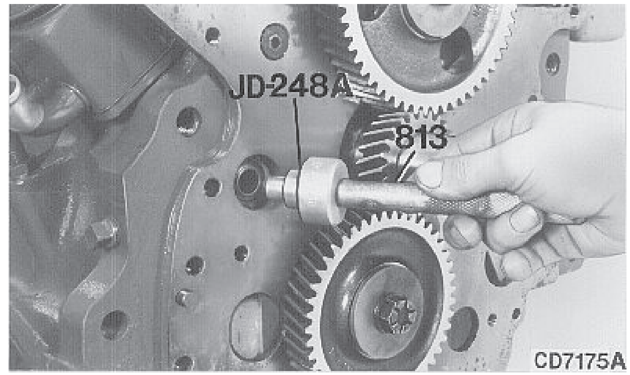
Oil pressure regulating valve spring—Load at a length of 42.5 mm (1.68 in.).. 60 to 75 N (13.5 to 16.5 lb.)

CD,CTM125,142 -19-24JAN01-1/1

Replace Oil Pressure Regulating Valve Seat

1. Remove valve seat bushing, using a suitable puller.
2. Drive in new bushing, using special tools JD248A (JD-248A)[1]and JDG536 or OTC813 until driver contacts cylinder block.

IMPORTANT: Do not damage the slightly protruding edge of the bushing as it is a sealing face.



CD7175A —UN—07MAR95

[1]*Order JD-248A when tool is ordered from European Parts Distribution Center (EPDC).*

CD,CTM125,143 -19-26AUG04-1/1

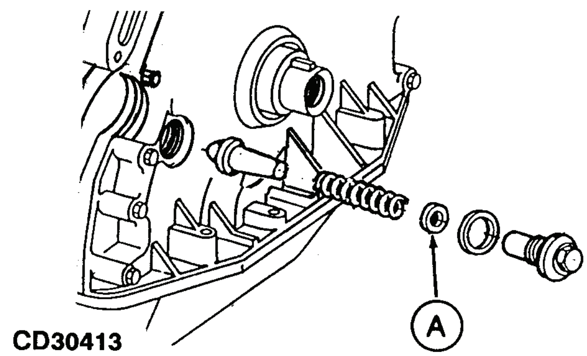
Install Oil Pressure Regulating Valve

NOTE: One or several shims (A) may be used to adjust the oil pressure.

1. Install valve, spring, shims, washer and plug in timing gear cover.
2. Tighten plug as specified.

Specification

Oil pressure regulating valve plug—Torque.. 95 N·m (70 lb-ft)

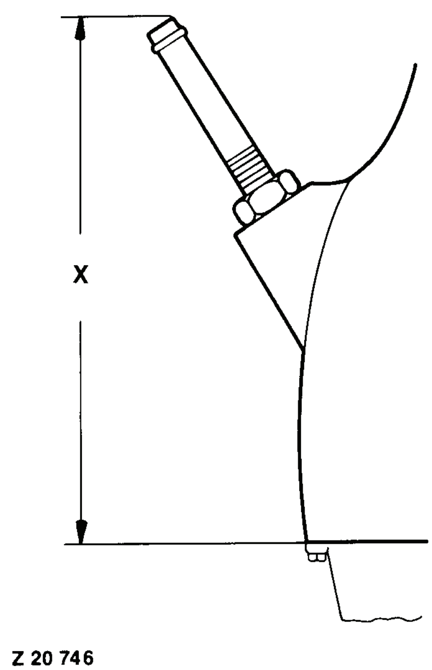


CD30413 —UN—10MAY95

CD,CTM125,144 -19-24JAN01-1/1

Replace Oil Dipstick Guide

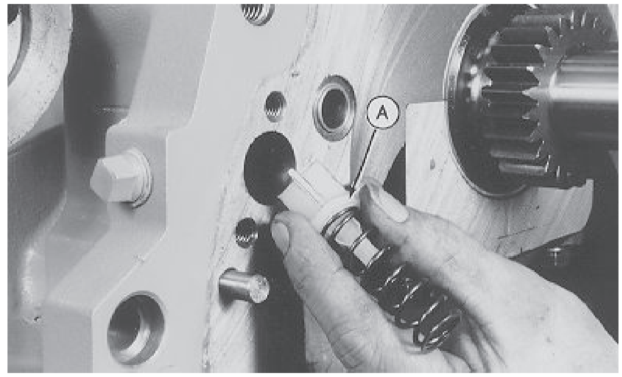
1. Loosen lock nut and unscrew dipstick guide.
2. Apply sealing compound on thread of new guide.
3. Install new dipstick guide and adjust height (X) in accordance with specifications.



Z20746 —UN—08MAR95

CD,CTM125,145 -19-24JAN01-1/1

Replace Oil By-Pass Valve



CD30622 —UN—04MAY98

1. Remove timing gear cover and front plate.
2. Remove oil by-pass valve and spring (A). Inspect valve and spring for damage.
3. Check spring load and compare with specification.

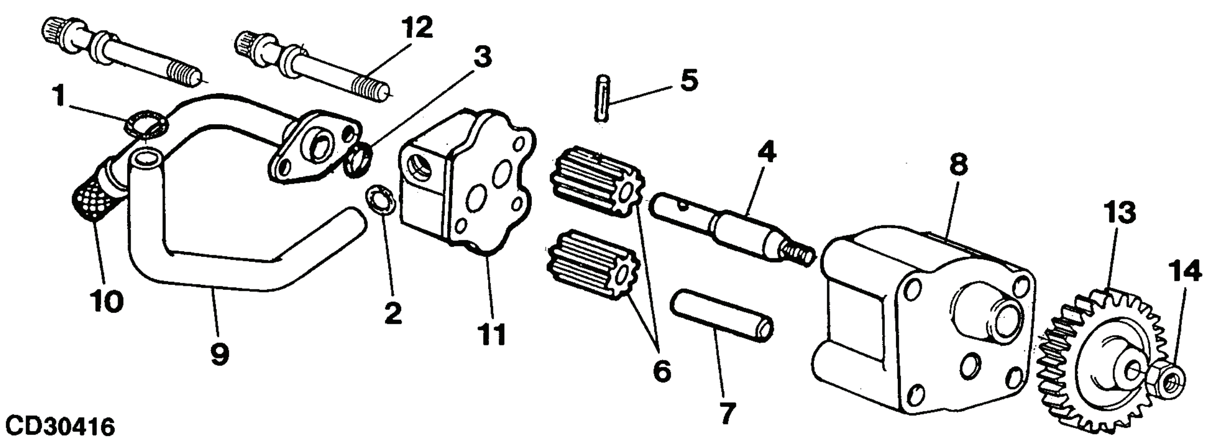
Specification

Oil by-pass valve spring —Load at a length of 29 mm (1.14 in.)... 79 to 96.5 N (18 to 22 lb.)

4. Install oil by-pass valve and spring.
5. Install front plate and timing gear cover.

CD,CTM125,146 -19-24JAN01-1/1

Oil Pump - Exploded View



CD30416 —UN—10MAY95

1— Cylinder block seal
2— O-ring (outlet tube)
3— O-ring (oil strainer tube)
4— Drive shaft
5— Spring pin
6— Gears
7— Shaft
8— Housing
9— Outlet tube
10— Strainer
11— Cover
12— Cap screws (3 or 4 used)
13— Drive gear
14— Nut

NOTE: More recent engines use now a new oil pump with reduced flow. The main difference is the thickness of gears (6) and housing (8). However the overall dimensions remain the same.

CD03523,000012F -19-26AUG04-1/1

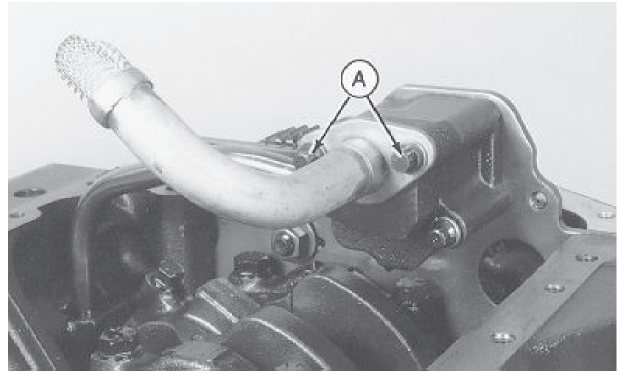
Replace Oil Pump Strainer

1. Remove oil pan.
2. Loosen the two lower cap screws (A) and remove oil strainer.
3. Install new strainer with new O-ring and tighten cap screws to specification.

Specification

Oil pump strainer screws—Torque.. 50 N·m (35 lb-ft)

4. Reinstall oil pan.

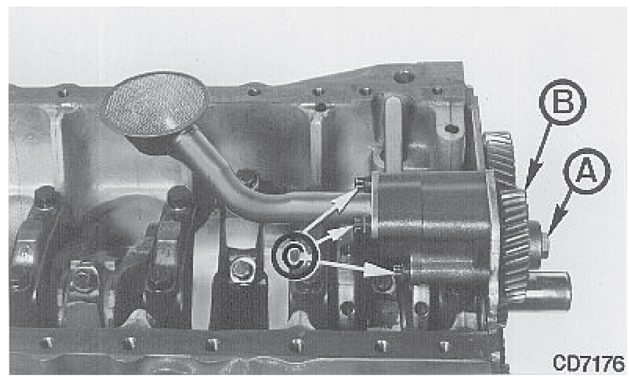


CD30623 —UN—04MAY98

CD,CTM125,147 -19-24JAN01-1/1

Remove Oil Pump

1. Remove oil pan.
2. Remove nut (A) from pump shaft.
3. Pull gear (B) from conical shaft of pump, using a suitable puller.
4. Remove the 3 cap screws (C) attaching pump housing to front plate.



CD7176 —UN—07MAR95

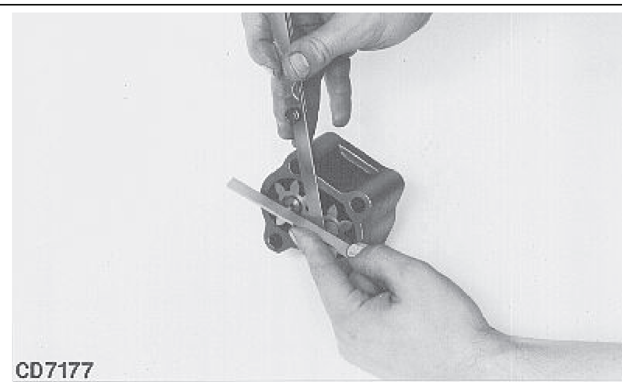
A—Oil pump drive gear nut
B—Oil pump drive gear
C—Screw

CD,CTM125,148 -19-14JAN09-1/1

Oil Pump Gear Axial Clearance

Oil pump gear axial clearance—Specification

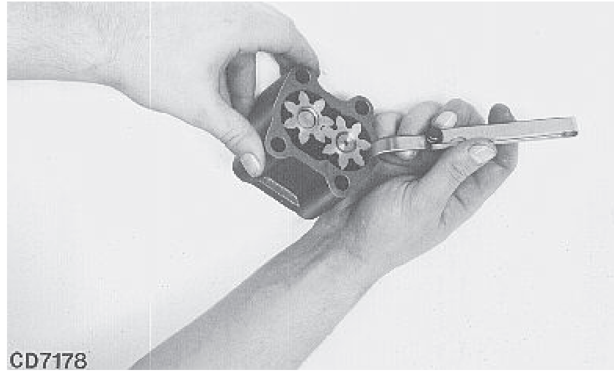
Standard flow oil pump—Gear thickness................. 41.15 to 41.20 mm (1.62 to 1.622 in.)
Reduced flow oil pump—Gear thickness........... 28.80 to 28.85 mm (1.1339 to 1.1358 in.)
Clearance .... 0.05 to 0.17 mm (0.002 to 0.007 in.)
Wear tolerance .... 0.22 mm (0.0085 in.)



CD7177 —UN—07MAR95

CD,3274,G25,26 -19-27AUG04-1/1

Oil Pump Gear Radial Clearance



CD7178 —UN—07MAR95

Specification

Oil pump—Radial clearance between gear and pump housing	0.10 to 0.16 mm (0.004 to 0.006 in.)
Wear tolerance	0.20 mm (0.008 in.)

CD,3274,G25,27 -19-27AUG04-1/1

Oil Pump Specifications

T81953 —UN—09NOV88

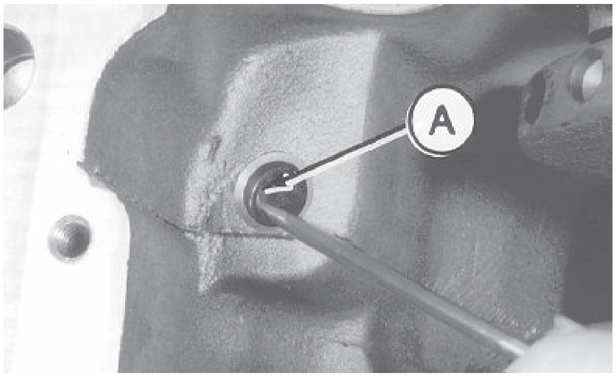
T81781 —UN—09NOV88

Oil pump—Specification

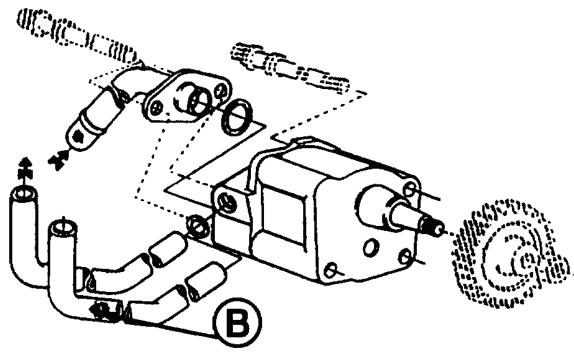
Drive shaft bore—Diameter	16.05 to 16.08 mm (0.632 to 0.633 in.)
Wear tolerance	0.08 mm (0.003 in.)
Drive shaft—Diameter	16.02 to 16.03 mm (0.630 to 0.631in.)
Wear tolerance	0.025 mm (0.001 in.)
Idler shaft—Diameter	12.32 to 12.34 mm (0.485 to 0.486 in.)
Wear tolerance	0.013 mm (0.0005 in.)

CD,CTM125,153 -19-24JAN01-1/1

Oil Pump Installation



CD30624 —UN—04MAY98

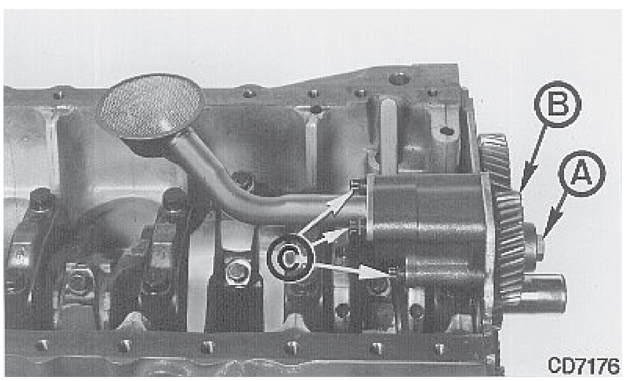


CD30625 —UN—16JUN98

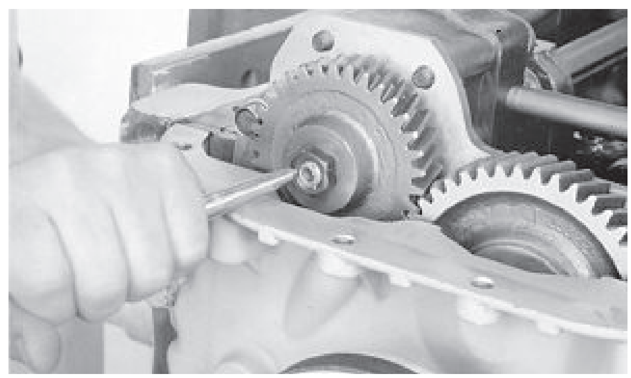
1. Install new seal (A) in cylinder block.
2. Using JDG127 O-Ring Seal Tool Set, install O-rings in pump cover (for outlet tube) and on oil strainer tube.
3. Install drive shaft with gear and idler gear in pump housing. Both gears must turn freely.
4. Install outlet tube, strainer and pump cover.

NOTE: Service oil pump kit has two outlet tube. Install tube without paint mark (B).

CD,CTM125,150 -19-20SEP04-1/2



CD7176 —UN—07MAR95



T81782 —UN—09NOV88

5. Attach oil pump assembly to front plate, tightening cap screws (C) to specification.

Specification

Oil pump-to-front plate, screws—Torque.. 50 N·m (35 lb-ft)

6. Rotate pump shaft, again making sure that pump gears turn freely.
7. Install pump drive gear (B) and a new nut (A). Tighten to specification.

Specification

Oil pump drive gear nut—Torque.. 75 N·m (55 lb-ft)

8. Secure the nut by applying three center punch marks.

NOTE: Engine may be equipped with a self-lock nut. When reassebling such engine, use the standard nut and tighten as indicated above.

CD,CTM125,150 -19-20SEP04-2/2

Install Oil Pan

1. Place LOCTITE® 515 Sealant (or an equivalent sealant) on oil pan rail where flywheel housing, front plate and timing gear cover are attached to the cylinder block.

NOTE: A tube of LOCTITE® 515 Sealant is provided with overhaul gasket set. This tube is also available under part number DD15664.

2. Select and install the correct gasket for the oil pan being used.
3. Install oil pan and tighten cap screws as follows:

Specification

Oil pan (all types)-to-timing gear cover—Torque .... 50 N·m (35 lb-ft)
Sheet metal oil pan-to-block and flywheel housing—Torque .... 50 N·m (35 lb-ft)
Aluminium oil pan-to-block and flywheel housing—Torque .... 50 N·m (35 lb-ft)
Cast iron pan-to-block and flywheel housing: SAE 5 screws (3 dashes)—Torque .... 50 N·m (35 lb-ft)
Cast iron pan-to-block and flywheel housing: SAE 8 screws (6 dashes)—Torque .... 70 N·m (50 lb-ft)

4. Install a new seal onto cylindrical drain plug. Tighten as follows:

Oil pan drain plug —Specification

Cylindrical plug with copper seal—Torque .... 70 N·m (50 lb-ft)
Cylindrical plug with O-ring seal—Torque .... 50 N·m (35 lb-ft)
Conical plug—Torque .... 55 N·m (40 lb-ft)

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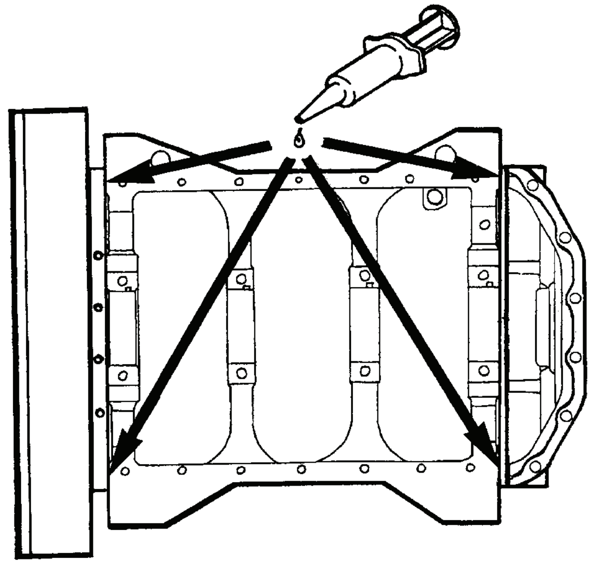
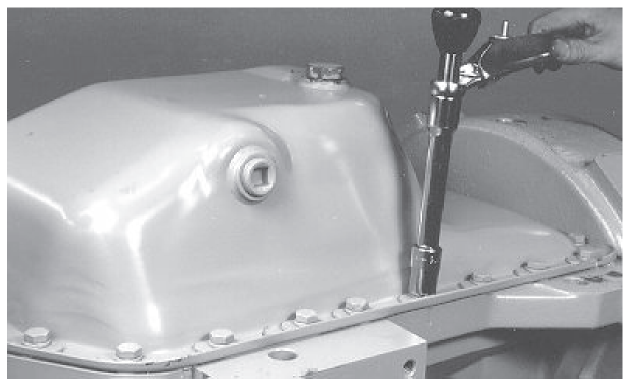


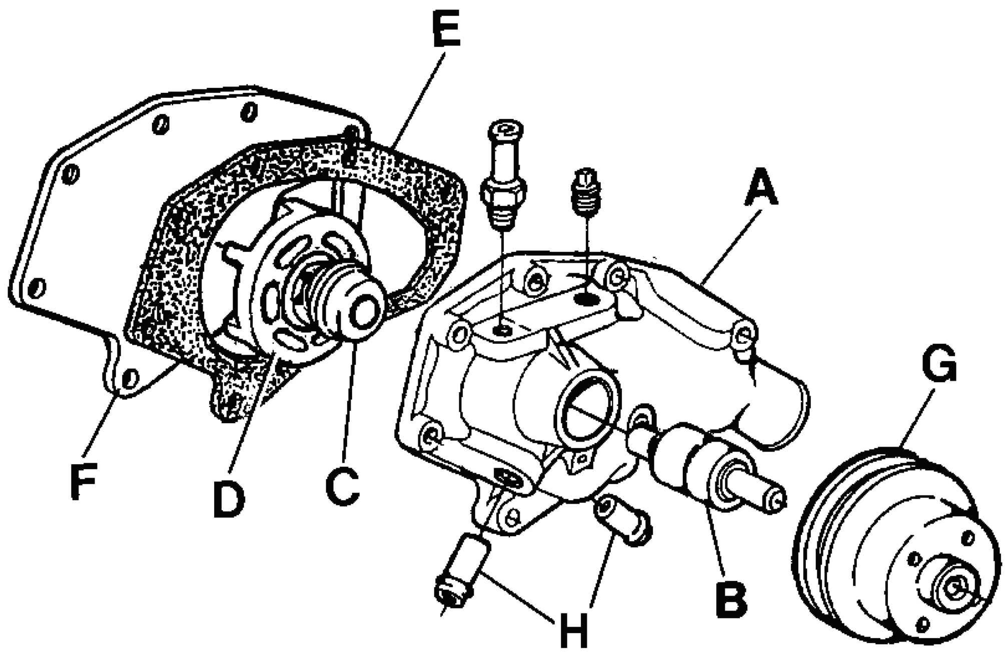
CD30626 —UN—16JUN98



CD30627 —UN—04MAY98

CD,CTM125,151 -19-24JAN01-1/1

Water Pump — Exploded View

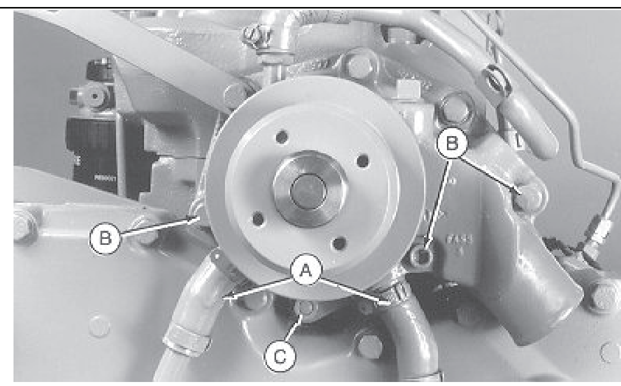


A—Housing
B—Bearing shaft
C—Seal
D—Impeller
E—Gasket
F—Rear cover
G—Hub (or pulley)
H—Tubes

CD,CTM125,156 -19-31JUL12-1/1

Remove Water Pump

1. Remove fan and sheet metal pulley when equipped.
2. Disconnect water pump hoses (A).
3. Remove attaching screws (B) and nut (C) then lift out water pump.



CD,CTM125,157 -19-01DEC97-1/1

Disassemble Water Pump

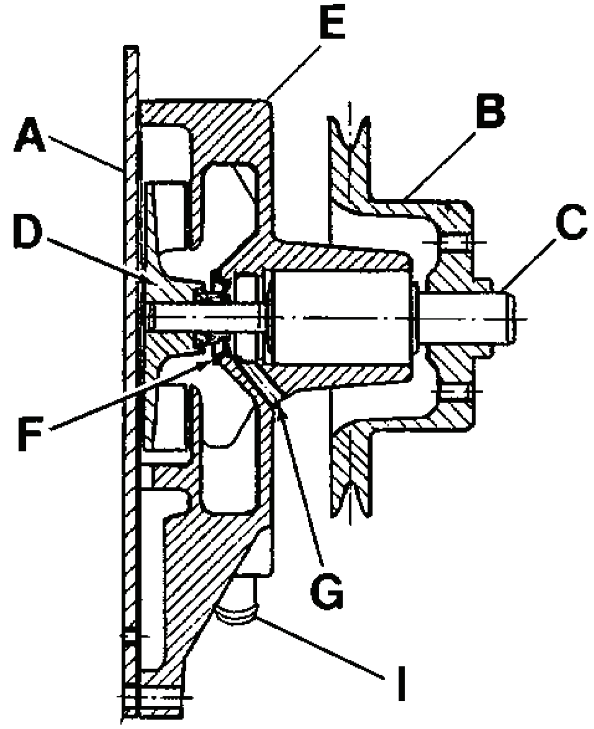
NOTE: When water pump operation is abnormal or when coolant drains from weep hole (G), disassemble water pump as follows.

1. Remove rear cover (A) and discard gasket.
2. Using a suitable puller, remove pulley (B) or hub from bearing shaft (C).
3. Support pulley end of housing, then using a 13 mm (0.5 in.) driver, simultaneously remove impeller (D) from bearing shaft and bearing shaft from pump housing (E). Discard bearing and impeller.
4. Using a suitable driver, remove seal (F) from pump housing and discard.
5. Inspect water pump housing, cover and pulley for wear, debris, cracks or other damage. Replace as necessary.

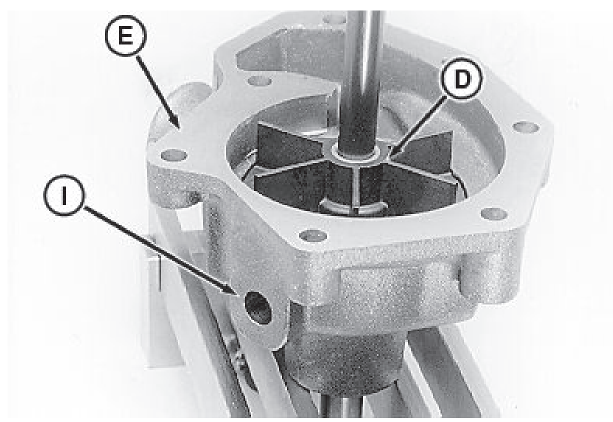
NOTE: Complete or pre-assembled (H) water pumps are available for service as well as a seal kit including bearing shaft (C), impeller (D), seal (F) and gasket set.

NOTE: Factory installed and pre-assembled water pumps have tubes (I) installed. If damaged, install new tube dry with a brass drift.

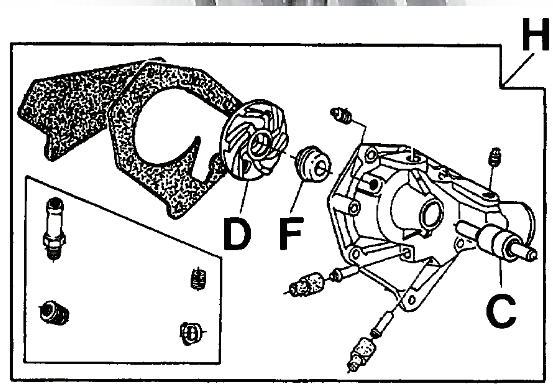
A—Rear cover
B—Pulley
C—Bearing shaft
D—Impeller
E—Housing
F—Seal
G—Weep hole
H—Pre-assembled water pump
I— Tube



RG21743 —UN—31JUL12



RG21744 —UN—31JUL12



CD30632 —UN—16JUN98

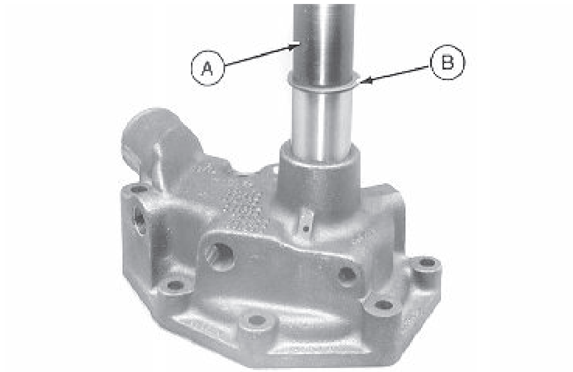
Pre-assembled water pump

CD,CTM125,158 -19-31JUL12-1/1

Assemble Water Pump

1. Use JD262A (JD-262A)[1] (A) to install bearing shaft.
2. Press bearing shaft into housing until bearing face is flush with housing. A flat washer (B) can be used to stop the driver and ensure proper installation.

NOTE: If pipe fittings were removed from the water pump or need to be installed on replacement pump, apply Loctite® 243 Thread Lock and Sealer (or equivalent thread sealant) to fitting threads and install elbow fittings finger tight PLUS 2-3 TURNS.
Torque: 1/2-14 NPT plug to 45 N·m (33 lb.-ft.)
1/4-18 NPT fitting to 30 N·m (22 lb.-ft.)

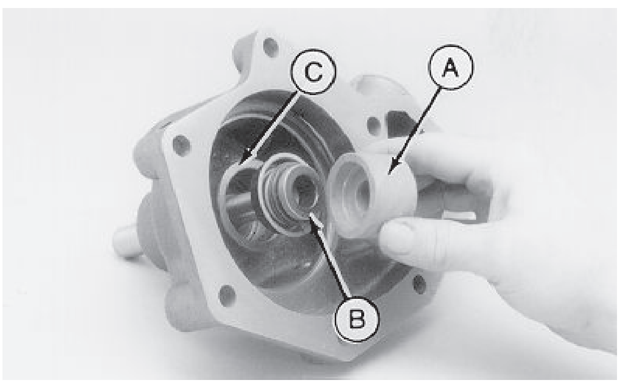


CD30633 —UN—04MAY98

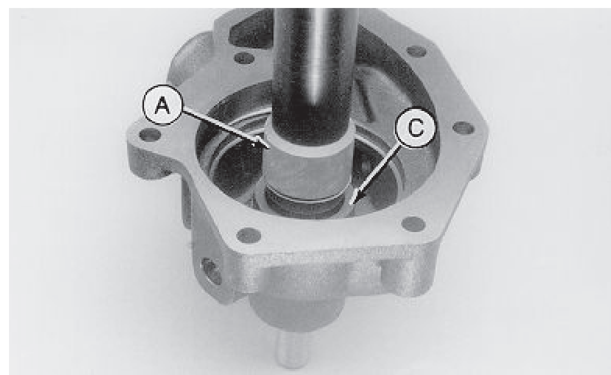
Loctite is a trademark of Henkel Corporation

[1]Order JD-262A when tool is ordered from European Parts Distribution Center (EPDC).

CD,CTM125,162 -19-09AUG12-1/5



CD30634 —UN—19MAY98



CD30635 —UN—19MAY98

3. Support water pump on shaft end. Using the installation tool (A) included in the seal kit, install water pump seal (B) over shaft until seal bottoms on shoulder (C) of housing.

NOTE: Install seal dry. Installation tool (A) must be used as it exerts the proper pressure on seal and therefore avoids risk to damage the seal faces.

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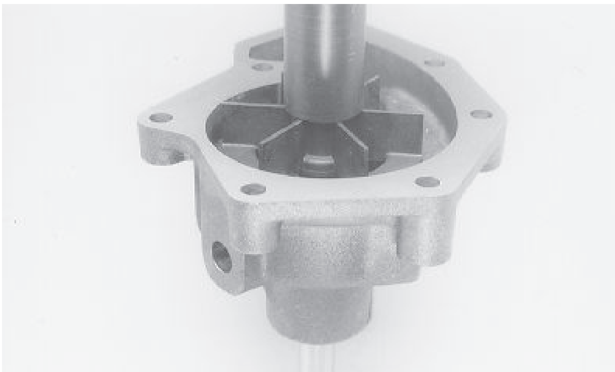
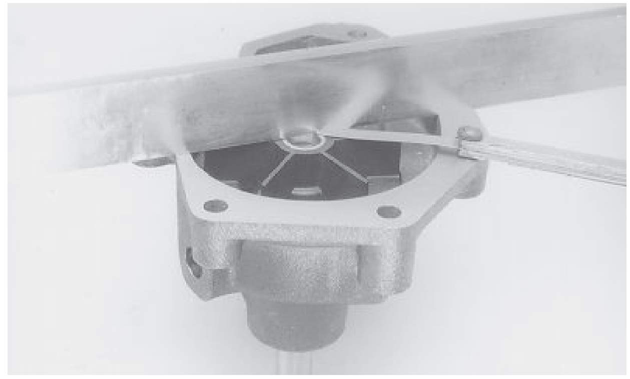
CD,CTM125,162 -19-09AUG12-2/5



CD30636 —UN—04MAY98



CD30637 —UN—04MAY98

4. Place pump housing under a press and support on pulley end of shaft.

NOTE: Install impeller vanes up for Standard Flow Pump and vanes down for High Flow Pump.

5. Using special tool JD262A (JD-262A)[1], press impeller onto pump shaft until flush with pump housing face within clearance specification.

[1]Order JD-262A when tool is ordered from European Parts Distribution Center (EPDC).

Specification

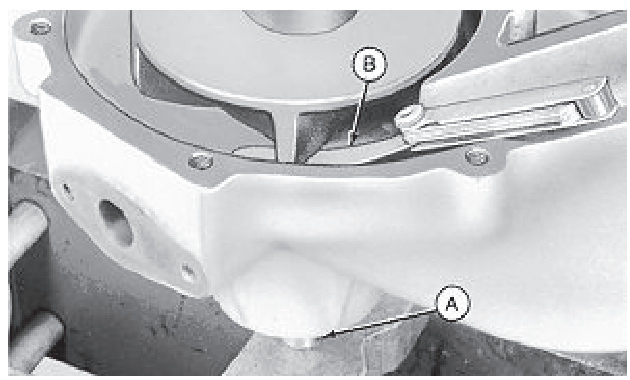
Impeller-to-water pump
housing —Clearance..................................0 to -0.25 mm (0 to -0.01 in.)

CD,CTM125,162 -19-09AUG12-3/5

6. Install impeller on High Flow water pump with vanes toward housing. Support assembly on pulley end of shaft (A) and press impeller to specification (B).

Specification

Impeller-to-water pump
housing—Clearance..............................0.38-0.89 mm (0.015-0.035 in.)



RG4015 —UN—09NOV89

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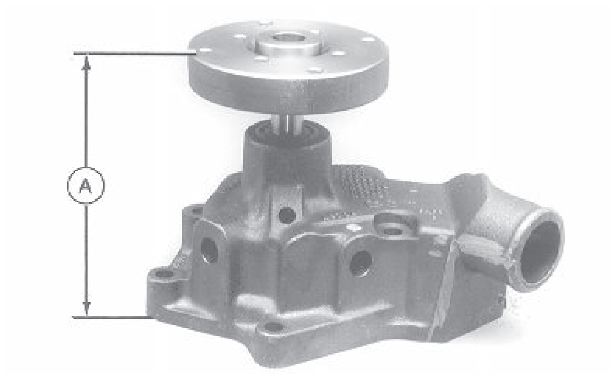
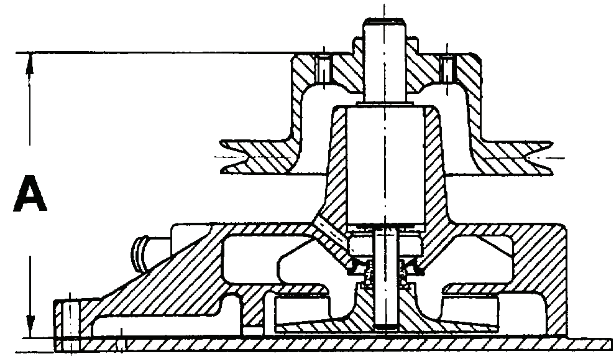
CD,CTM125,162 -19-09AUG12-4/5



CD30638 —UN—04MAY98

7. Place pump housing under a press and support on impeller end of shaft.



CD30652 —UN—16JUN98

8. Install pulley or hub to the specified dimension “A” (see specifications).

CD,CTM125,162 -19-09AUG12-5/5

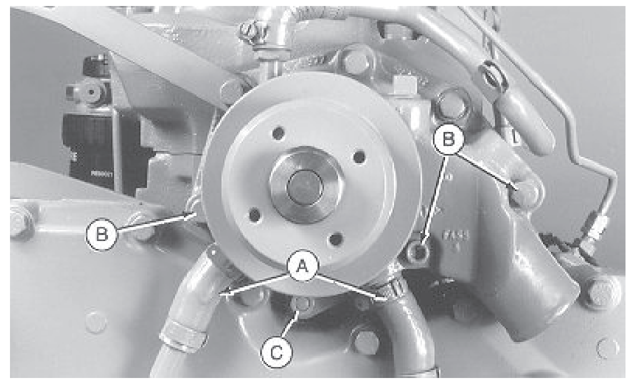
Install Water Pump

1. Attach pump cover to pump housing using a new gasket and tighten cap screws to specification.
2. Install water pump, placing a new gasket between the pump cover and cylinder block. Tighten cap screws (B) and nut (C) to specification.

Specification

Water pump housing-to-cover, cap screws—Torque	45 N·m (33 lb-ft)
Water pump-to-engine, cap screws—Torque	50 N·m (35 lb-ft)
Water pump-to-engine, nut—Torque	40 N·m (30 lb-ft)

3. Connect coolant hoses (A).

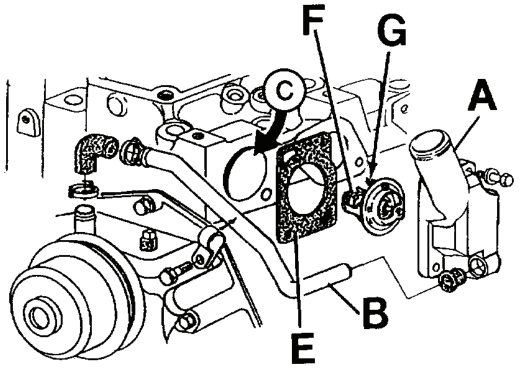


CD30629 —UN—04MAY98

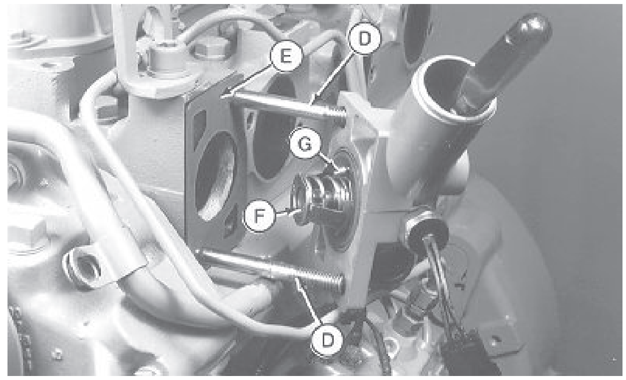
A—Coolant hose
B—Cap screw
C—Nut

CD,CTM125,163 -19-25JAN01-1/1

Inspect Thermostat



CD30640 —UN—16JUN98



CD30641 —UN—04MAY98

A—Thermostat cover
B—By-pass tube
C—Cylinder head orifice
D—Guide stud
E—Gasket
F—Thermostat
G—Jiggle pin

1. Visually inspect area around thermostat cover (A) for leaks. Partially drain coolant from system.
2. Remove by-pass tube (B) from thermostat cover.
3. Remove thermostat cover from cylinder head (C).
4. Test thermostat (F) in hot water for correct opening and closing temperature (see ENGINE SYSTEM - DIAGNOSIS and TEST). Replace if defective.
5. Remove gasket material from gasket surfaces.
6. Using guide studs (D), install a new gasket (E) onto cylinder head.
7. Place thermostat (F) in cover with jiggle pin (G) on top for a proper deaeration.
8. Using a screwdriver to hold thermostat in place, install cover. Tighten cap screws to specification.

Specification

Thermostat cover cap screws—Torque.. 50 N·m (35 lb-ft)

9. Install by-pass tube into thermostat cover. Tighten clamp.
10. Fill cooling system and check for leaks.

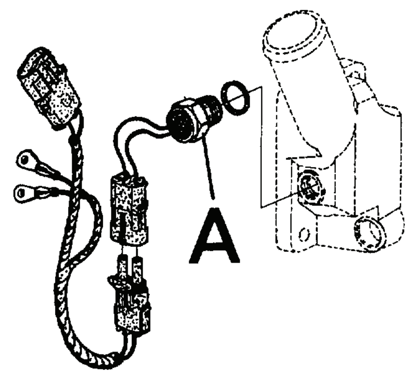
CD,CTM125,205 -19-25JAN01-1/1

Cold Start Advance Switch

Engine may have an injection pump with a cold start advance system to allow easy start-up when engine is cold. The temperature signal is given by a switch (A) located in thermostat cover. Tighten this switch as specified.

Specification

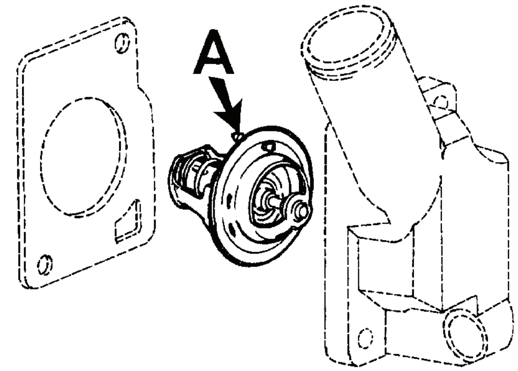
Cold Start Advance Switch—Torque.. 5 N·m (3.5 lb-ft)



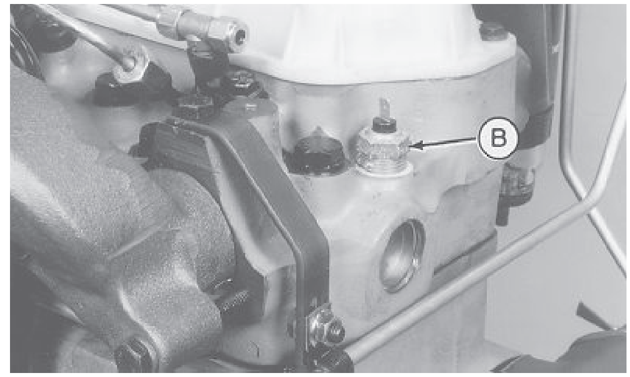
CD30682 —UN—16JUN98

CD03523,0000100 -19-26JAN01-1/1

Cooling System Deaeration



CD30642 —UN—16JUN98

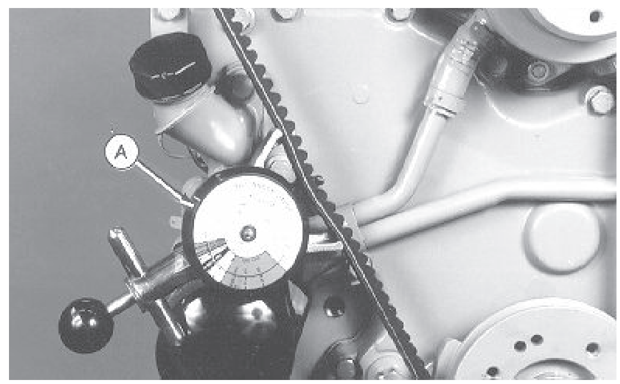


CD30643 —UN—04MAY98

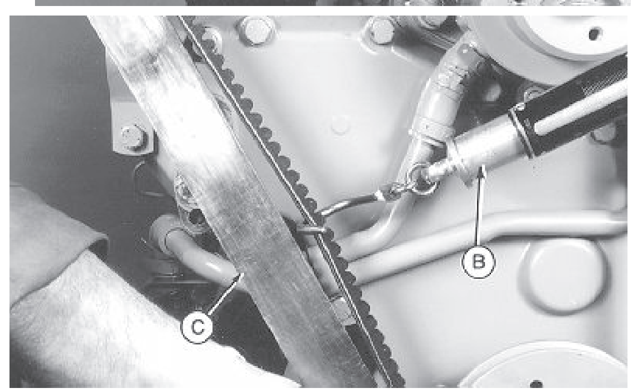
Deaeration is normally accomplished by the jiggle pin (A) in thermostat flange area. However a pocket of air can stay on the top rear of engine. When refilling cooling system, loosen coolant temperature sensor or plug at the rear of cylinder head (B) to allow air to escape.

CD,CTM125,165 -19-01DEC97-1/1

Check Fan/Alternator Belt Tension



CD30644 —UN—04MAY98



CD30645 —UN—04MAY98

1. Check belt tension using one of following methods:

NOTE: On engine with dual belts, check tension of front belt only.

a. **Use of JDG529 Tension Gauge (A)**

Fan/Alternator belt—Specification

Single belt (New belt)—Tension .... 578—622 N (130—140 lb-force)
Single belt (Used belt[1])—Tension.. 378—423 N (85—94 lb-force)
Dual belt (New belt)—Tension... 423—467 N (95—104 lb-force)
Dual belt (Used belt[1])—Tension.. 378—423 N (85—94 lb-force)

b. **Use of tension tester (B) and straightedge (C)**

Specification

Fan/Alternator belt—Tension..................... 19 mm (0.75 in.) deflection with an 90 N (20 lb-force) halfway between pulleys

A—JDG529 Tension gauge
B—Tension tester
C—Straightedge

[1]Belts are considered used after 10 minutes of operation.

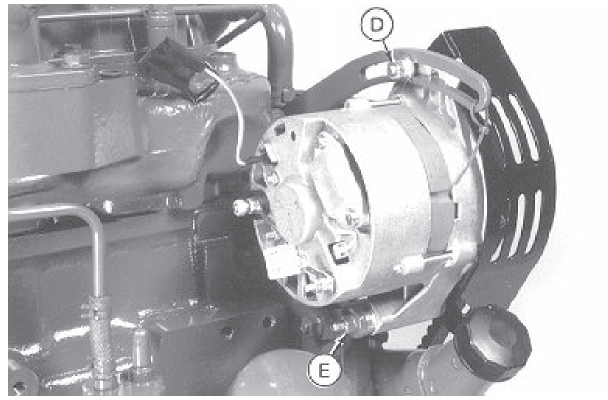
Continued on next page

CD,CTM125,166 -19-26JAN01-1/2

2. If adjustment is necessary, loosen alternator nuts (D) and (E). Pull alternator frame outward until belt is correctly tensioned.

IMPORTANT: Do not pry against the alternator rear frame. Do not tighten or loosen belts while they are hot.

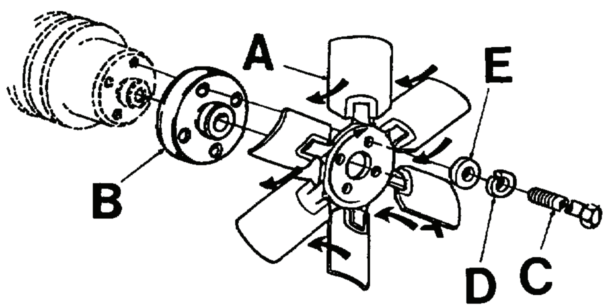
3. Tighten alternator bracket nuts firmly.
4. Run engine for 10 minutes then recheck belt tension.



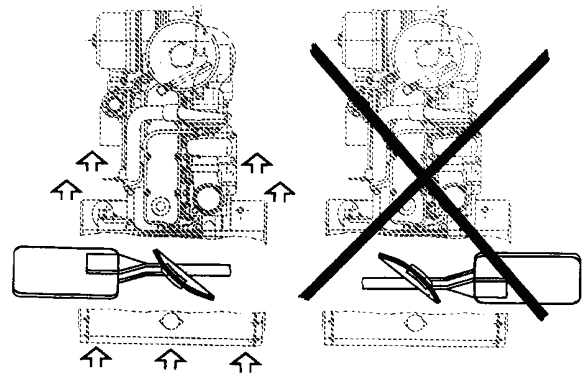
CD30646 —UN—04MAY98

CD,CTM125,166 -19-26JAN01-2/2

Install Fan



CD30647 —UN—16JUN98



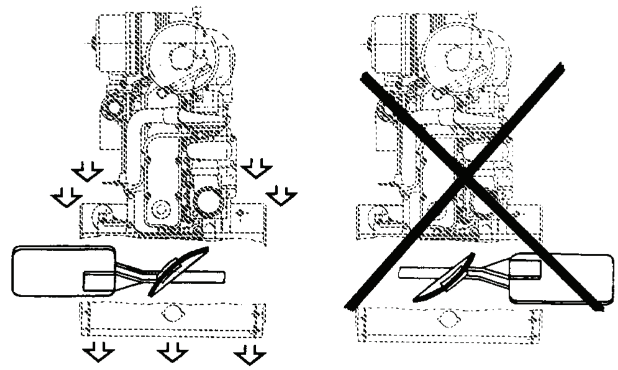
CD30648 —UN—16JUN98

Suction fan (top view)

1. Inspect fan blades for bent or damaged condition. Bent blades reduce cooling system efficiency and throw the fan out of balance. Replace if necessary.

NOTE: Depending on application, engine may be equipped with either suction-type or blower-type fan. Take care not to install the fan wrongly. Refer to illustrations to identify the fan type and the corresponding installation.

2. On water pump with hub, install first the sheet metal pulley.
3. Install fan (A) with spacer (B) when required.
4. Install cap screws (C) with new lock washers (D) and, when required, flat washers (E). Tighten as specified.



CD30649 —UN—16JUN98

Blower fan (top view)

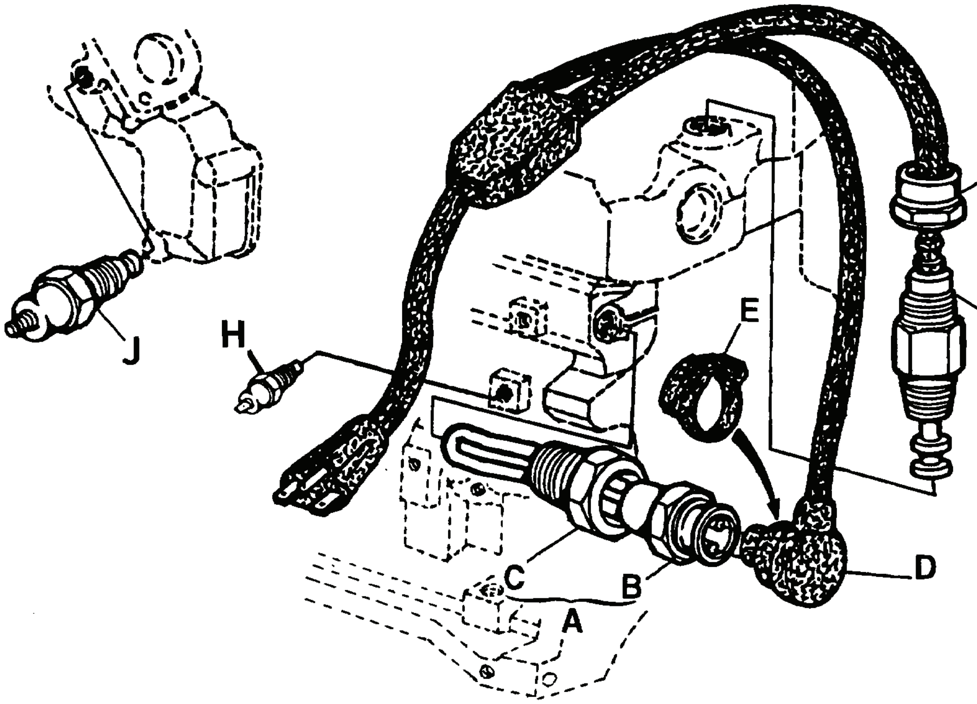
A—Fan
B—Spacer
C—Cap screw
D—Lock washer
E—Flat washer

Specification

Fan-to-pulley, 5/16 in. cap screws—Torque	30 N·m (22 lb-ft)
Fan-to-pulley, 3/8 in. cap screws—Torque	50 N·m (35 lb-ft)

CD,CTM125,167 -19-26JAN01-1/1

Coolant Heater



CD30723 —UN—23FEB99

A—Coolant heater
B—Heater element: RE64803 (240 V, 1000 W)
C—Adapter
D—Electrical cord
E—Clamp
F—Coolant temperature sensor for heater regulation
G—Hexagonal cap
H—Engine coolant temperature sensor in cyl. block
J—Engine coolant temperature sensor in thermostat housing

The coolant heater is installed at the rear of cylinder block coolant gallery. This coolant heater heats engine coolant resulting in a better starting performance. Furthermore, the engine will reach its operating temperature more quickly.

The coolant heater keeps the temperature between 26°C (80°F) and 37°C (100°F). A temperature sensor (F), located at the rear of the cylinder head, allows to leave the coolant heater on power supply indefinitely.

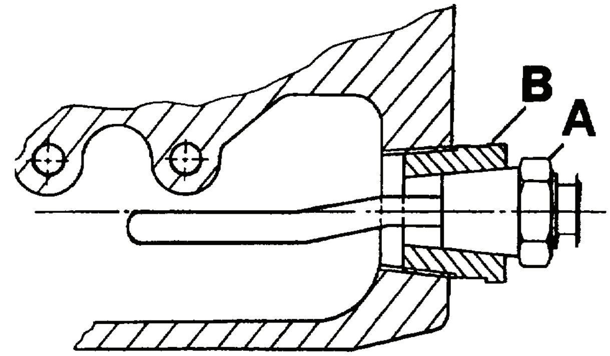
NOTE: Due to the location of the coolant temperature sensor for heater regulation at the rear of the cylinder head, the engine coolant temperature sensor is located either in cyl. block (H) or in thermostat housing (J).

CD,CTM125,169 -19-26JAN01-1/3

Precaution for Removal

IMPORTANT: Heater element (A) is bent to avoid interference with cylinder block walls. For removal, DO NOT TURN neither the heater element nor the conical adapter (B). Failure to this will irremediably damage the heater element.

1. Apply a pulling motion between heater element and adapter to release the conical assembly.
2. Pull out heater element from cylinder block. It is not necessary to remove the conical adapter.



CD30651 —UN—16JUN98

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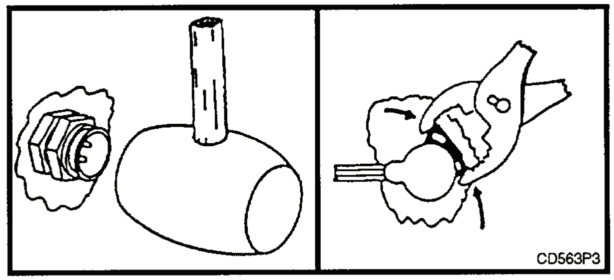
CD,CTM125,169 -19-26JAN01-2/3

Installation

1. Apply LOCTITE® 609 (JD part number: TY15969) Retaining Compound or equivalent to heater element tapered surface and to conical adapter.
2. Install heater element in cylinder block. Be sure that heater element do not touch internal walls of the block.
3. When heater element is properly positioned, tap into place with a rubber mallet.
4. Connect electrical cord to heater element and fix it with the clamp using a pliers.



CD563P3 —UN—31OCT96

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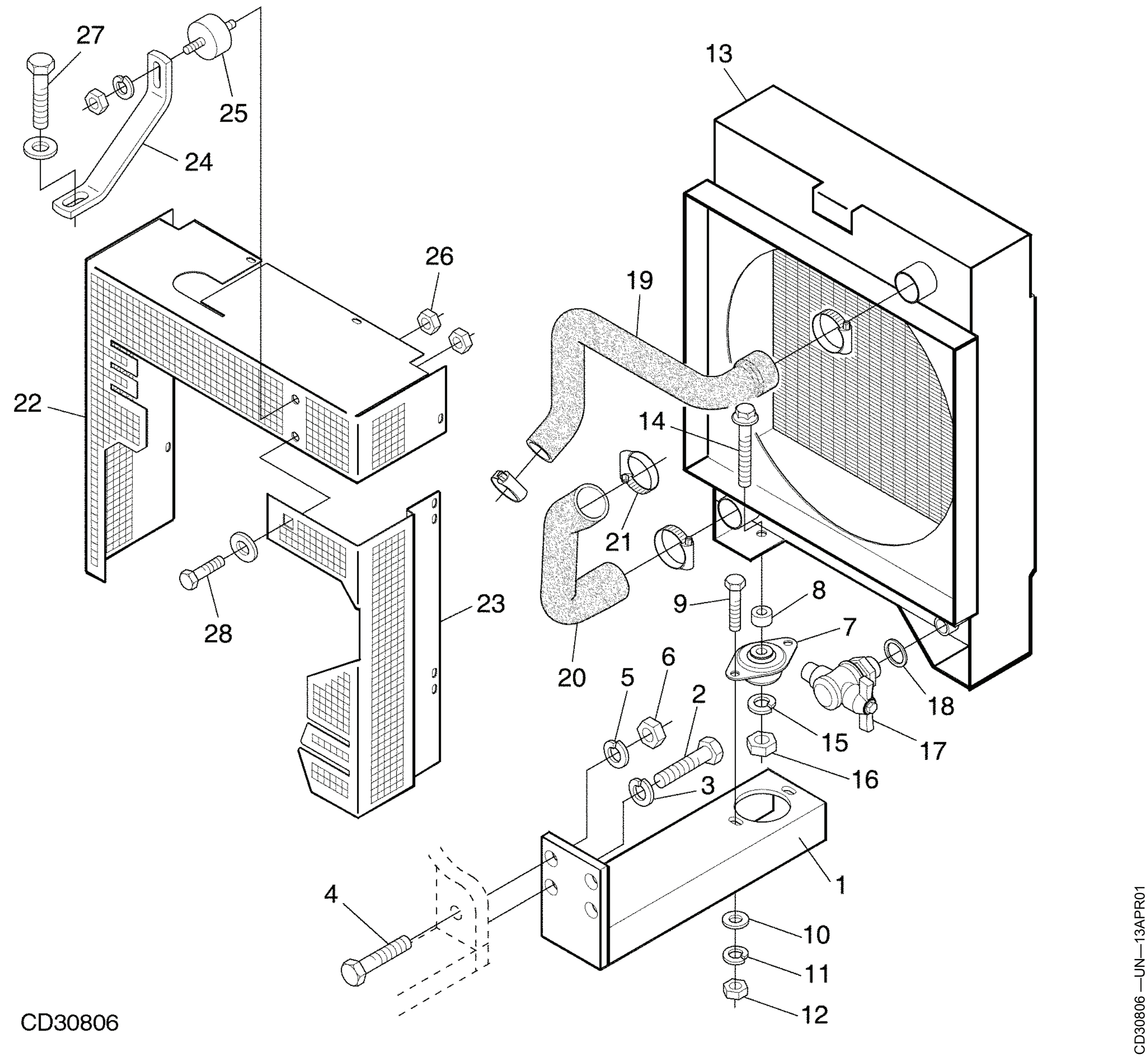
CD,CTM125,169 -19-26JAN01-3/3

Radiator Exploded View (Typical Installation)



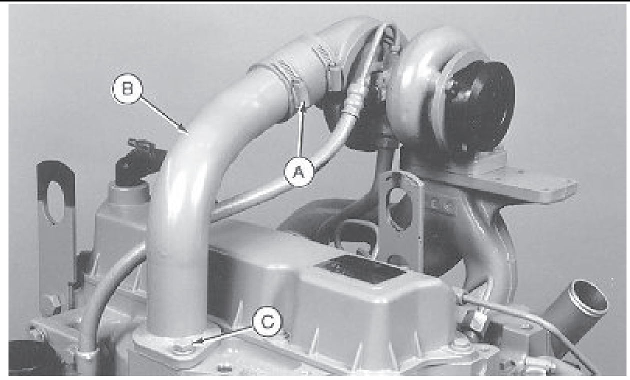
1— Radiator bracket
2— Cap screw (5/8"x1-1/2")
3— Lock washer
4— Cap screw (9/16"x2-1/4")
5— Lock washer
6— Nut
7— Rubber mount
8— Spacer
9— Cap screw (M8x18)
10— Flat washer
11— Lock washer
12— Nut
13— Radiator
14— Cap screw (M10x60)
15— Lock washer
16— Nut
17— Drain tap
18— Copper seal
19— Upper hose
20— Lower hose
21— Clamp
22— Main fan guard
23— Secondary fan guard
24— Reinforcement
25— Rubber mount
26— Nut
27— Cap screw (1/2"x1")
28— Cap screw (M8x12)

CD03523,0000105 -19-12APR12-1/1

Group 35

Air Intake and Exhaust System

Check Air Inlet Pipe



CD30653 —UN—04MAY98

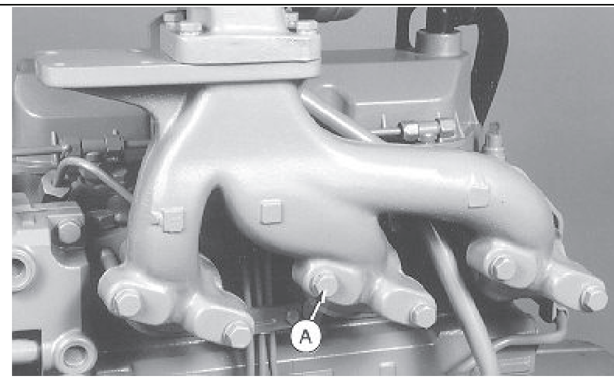
1. Loosen hose clamps (A) holding air inlet hose.
2. Remove air inlet pipe (B).
3. Inspect inlet pipe for serviceability and repair or replace, if it is cracked or otherwise damaged.
4. Inspect machined mating surfaces of cylinder head and inlet pipe. Clean as required, using a scraper and/or wire brush and compressed air.
5. To install inlet pipe, reverse removal procedure and use new gaskets.
6. Make sure that air inlet hose is in good condition. Tighten hose clamps securely.
7. Tighten air inlet pipe attaching cap screws (C) to specification.

Specification

Intake manifold-to-cylinder head, cap screws—Torque.. 50 N·m (35 lb-ft)

CD,CTM125,172 -19-29JAN01-1/1

Exhaust Manifold Inspection



CD30654 —UN—04MAY98

1. On engines with turbocharger, remove turbocharger.
2. Remove cap screws (A) and lift off exhaust manifold.
3. Inspect exhaust manifold for serviceability and replace if it is cracked or otherwise damaged.

NOTE: Exhaust manifold may have been factory-installed using liquid sealant. When re-installing manifold, use standard gaskets.

Gaskets with one steel-backed side must be installed with the non-steel backed side toward cylinder head.

4. To install exhaust manifold, reverse removal procedure and use new gaskets.
5. Tighten exhaust manifold attaching cap screws to specification.

Specification

Exhaust manifold-to-cylinder head, cap screws—Torque.. 50 N·m (35 lb-ft)

CD,CTM125,173 -19-01DEC97-1/1

Turbocharger Failure Analysis

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

NOTE: After turbocharger shaft/bearing failure has occurred it is recommended to perform:

- *Engine oil and oil filter change*
- *Inspect the used oil for debris from the failure.*
- *Remove and inspect turbocharger oil drain line to ensure that debris is not lodged in the line.*
- *Clean the intake system (intake manifold and charge air cooler circuit).*

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

Continued on next page RE38635,000002E -19-20JUN12-1/2

TURBINE HOUSING OUTLET DEFECTS

Foreign Object Damage	Internal engine failure.	Inspect and repair engine as required.
	Objects left in intake system.	Disassemble and inspect air intake system (this group).
	Leaking air intake system.	Correct as required (this group).
Oil and/or Excessive Carbon	Internal engine failure.	Verified by oil in turbine housing.
	Turbine seal failure.	Inspect for excessive heat from overfueling and/or restricted air intake.
	Prolonged periods of low rpm engine idling.	Ask operator to run engine under load or at a higher rpm (See Operator's Manual).
	Restricted oil drain line.	Inspect and clear oil drain line as required.

EXTERNAL CENTER HOUSING AND JOINT DEFECTS

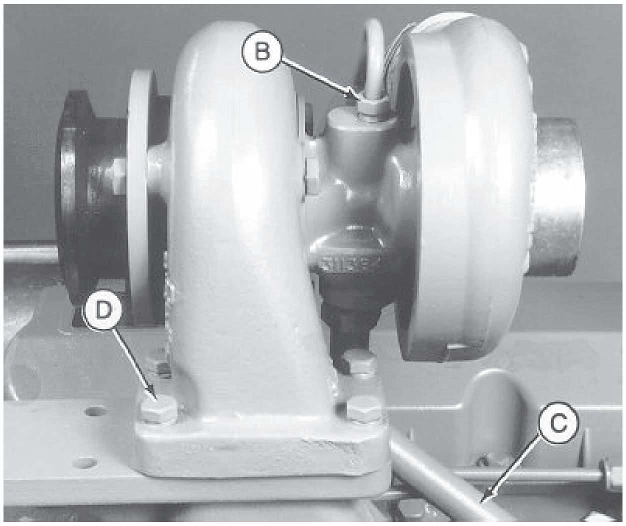
Leaks from Casting	Defective casting.	Replace turbocharger (this group).
	Defective gasket.	Verify if leaks are occurring at gasket joints.
Leaks from Joints	Loose attaching screws.	Tighten to specifications in CTM (this group).
	Defective gasket.	Inspect and repair as required.

INTERNAL CENTER HOUSING DEFECTS

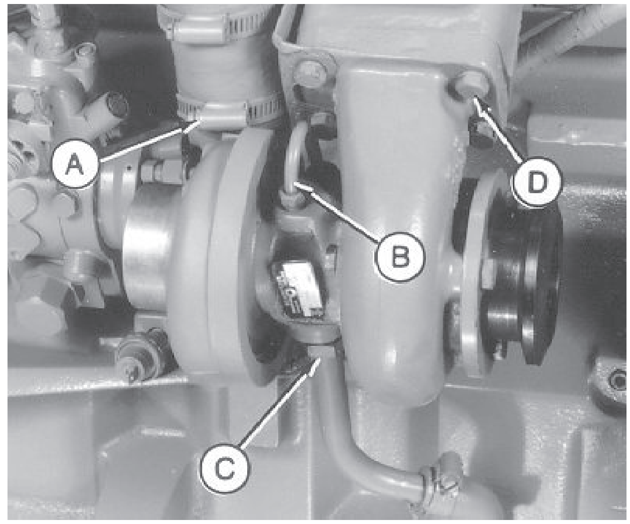
Excessive Carbon Build-Up in Housing or on Shaft	Hot engine shutdown.	Review proper operation with operator as shown in operator's manual.
	Excessive operating temperature.	Restricted air intake; overfueling or mistimed engine.
	Restricted oil drain line.	Inspect and clean oil drain lines as required.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

RE38635,000002E -19-20JUN12-2/2

Remove Turbocharger



High mount



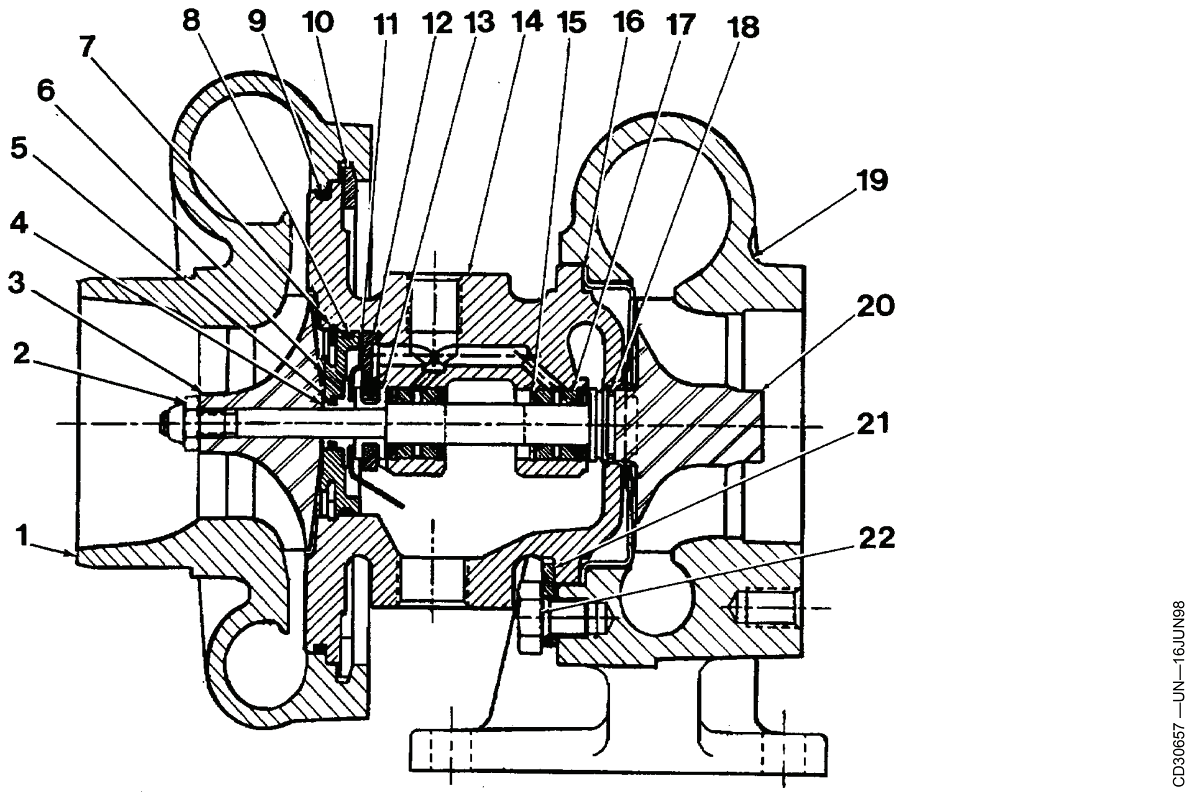
Side mount

A—Clamp
B—Oil inlet oil
C—Oil return tube
D—Cap screw

1. Thoroughly clean exterior of turbocharger and surrounding area.
2. Loosen clamp (A) holding the air inlet pipe.
3. Disconnect oil inlet line (B) and return tube (C) and plug turbocharger orifices immediately to prevent entry of dirt.
4. Remove air cleaner hose.
5. Remove muffler connection.
6. Unscrew the four cap screws (D) and remove turbocharger assembly from exhaust manifold.

CD,CTM125,174 -19-31JAN01-1/1

Turbocharger Cut-Away View (Borg-Warner/Schwitzer)

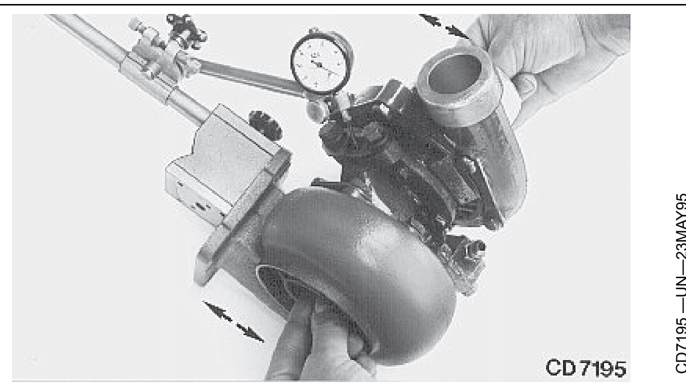


1— Compressor cover
2— Compressor locknut
3— Compressor wheel
4— Flinger
5— Piston ring
6— Insert
7— Circlip
8— O-Ring
9— O-Ring
10— Circlip
11— Oil deflector
12— Thrust bearing
13— Thrust sleeve
14— Central housing
15— Circlip
16— Turbine backplate
17— Journal bearing
18— Piston ring
19— Turbine housing
20— Shaft & wheel assy.
21— Clamp ring
22— Cap screw (Qty: 3)

CD,CTM125,175 -19-31AUG04-1/1

Check Radial Clearance

Garrett Turbocharger



1. Using an adapter with indicator extension rod, fasten a dial indicator to the turbocharger and place indicator rod against compressor shaft through lube hole.
2. Move shaft alternately toward and away from indicator.
3. Applying equal pressure to both ends of shaft, compare the radial bearing end play with specification.

Garrett Turbocharger—Specification

TA25 model—Radial clearance...0.06—0.13 mm (0.0024—0.005 in.)

If radial clearance is not within specifications, replace turbocharger.

Continued on next page

CD,CTM125,176 -19-31AUG04-1/2

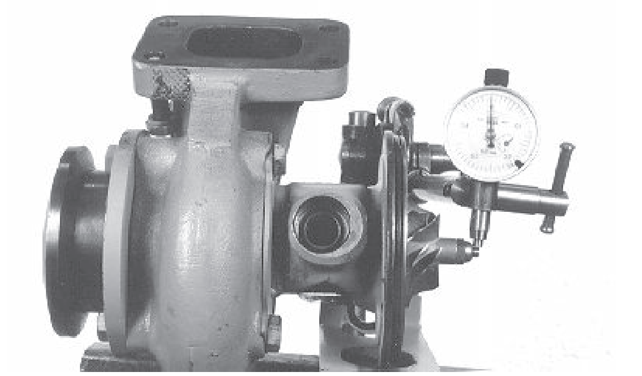
Borg-Warner/Schwitzer Turbocharger

1. Remove compressor cover.
2. Install a dial indicator against shaft end.
3. Move shaft alternately toward and away from indicator. Range of travel should not exceed specification.

Borg-Warner/Schwitzer Turbocharger—Specification

S1B model—Radial clearance.......... 0.51 mm (0.20 in.) Maxi

If radial clearance is exceeds specifications, replace turbocharger.



CD30658 —UN—04MAY98

CD,CTM125,176 -19-31AUG04-2/2

Check Axial Clearance

1. Using a dial indicator with indicator rod against shaft, measure axial end play.
2. Move shaft axially back and forth by hand. Compare reading with specification.

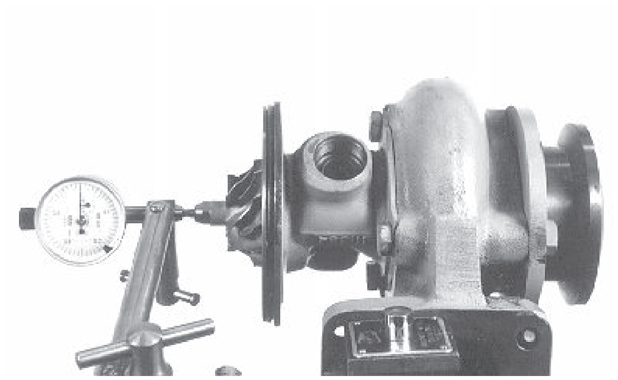
Garrett Turbocharger—Specification

TA25 model—Axial clearance.......... 0.025—0.09 mm (0.001—0.0035 in.)

Borg-Warner/Schwitzer Turbocharger—Specification

S1B model—Axial clearance.......... 0.14 mm (0.0055 in.) Maxi

If axial clearance is not within specifications, replace turbocharger.



CD30659 —UN—04MAY98

CD,CTM125,177 -19-31AUG04-1/1

Repair Turbocharger

Due to special tooling and highly specialized personnel required, turbochargers can be serviced only by an authorized workshop.

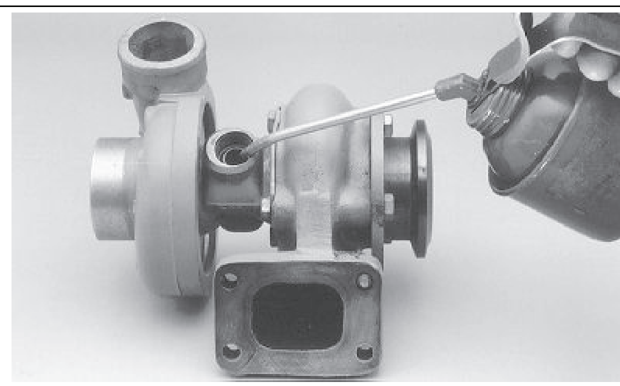
Only complete turbochargers are available through service parts channel. Individual components for repair are not available.

CD,CTM125,178 -19-01DEC97-1/1

Prelube Turbocharger

IMPORTANT: DO NOT spin the rotor assembly with compressed air. Rotor may seize due to high speed reached.

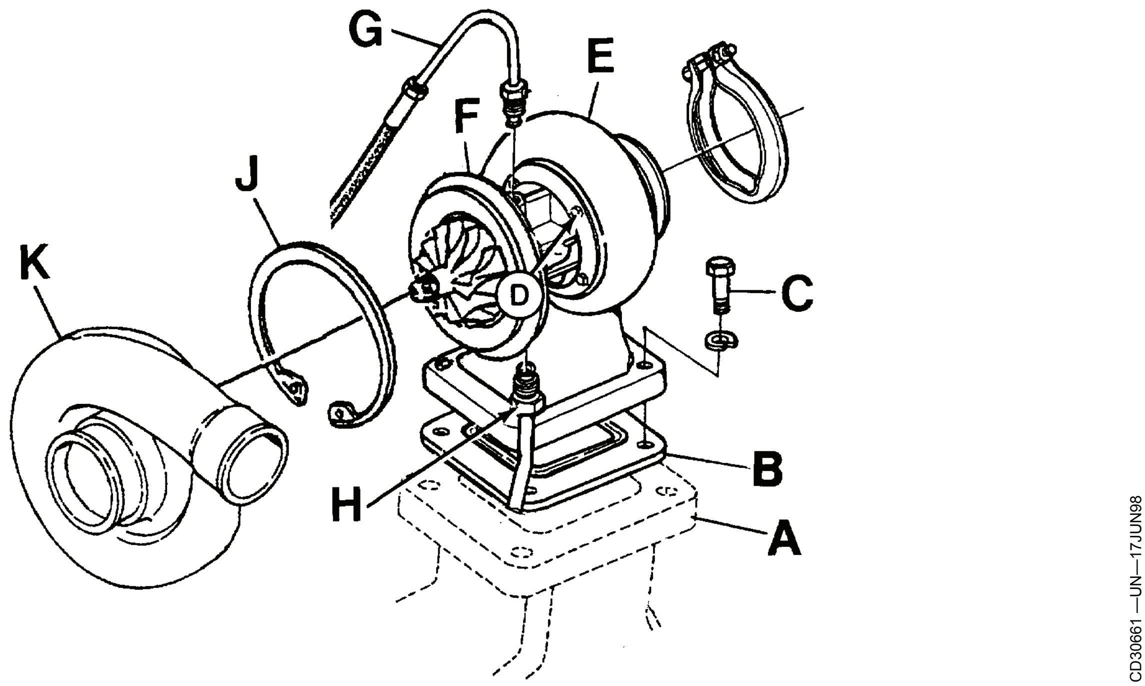
Fill oil inlet or drain port with clean engine oil and spin rotating assembly **(by hand)** to properly lubricate bearings.



CD30660 —UN—04MAY98

CD,CTM125,179 -19-01DEC97-1/1

Install Turbocharger



Install Turbocharger

A—Exhaust manifold
B—Gasket
C—Cap screw
D—Cap screw
E—Turbine housing
F—Center housing
G—Oil inlet line
H—Oil return tube
J—Circlip
K—Compressor cover

1. Install turbocharger on exhaust manifold (A) with a new gasket (B). Tighten cap screws (C) to specification.

NOTE: Turbocharger for service are designed for a specific application. In case where engine connections are not in line with turbocharger connections, follow the procedure described in step 2. Otherwise go directly to step 3.

2. Procedure to re-orient turbocharger housings:

   a. Loosen cap screws (D) of turbine housing (E).

   b. Rotate center housing (F) until oil inlet is in line with oil supply tube (G) and oil outlet is in line with oil return tube (H).

   c. Tighten turbine housing cap screws (D) to specification.

   d. Compress circlip (J) securing compressor cover (K), then rotate until in line with air inlet pipe. Release circlip.

3. If not done previously, prelube turbocharger then reconnect the oil supply line (G). Tighten to specification.

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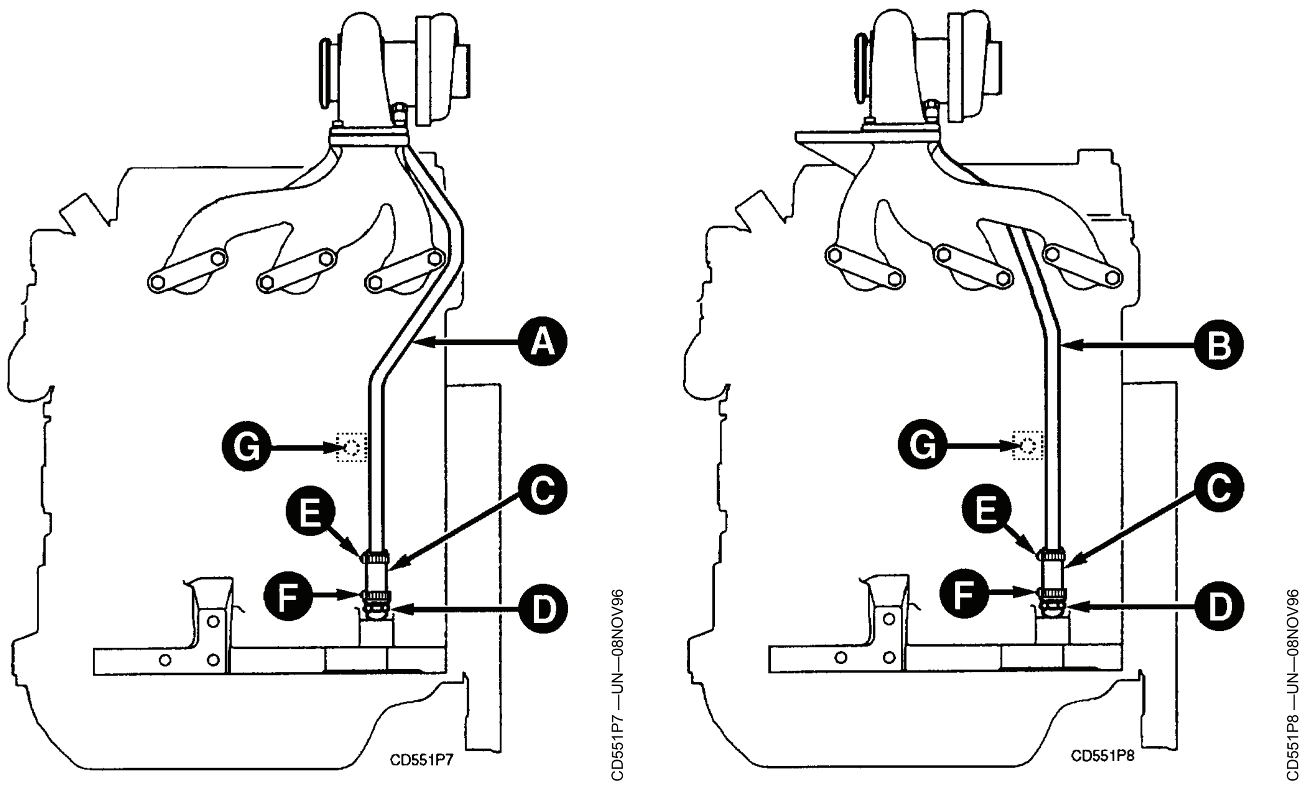
CD,CTM125,180 -19-01SEP04-1/2



5000/5010 Tractors *Other applications*

A—RE65182 Oil return tube (5000/5010 tractors)
B—RE65184 Oil return tube (Other applications)
C—R129647 Hose
D—R82859 fitting
E—AR21837 Clamp
F—AT18904 Clamp
G—Previous turbocharger oil return hole location

4. Reconnect the oil return tube (A) or (B). Tighten to specification.

NOTE: When cylinder block is replaced, turbocharger oil return line may need to be connected differently from original installation. Depending on application, order the parts as indicted in legend.

5. Reconnect exhaust system and air hoses.

IMPORTANT: Be sure that the air hose connections are tight to prevent entry of dirt into engine.

Garrett Turbocharger—Specification

Turbocharger-to-Exhaust manifold—Torque.......... 30 N·m (20 lb-ft)
Center housing-to-Turbine housing—Torque.......... 25 N·m (18 lb-ft)
Oil inlet line-to-Turbocharger —Torque.......... 25 N·m (18 lb-ft)
Oil return line-to-Turbocharger—Torque.......... 40 N·m (30 lb-ft)

Borg-Warner/Schwitzer Turbocharger—Specification

Turbocharger-to-Exhaust manifold—Torque.......... 30 N·m (20 lb-ft)
Center housing-to-Turbine housing—Torque.......... 25 N·m (18 lb-ft)
Oil inlet line-to-Turbocharger —Torque.......... 25 N·m (18 lb-ft)
Oil return line-to-Turbocharger—Torque.......... 40 N·m (30 lb-ft)

CD,CTM125,180 -19-01SEP04-2/2

Turbocharger Break-In

IMPORTANT: A new or repaired turbocharger does not have adequate oil supply. Perform the following steps to prevent damage to turbocharger.

1. To avoid engine starts, proceed as follows according to application:
   - either push the throttle lever to “Stop” position,
   - or hold engine shut-off knob out,
   - or disconnect electrical cable from fuel injection pump.
2. Crank engine by means of starting motor until needle of engine oil pressure gauge is in green zone or until indicator light (engine oil pressure) goes out.

CD,CTM125,181 -19-01DEC97-1/1

Recommendations for Turbocharger Use

In most cases, turbocharger damage is caused by improper start-up and shutdown procedure. Always idle the engine for at least 30 seconds (no load) after start-up and before shutdown.

IMPORTANT: Should the engine stall when operating under load, IMMEDIATELY restart the engine to prevent overheating of turbocharger parts.

CD,CTM125,182 -19-01DEC97-1/1

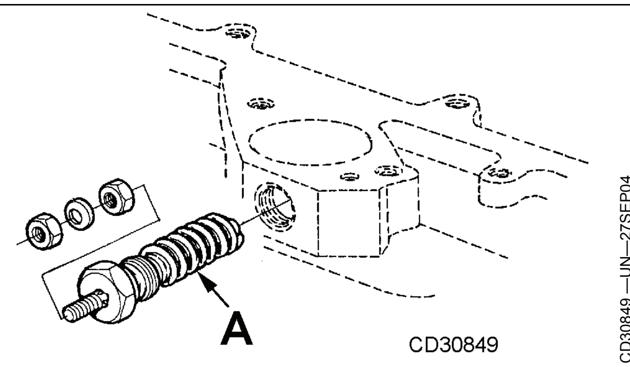
Remove and Install Air Heater Glow Plug

1. Disconnect wiring.
2. Remove the glow plug (A).
3. Replace parts as required.
4. Coat threads of the glow plug with Loctite 592 “Pipe Sealant with Teflon” and install.
5. Tighten to specification.

Specification

Air heater glow plug—Torque.. 35 N·m (25 lb-ft)

6. Reconnect wiring.



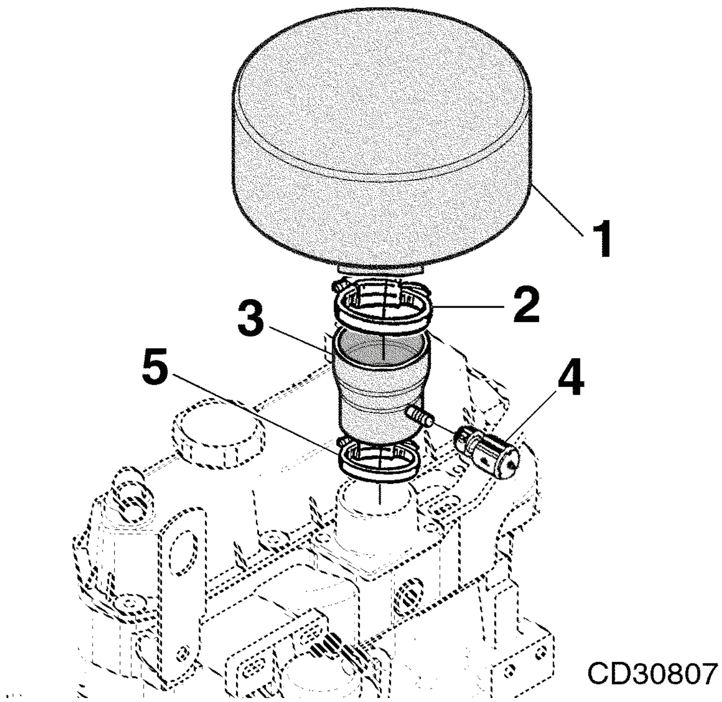
Air heater glow plug

A—Glow plug

CD03523,0000132 -19-01SEP04-1/1

Air Filter Exploded View

NOTE: Applies only to air filters installed by John Deere.



Light duty configuration

1— Air filter
2— Clamp
3— Hose
4— Air restriction indicator
5— Clamp

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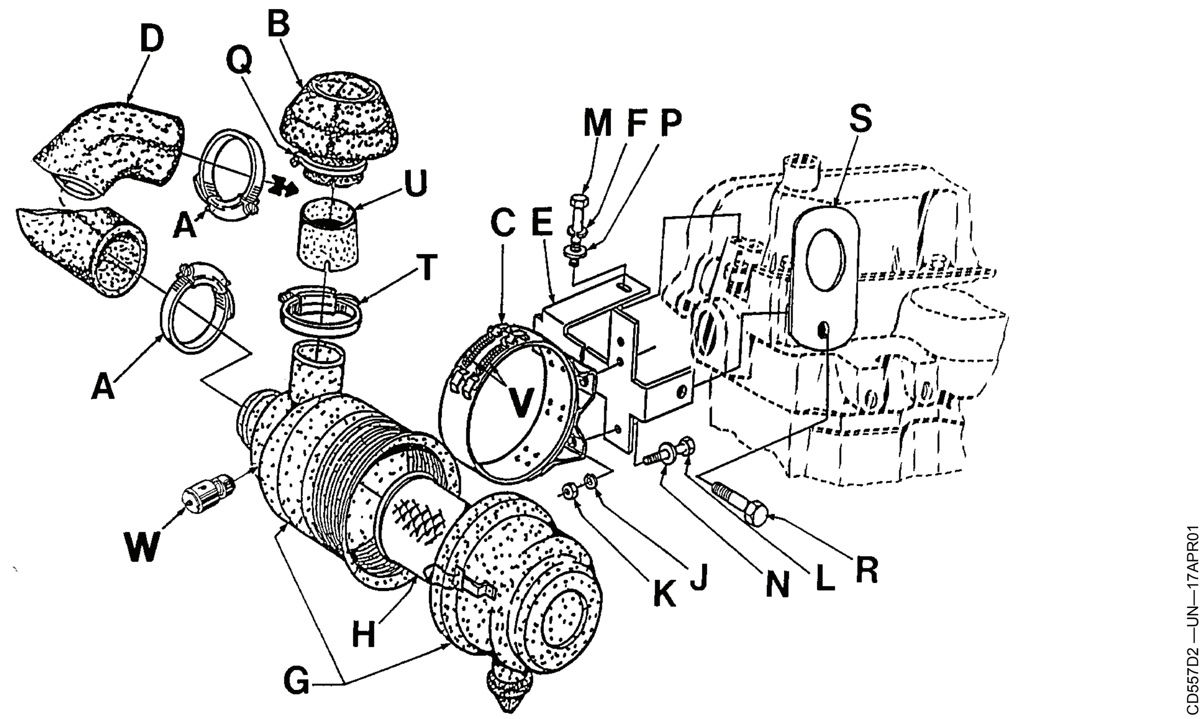
CD03523,0000107 -19-31JAN01-1/2

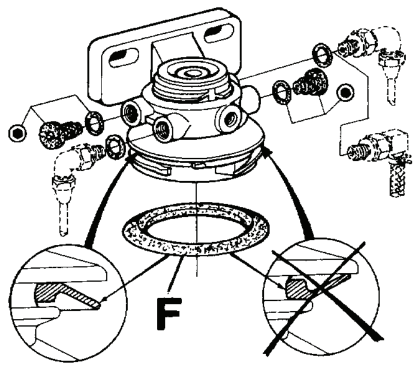


Medium duty configuration

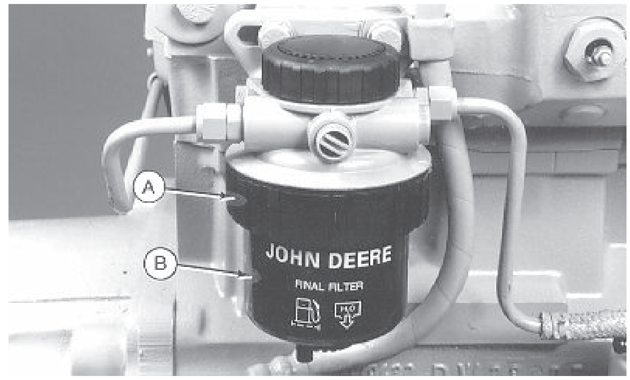
A—Clamp
B—Rain cap
C—Clamp
D—Hose
E—Bracket
F—Lock washer
G—Air cleaner assembly
H—Filter element
J—Lock washer
K—Nut
L—Cap screw
M—Cap screw
N—Washer
P—Washer
Q—Clamp
R—Cap screw
S—Lifting strap
T—Clamp
U—Sleeve
V—Spring
W—Air restriction indicator

CD03523,0000107 -19-31JAN01-2/2

Replace Fuel Filter Element (Rotary Fuel Injection Pump)



CD30667 —UN—17JUN98



CD30664 —UN—04MAY98

Remove Filter Element (Rotary fuel injection pump)

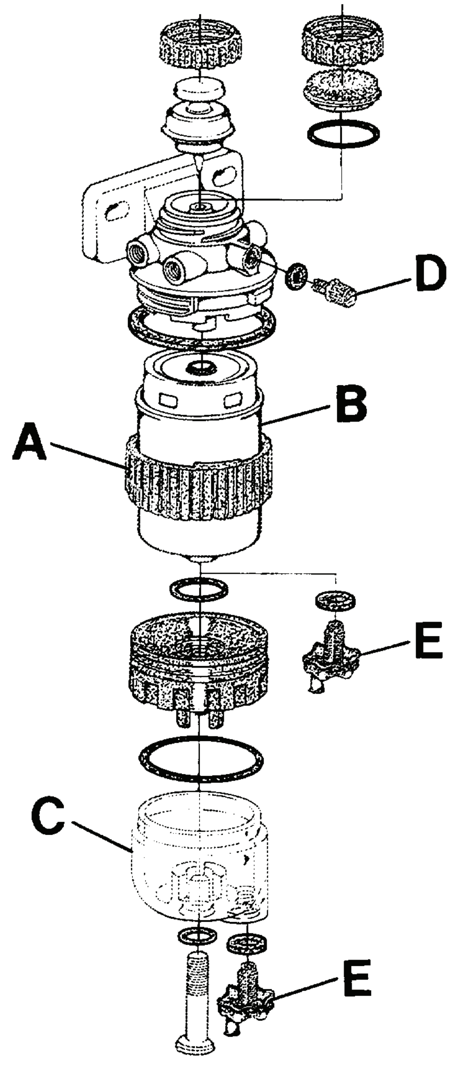
NOTE: For proper filter servicing and replacement, see Operator's Manual.

1. If equipped, rotate the fuel inlet valve to the closed position.
2. Unfasten filter retaining ring (A) and remove filter element (B).

NOTE: For a cleaner service, obturate the previous element with the plug provided with the new element.

3. If equipped, remove sediment glass bowl (C) from filter element and reinstall it onto the new element.
4. Install dust seal (F) as shown.
5. Position new element in proper location then tighten about 1/3 turn until retaining ring fits into the detent. DO NOT overtighten.
6. Bleed fuel system.

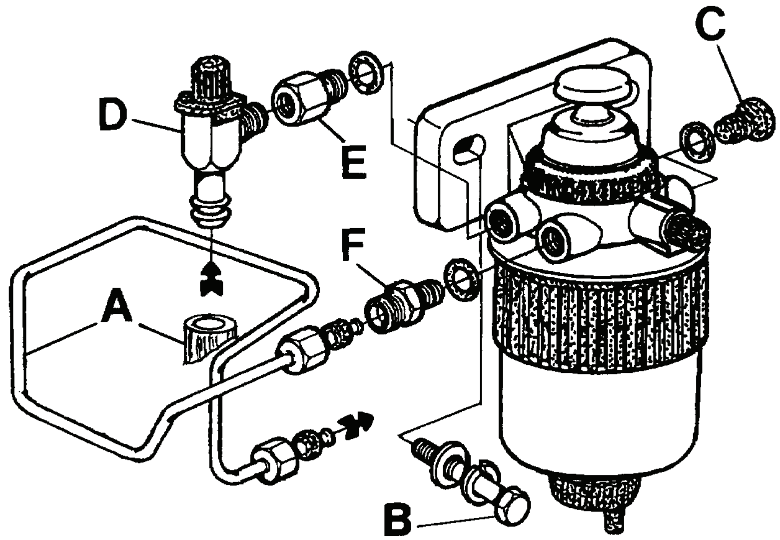
A—Retaining ring
B—Filter element
C—Sediment glass bowl
D—Bleed screw
E—Drain screw
F—Dust seal



CD30665 —UN—16JUN98

CD,CTM125,187 -19-06SEP04-1/1

Replace Fuel Filter Assembly (Rotary Fuel Injection Pump)



Replace Fuel Filter Assembly (Rotary fuel injection pump)

A—Fuel line
B—Fuel filter head-to-engine, cap screw
C—Plug
D—Fuel inlet valve
E—Adaptor
F—Fitting

1. Disconnect fuel lines (A).
2. Unscrew cap screws (B) and remove fuel filter assembly.
3. Replace parts as necessary, then tighten cap screws (B) to specification.
4. Install plugs (C) on filter head and tighten to specification.
5. If equipped, install fuel inlet valve (D) on adaptor (E), then install the assembly on filter head.
6. Install fittings (F) on filter head.
7. Install fuel lines then tighten to specification.

Round fuel filter assembly—Specification

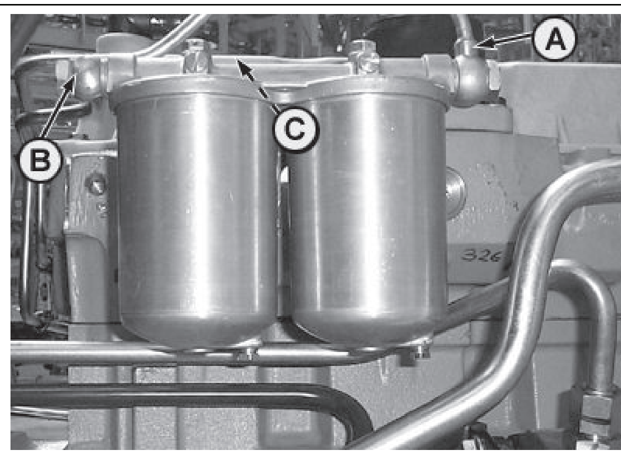
Fuel filter head-to-engine bolts—Torque	50 N·m (37 lb.-ft.)
Plug-to-Fuel filter head—Torque	5 N·m (3.5 lb.-ft.)
Fuel lines—Torque	30 N·m (23 lb.-ft.)

CD,CTM125,188 -19-23APR12-1/1

Replace Fuel Filter Assembly (MICO - BOSCH in-Line Injection Pump)

1. Disconnect inlet fuel line (A) and outlet fuel line (B).
2. Remove two cap screws (C).
3. Install fuel filter assembly and cap screws.
4. Connect fuel lines.

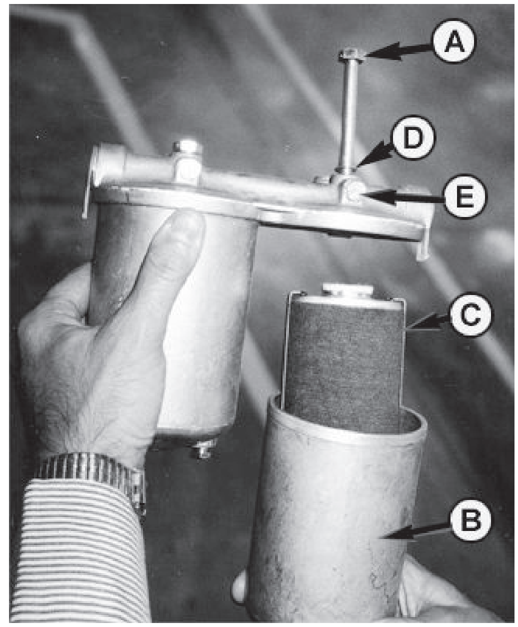
A—Inlet fuel line
B—Outlet fuel line
C—Cap screw (2 used)



MICO - BOSCH fuel filter assembly

CD03523,0000133 -19-10SEP04-1/1

Replace Fuel Filter Element (MICO - BOSCH in-Line Injection Pump)



PY1067 —UN—27JUN01

Replace MICO - BOSCH fuel filter element

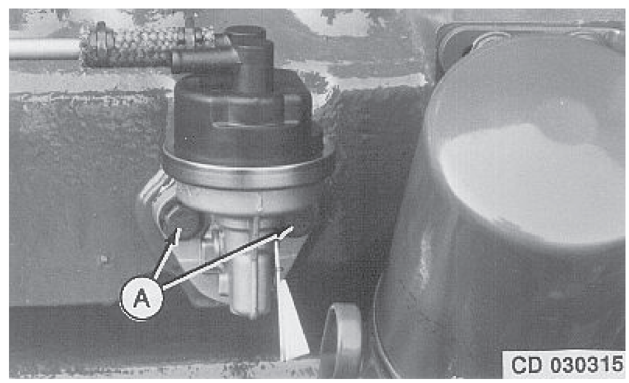
1. Remove cap screw (A) and filter element bowl (B)
2. Take out filter element (C)
3. Drain the fuel and clean the bowl
4. Install new filter element
5. Reinstall the bowl (B) then tighten screw (A) and washer (D).
6. Bleed the system from bleed screw (E)

IMPORTANT: Do not change both filter inserts simultaneously. Change primary and secondary filter inserts alternatively. (eg. If primary insert is changed at 250 hours, change secondary inserts at 500 hours, again primary at 750 hours likewise)

A—Cap screw
B—Sediment bowl
C—Filter element
D—Washer
E—Bleed screw

CD03523,0000134 -19-06SEP04-1/1

Replace Fuel Supply Pump (Rotary Fuel Injection Pump)



CD30315 —UN—17FEB95

Fuel Supply Pump (Rotary fuel injection pump)

1. Disconnect fuel lines and plug both connections on fuel pump and fuel lines.
2. Remove cap screws (A) and lift out fuel pump.

NOTE: Fuel pump is not repairable, replace if defective.

3. Install new gasket.
4. Apply sealing compound on thread of cap screws and attach the fuel pump to cylinder block. Tighten to specification.

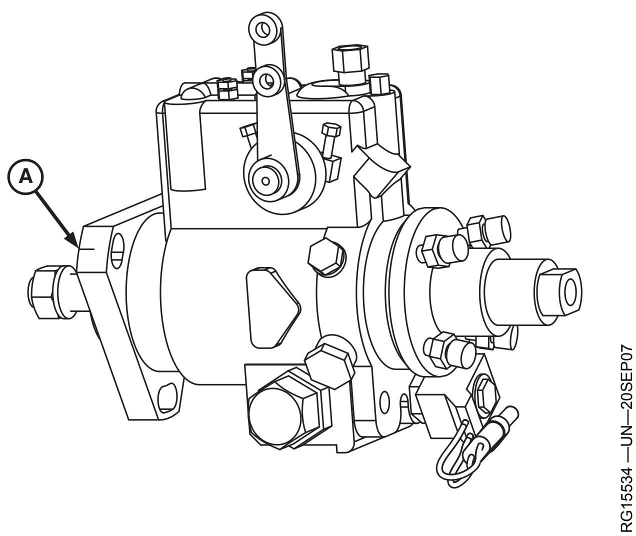
Specification

Fuel pump-to-Cylinder block, cap screws—Torque... 30 N·m (23 lb.-ft.)

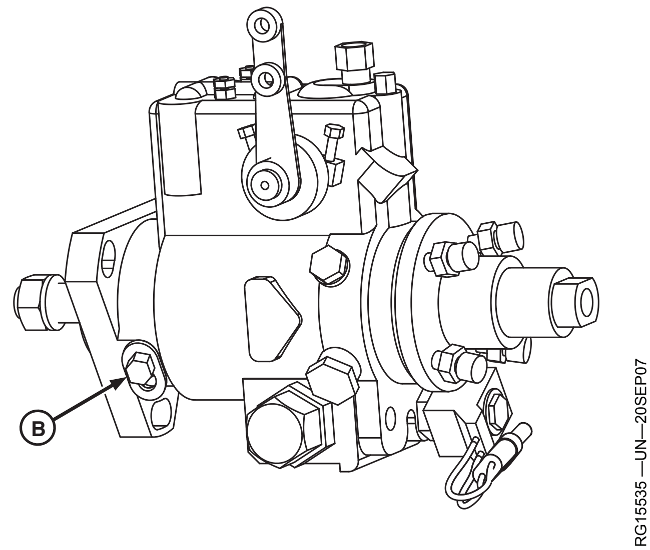
5. Reconnect fuel lines and bleed fuel system.

CD,CTM125,189 -19-21JUN12-1/1

STANADYNE Rotary Fuel Injection Pump Identification



Injection Pump Without Lock Shaft Timing



Injection Pump With Lock Shaft Timing

A—Injection pump without lock shaft timing
B—Injection pump with lock shaft timing

Two types of STANADYNE rotary injection pumps can be found on PowerTech 2.9 L engines.

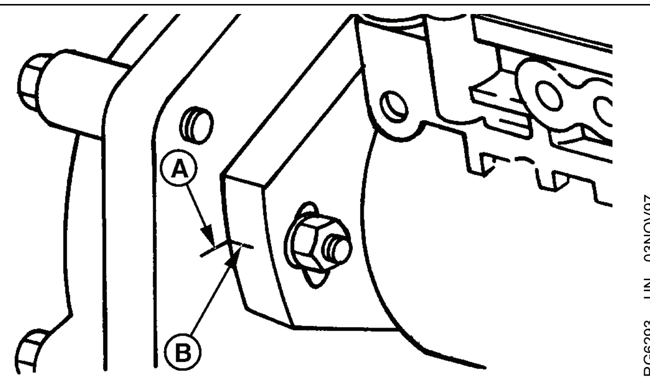
- Without Lock Shaft Timing (A)
- With Lock Shaft Timing (B)

The different pumps allow engines to comply with various exhaust emission regulations.

The lock shaft timing feature consists of a drive shaft locking screw and a key plate mounted in the pump housing. Once proper pump timing orientation has been established, the drive shaft is locked in position for accurate pump to engine timing. On injection pump with the lock shaft timing feature, the timing mark on the pump flange is not needed.

CD05019,0000079 -19-17APR12-1/1

Remove STANADYNE models DB2 or DB4 Fuel Injection Pump (Without Lock Shaft Timing)



IMPORTANT: Never steam clean or pour cold water on a fuel injection pump while the pump is running or while it is warm. Seizure of internal component can occur.

1. Clean fuel injection pump, lines and area around pump with cleaning solvent or a steam cleaner.
2. Check for the presence of timing marks on front plate (A) and injection pump flange (B). If necessary, mark both the pump and the front plate.

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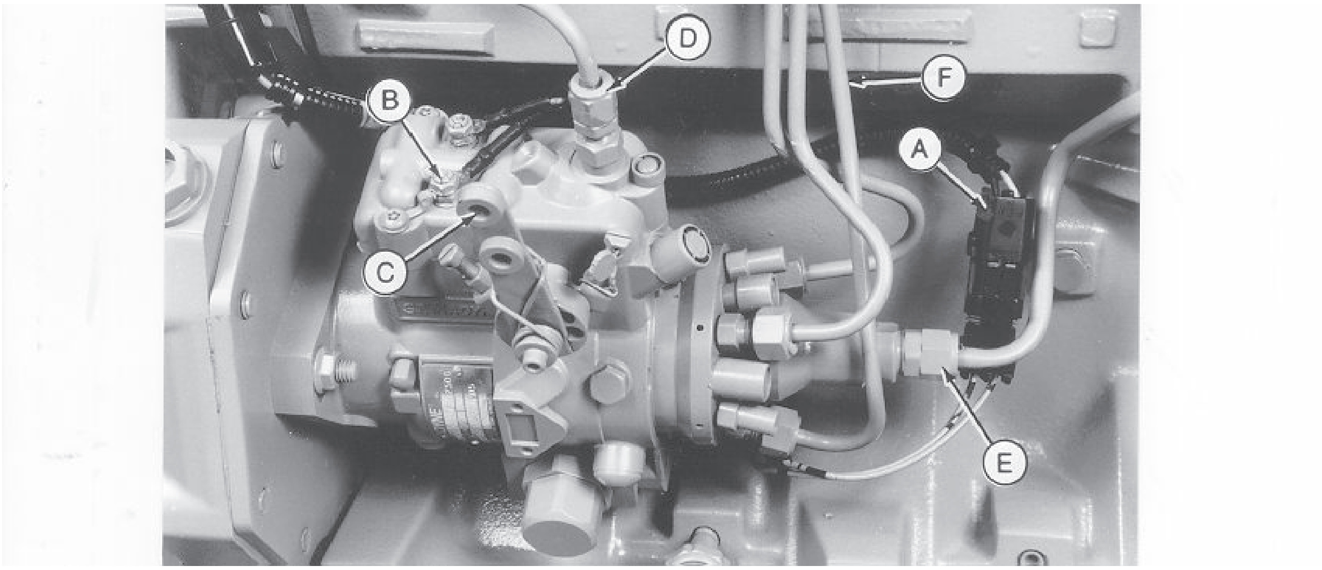
CD05019,000007A -19-21JUN12-1/4



CD30668 —UN—20MAY98

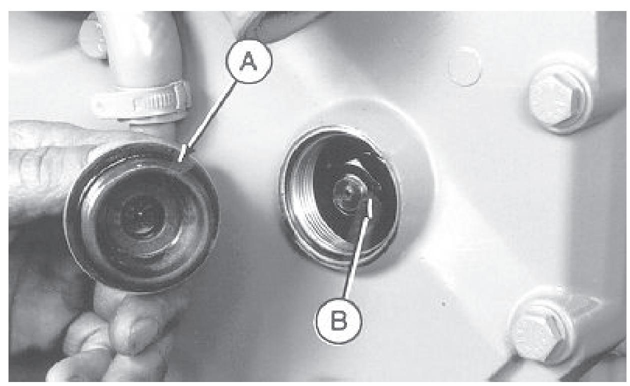
3. Disconnect the following elements:
   - cold start advance system (A)
   - shut-off system (B) and speed control linkage (C)
   - fuel return line (D)
   - fuel supply line (E)
   - fuel injection lines (F)

IMPORTANT: Always use a backup wrench when loosening or tightening fuel injection lines at injection pump to prevent rotation of the discharge fitting.

4. Plug all open connections on pump and fuel lines. Do not use fibrous material.

CD05019,000007A -19-21JUN12-2/4

5. Remove plug (A) from mounting hole in timing gear cover.
6. Remove nut (B) and washer securing the fuel injection pump drive gear to pump shaft.



CD30669 —UN—20MAY98

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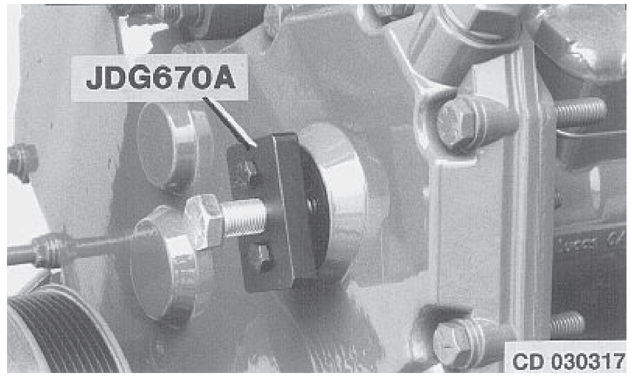
CD05019,000007A -19-21JUN12-3/4

7. Attach special tool JDG1560 (or JDG670A)[1] to gear. Remove the three nuts holding fuel injection pump to engine front plate.
8. Turn cap screw of special tool clockwise until pump shaft is loosened from conical seat of drive gear.
9. Remove center forcing screw from pulling tool and tighten the two screws of the tool until gear is pulled against cover. This will avoid that gear becomes disengaged from upper idler gear.
10. Pull fuel injection pump backward from the three studs.

NOTE: When removing fuel injection pump, be careful not to lose the pump shaft Woodruff key.



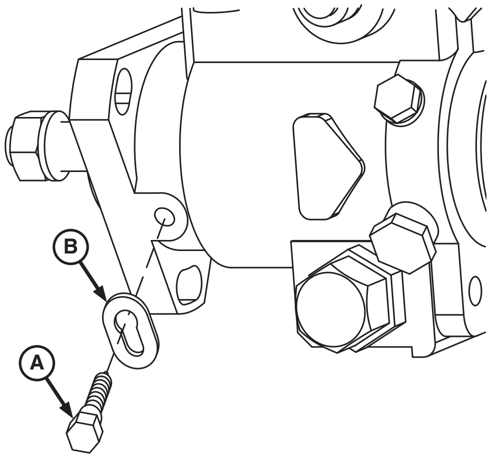
CD30317 —UN—17FEB95

Special Tool JDG670A shown

[1]JDG670A is no longer available. Order JDG1560.

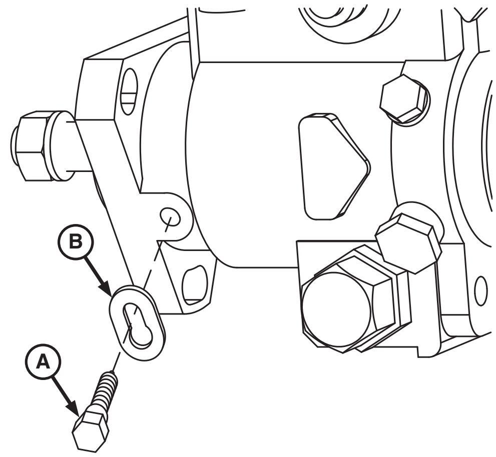
CD05019,000007A -19-21JUN12-4/4

Remove STANADYNE Model DB4 Fuel Injection Pump (with Lock Shaft Timing)



RG15538 —UN—19SEP07

Lock Screw in Locked Position



RG15539 —UN—19SEP07

Lock Screw in Unlocked Position

A—Lock Screw **B—Key Plate**

1. Put engine at TDC, compression stroke.
2. Put the key plate (B) in locked position. Tighten lock screw (A) to specification.

Specification

Lock Shaft Timing
Lock Screw—Locked
Position—Torque.. 8 N·m (71 lb-in.)

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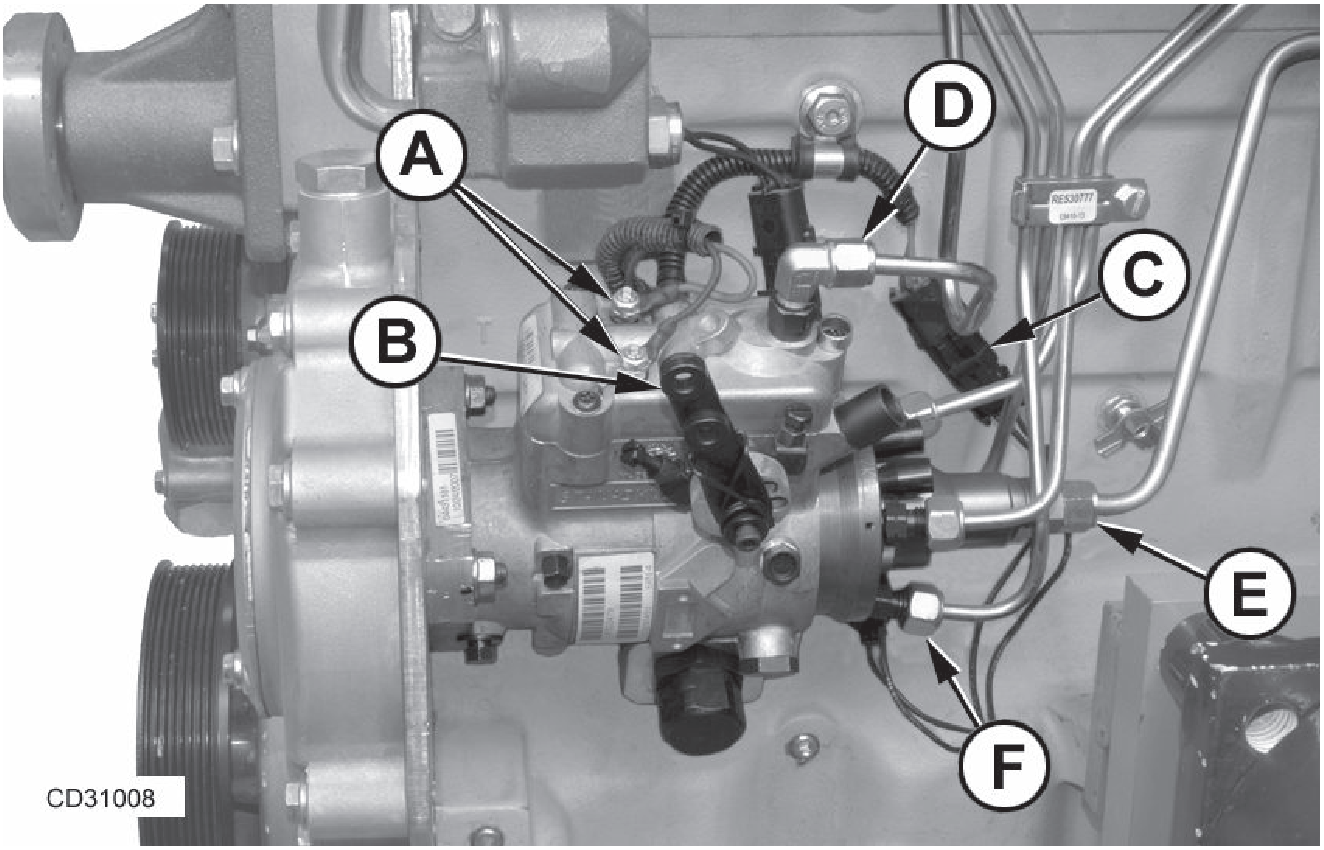
CD05019,000007B -19-21JUN12-1/5



Remove Connections

A—Fuel Shut-off Wires
B—Speed Control Linkage
C—Cold Start Switch Connector
D—Fuel Return Line
E—Fuel Supply Line
F—High Pressure Fuel Lines

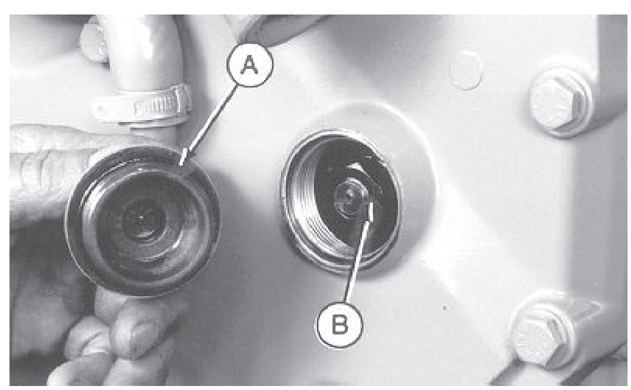
3. Disconnect fuel shut-off wires (A) and speed control linkage (B). Disconnect cold start switch (C). Tag electrical wires for correct reassembly.

IMPORTANT: ALWAYS use a backup wrench when loosening or tightening fuel lines at injection pump so that discharge fittings are not altered to prevent possible internal pump damage.

4. Disconnect fuel return line (D) and fuel supply line (E).
5. Disconnect all high pressure fuel lines (F) from injection pump using a suitable 17 mm deep-well crowsfoot socket.

CD05019,000007B -19-21JUN12-2/5

6. Remove plug (A) from mounting hole in timing gear cover.
7. Remove nut (B) and washer securing the fuel injection pump drive gear to pump shaft.



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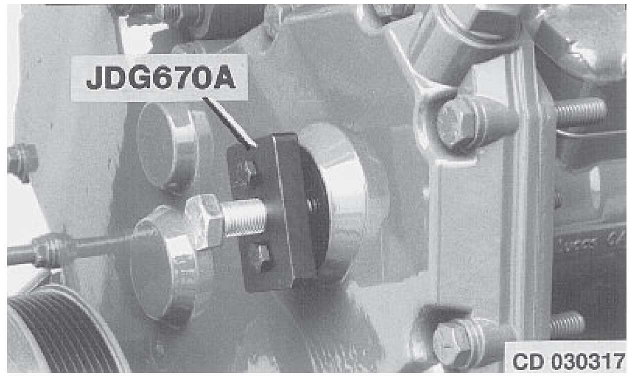
CD05019,000007B -19-21JUN12-3/5

8. Attach special tool JDG1560 (or JDG670A)[1] to gear. Remove the three nuts holding fuel injection pump to engine front plate.
9. Turn cap screw of special tool clockwise until pump shaft is loosened from conical seat of drive gear.
10. Remove center forcing screw from pulling tool and tighten the two screws of the tool until gear is pulled against cover. This will avoid that gear becomes disengaged from upper idler gear.
11. Pull fuel injection pump backward from the three studs.

NOTE: When removing fuel injection pump, be careful not to lose the pump shaft Woodruff key.

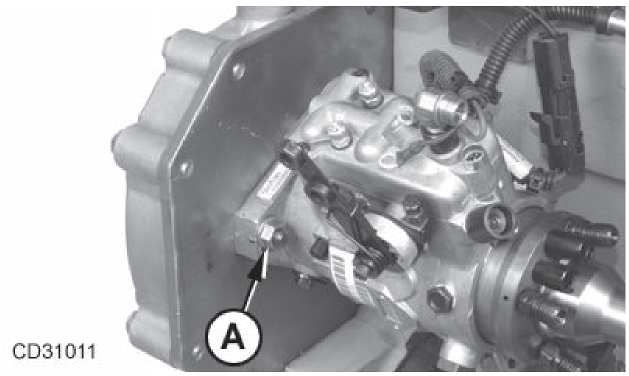


CD30317 —UN—17FEB95

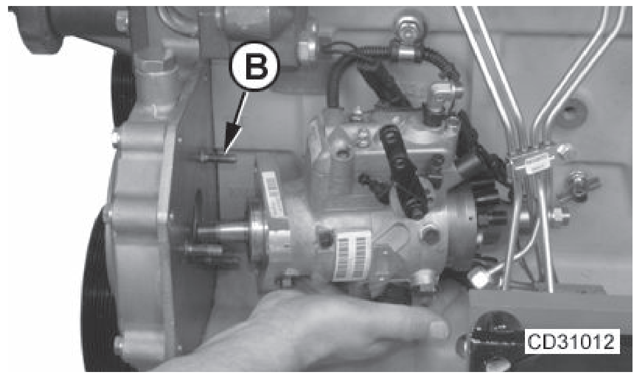
Special Tool JDG670A shown

[1]*JDG670A is no longer available. Order JDG1560.*

CD05019,000007B -19-21JUN12-4/5



CD31011 —UN—22SEP08



CD31012 —UN—22SEP08

A—Injection Pump Mounting Stud Nuts **B—Mounting studs**

12. Remove the three injection pump mounting stud nuts. Remove injection pump from mounting studs. Leave engine at TDC until injection pump is reinstalled.
13. Place pump on a clean flat surface and inspect shaft OD and drive gear as outlined later in this group.

CD05019,000007B -19-21JUN12-5/5

Inspect STANADYNE Injection Pump Drive Gear Inside Diameter and Shaft Diameter (all pumps)

IMPORTANT: Use a good light source to thoroughly inspect gear Inside Diameter and shaft Diameter.

1. Inspect entire Inside Diameter of injection pump drive gear for metal transfer as a result of slippage on shaft.
2. Inspect entire Diameter of drive shaft for presence of metal transfer from gear slippage. Also, check to see if index pin in shaft is damaged which would indicate gear slippage. If there is clear evidence of metal transfer on pump shaft Diameter or in drive gear Inside Diameter, or if index pin in pump shaft is damaged, injection pump and drive gear MUST BE replaced.

IMPORTANT: When replacing injection pump drive gear or installing a new pump, the tapered surfaces of the pump drive shaft Diameter and drive gear Inside Diameter MUST BE cleaned to remove protective coatings and oily residue. Use a suitable cleaner that does not leave a residue. Mating surfaces MUST BE ASSEMBLED DRY and LUBRICANTS MUST NOT BE USED.

CD05019,000007C -19-23APR12-1/1

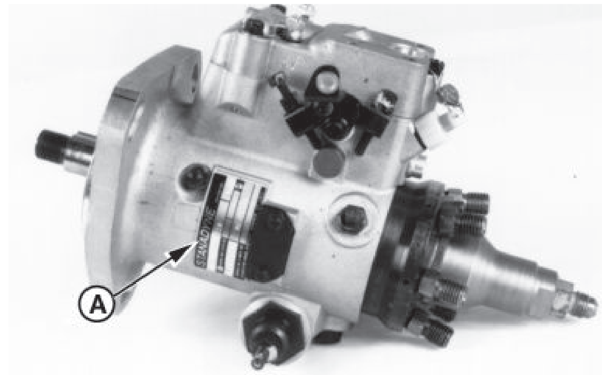
Repair STANADYNE Fuel Injection Pump

IMPORTANT: Do not disassemble the fuel injection pump further than necessary for installing available repair parts—not even for cleaning.

Be sure that injection pump serial number tag (A) is in place and that all identification numbers are legible so that pump is set to the correct specification for its intended application.

To comply with the exhaust emission regulations, for which this engine may be certified, the repair or adjustment of the injection pump can be only performed by an Authorized STANADYNE workshop.

Only complete injection pump is available for service. When injection pump need to be replaced, perform a dynamic timing during installation on engine.

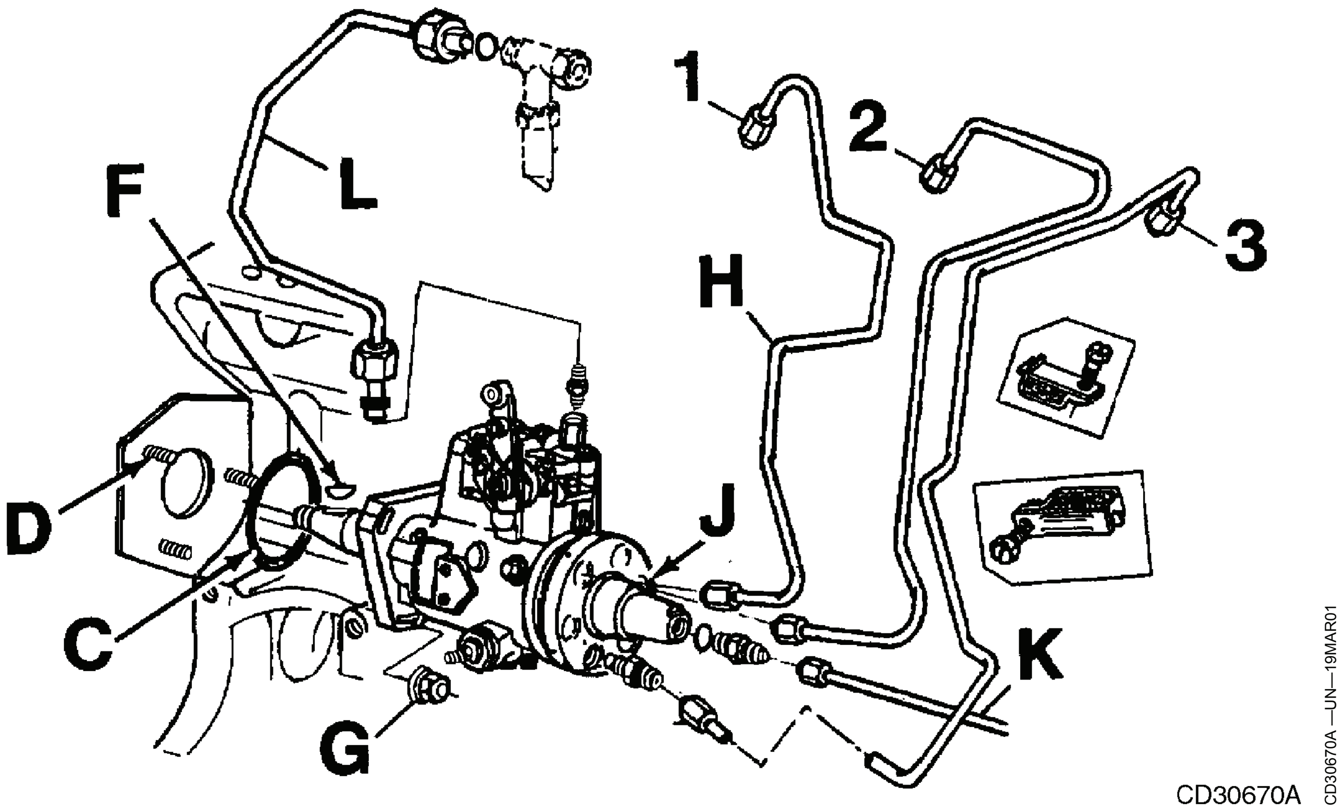


STANADYNE Fuel Injection Pump

A—Serial Number Tag

CD05019,000007D -19-17APR12-1/1

Install STANADYNE DB2 or DB4 Fuel Injection Pump (Without Lock Shaft timing)



A—Timing mark on front plate
B—Timing mark on fuel injection pump flange
C—O-ring or packing
D—Stud
E—Driver gear nut
F—Shaft key
G—Nut
H—High pressure fuel line
J—High pressure outlet connection to no. 1 cylinder
K—Fuel supply line
L—Fuel return line

1. Using a new O-ring or packing (C), slide housing onto the three studs (D), inserting shaft in drive gear.

NOTE: Make sure that the Woodruff key (F) is seated properly.

2. Screw the three nuts (G) onto studs and hand-tighten at this stage.

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CD,CTM125,195 -19-21JUN12-1/2

3. Push drive gear firmly onto shaft taper. Install washer and nut (E) then tighten to specification. Install injection pump drive gear nut access plug onto timing gear cover, using a new O-ring, if needed. Tighten to specifications.

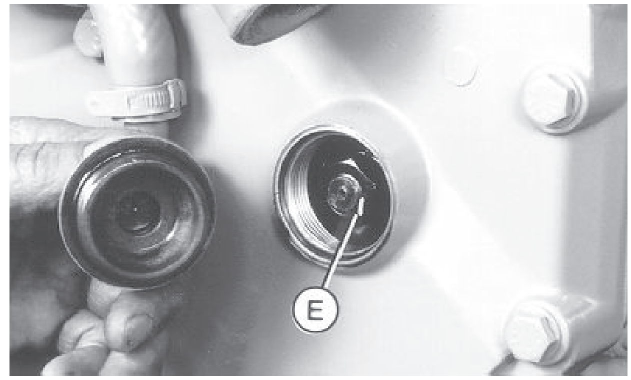
4. Align timing mark on pump flange (B) with timing mark on front plate (A) then tighten nuts (G) to specification.

NOTE: In case of replacement of injection pump, install injection pump with studs in middle of flange slots. Then perform a dynamic timing.

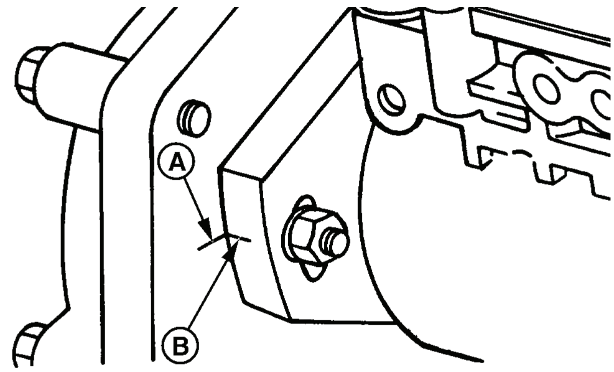
5. Connect injection line No. 1 (H) to outlet (J) and continue counter-clockwise with injection line No. 2. Using JDF22 socket and a backup wrench, tighten to specification.

6. Connect and tighten to specification:

- fuel supply line (K).
- fuel return line (L).
- shut-off system and speed control linkage.
- cold start advance system. Use a new seal at the injection pump connection (See "Cold Start Advance System Operation").



CD30671 —UN—20MAY98



RG6293 —UN—03NOV97

STANADYNE DB2 or DB4 Fuel Injection Pump—Specification

Drive gear nut (DB2)—Torque	125 N·m (92 lb.-ft.)
Drive gear nut (DB4)—Torque	200 N·m (145 lb.-ft.)
Injection Pump Drive Gear Nut Access Plug—Composite Material Plug	30 N·m (22 lb.-ft..)
Steel Plug	70 N·m (52 lb.-ft.)
Fuel injection line-to-Injection pump—Torque	25 N·m (18 lb.-ft.)
Fuel injection pump-to-front plate, nut—Torque	25 N·m (18 lb.-ft.)
Fuel supply line-to-Injection pump—Torque	30 N·m (23 lb.-ft.)
Fuel return line-to-Injection pump—Torque	15 N·m (11 lb.-ft.)
Engine firing order—3 Cyl.	1-2-3

CD,CTM125,195 -19-21JUN12-2/2

Install STANADYNE Model DB4 Injection Pump (with Lock Shaft Timing)

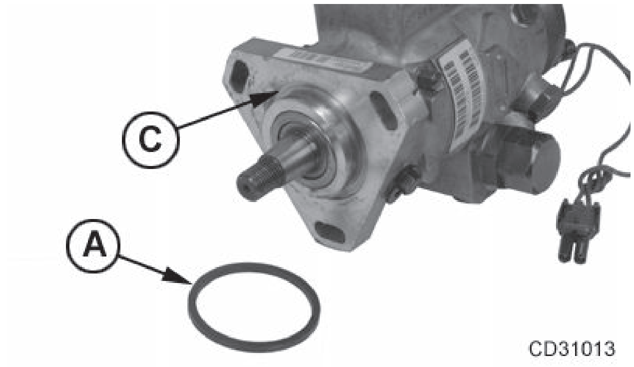
IMPORTANT: Repaired or replacement pumps have the drive shaft locked by the manufacturer or by the workshop Dealer once proper pump timing orientation has been established. To comply with Emission Regulations, do not install pump which has not the drive shaft locked. Bring the pump to a STANADYNE Agent for timing and installation of the lock shaft timing screw.

NOTE: When installing pump, do not use previous timing marks (if any) on front plate and on pump flange.

1. Lubricate a new square sealing ring (A) with clean engine oil. Install ring into groove (C) on front face of pump mounting flange.
2. Slide and rotate injection pump onto mounting studs (B) while inserting pump shaft into drive gear.

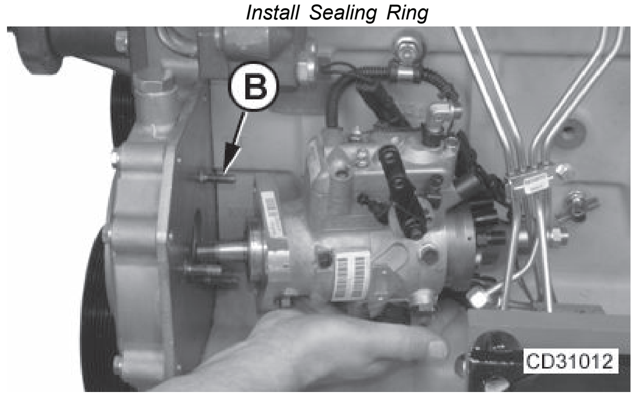
IMPORTANT: Rotate the complete pump to align pump shaft key with gear key slot.

A—Sealing Ring
B—Injection Pump Mounting Studs
C—Sealing Ring Groove



CD31013 —UN—26SEP08

Install Sealing Ring



CD31012 —UN—22SEP08

Install Injection Pump

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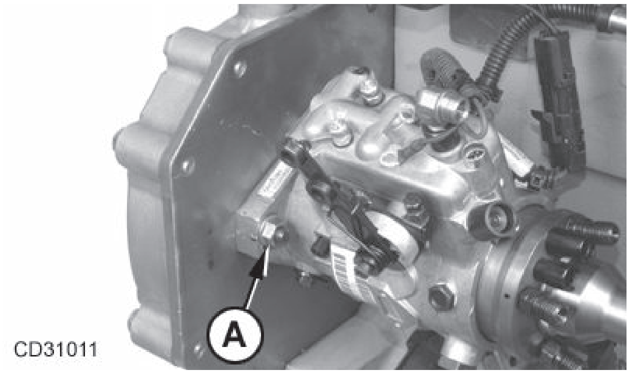
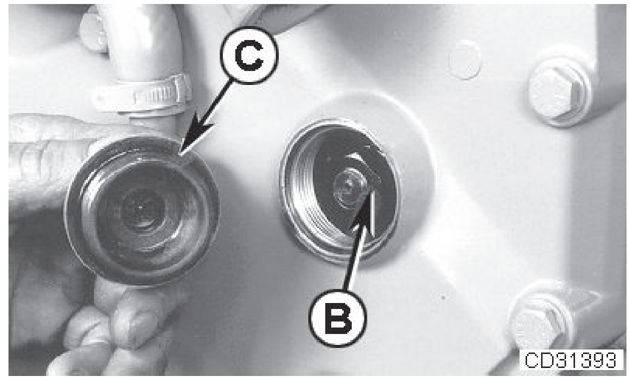
CD05019,000007F -19-21JUN12-1/5



Install Stud Nuts



Install Drive Gear Washer, Nut, and Plug

A—Injection Pump Mounting Stud Nuts
B—Drive Gear Washer and Retaining Nut
C—Drive Gear Nut Access Plug with O-Ring

3. Install the 3 injection pump mounting stud nuts (A) but do not tighten at this stage.
4. Install washer and drive gear retaining nut (B) onto end of pump shaft. Tighten to specifications.

Specification

STANADYNE DB4 Fuel Injection Pump Drive Gear-to-Shaft Retaining Nut—Torque.. 200 N·m (148 lb.-ft.)

5. Rotate pump towards engine to eliminate the gear backlash then tighten to specifications.

Specification

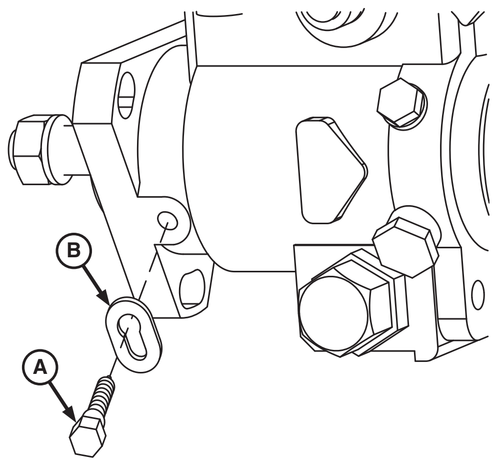
Injection Pump Mounting Nuts—Torque... 27 N·m (20 lb.-ft.)

6. Install injection pump drive gear nut access plug (C) using a new O-ring, if needed. Tighten to specifications.

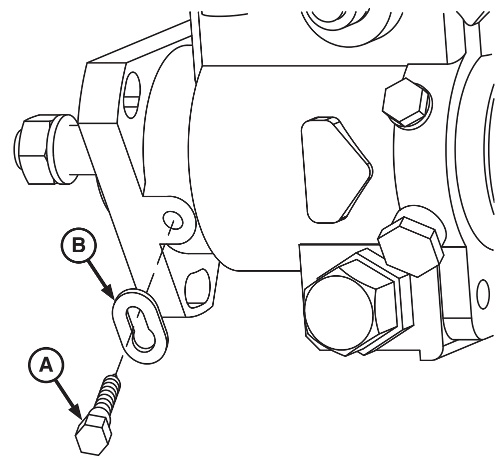
Specification

Injection Pump Drive Gear Nut Access Plug—Composite Material Plug... 30 N·m (22 lb.-ft.)
Steel Plug .... 70 N·m (52 lb.-ft.)

CD05019,000007F -19-21JUN12-2/5



Lock Screw in Locked Position



Lock Screw in Unlocked Position

A—Lock Screw
B—Key Plate

7. Loosen injection pump drive shaft lock screw (A) and position key plate (B) to unlocked position (small diameter end behind the lock screw head). Tighten lock screw to specification.

Specification

Lock Shaft Timing Lock Screw—Unlocked Position—Torque.. 8 N·m (06 lb.-ft.)

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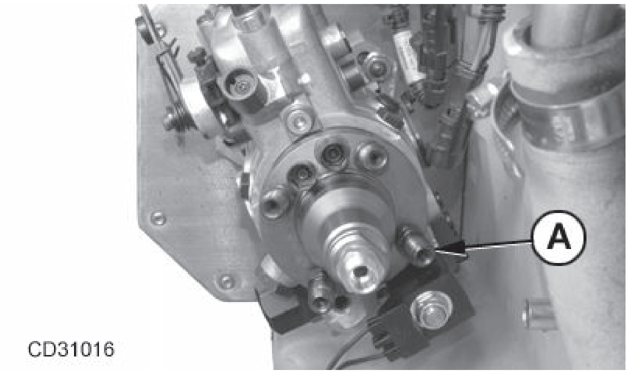
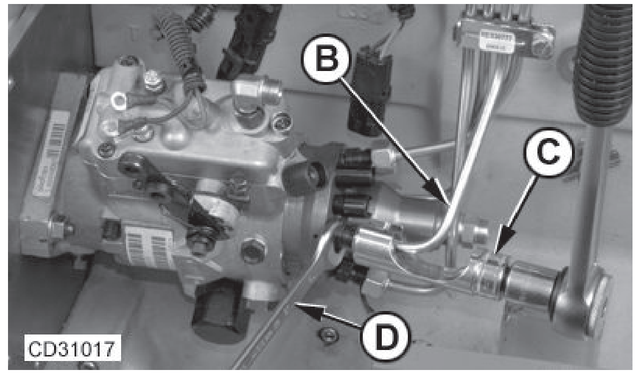
CD05019,000007F -19-21JUN12-3/5



High Pressure Outlet for Cylinder N° 1



Install High Pressure Fuel Lines

A—High Pressure Outlet for Cylinder N° 1
B—High Pressure Fuel Lines
C—Suitable 17 mm Socket
D—Backup Wrench

8. Connect high pressure fuel lines (B). Beginning with outlet (A) and continuing around the pump head in counterclockwise direction, attach lines in same order as engine firing (1-2-3).

IMPORTANT: ALWAYS use a backup wrench (D) when loosening or tightening fuel delivery lines at fuel injection pump, so that the pump discharge fittings are not altered. This prevents possible internal pump damage.

9. Tighten high pressure fuel lines at pump to specifications, using a suitable 17 mm deep-well socket (C).

Specification

Fuel Injection Pump Delivery Lines (At Pump)—Torque.. 27 N·m (20 lb.-ft.)

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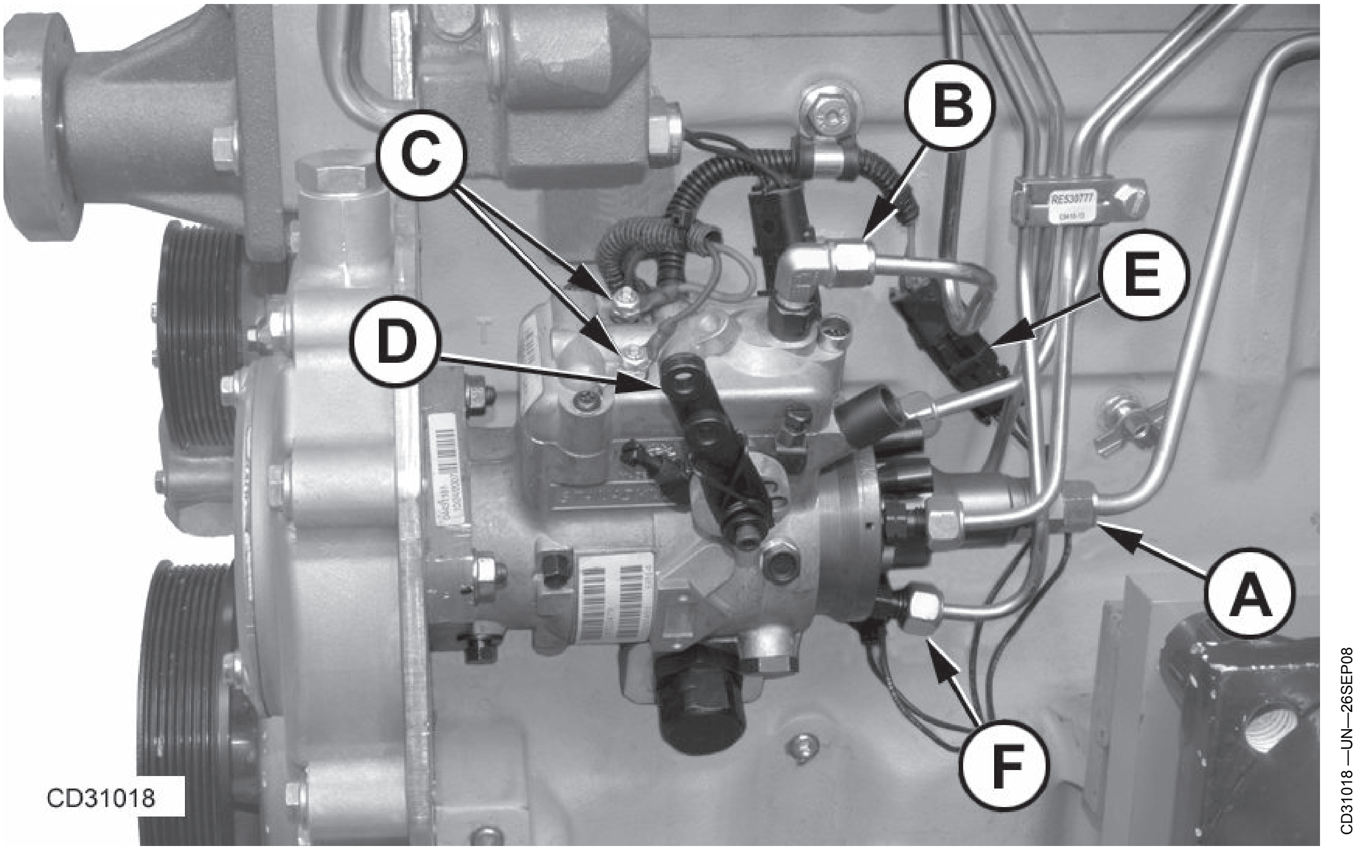
CD05019,000007F -19-21JUN12-4/5



Install Connections

A—Fuel Supply Line
B—Fuel Return Line
C—Fuel Shut-Off Wires
D—Speed Control Linkage
E—Cold Start Switch
F—High Pressure Fuel Lines

10. Connect fuel supply line (A) and fuel return line (B).
11. Connect fuel shut-off wires (C) and speed control linkage (D), if equipped.
12. Connect cold start switch (E).

NOTE: Fuel injection pumps with lock shaft timing do not require additional static or dynamic timing.

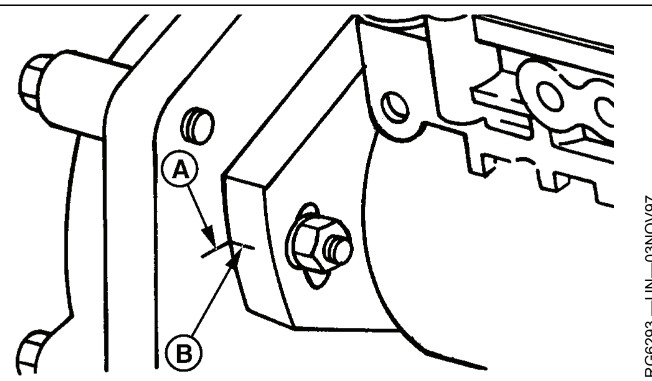
13. Bleed air from fuel system as outlined in this group. (See BLEED THE FUEL SYSTEM in this group.) Start engine, run for several minutes and check entire fuel system for leaks.

CD05019,000007F -19-21JUN12-5/5

Remove DELPHI/LUCAS Fuel Injection Pump

IMPORTANT: Never steam clean or pour cold water on a fuel injection pump while the pump is running or while it is warm. Seizure of internal component can occur.

1. Clean fuel injection pump, lines and area around pump with cleaning solvent or a steam cleaner.
2. Check for the presence of timing marks on front plate (A) and injection pump flange (B). If necessary, mark both the pump and the front plate.



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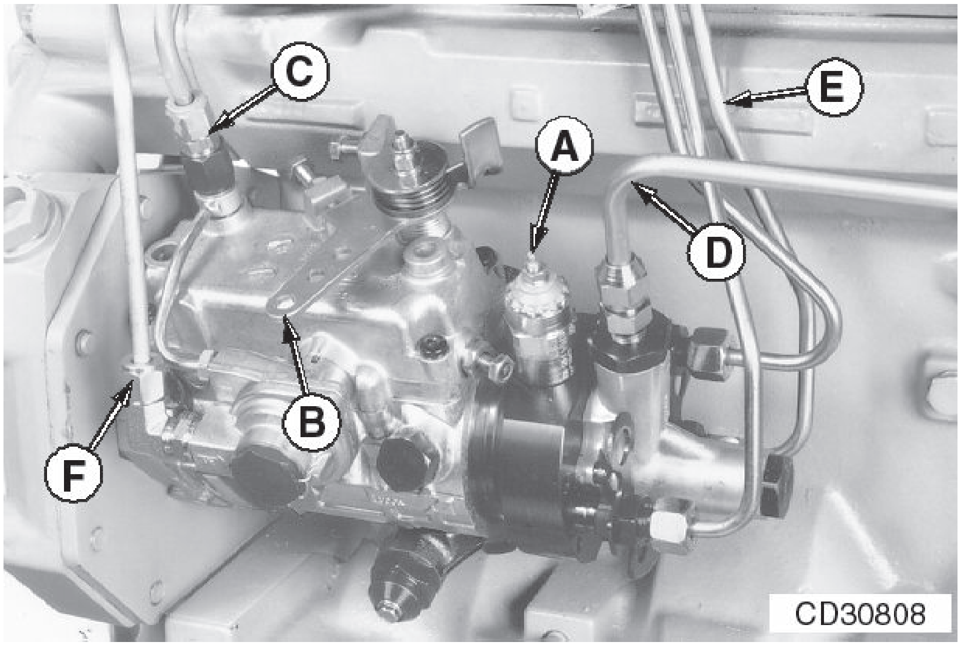
CD03523,000010F -19-07SEP04-1/4



CD30808 —UN—17APR01

3. Disconnect the following elements:

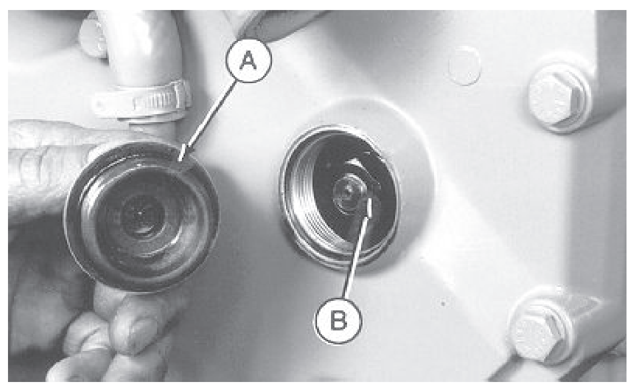
- cold start advance system, when equipped
- shut-off system (A) and speed control linkage (B)
- fuel return line (C)
- fuel supply line (D)
- fuel injection lines (E)
- Aneroid line (F), when equipped

IMPORTANT: Always use a backup wrench when loosening or tightening fuel injection lines at injection pump to prevent rotation of the discharge fitting.

4. Plug all open connections on pump and fuel lines. Do not use fibrous material.

CD03523,000010F -19-07SEP04-2/4

5. Remove plug (A) from mounting hole in timing gear cover.
6. Remove nut (B) and washer securing the fuel injection pump drive gear to pump shaft.



CD30669 —UN—20MAY98

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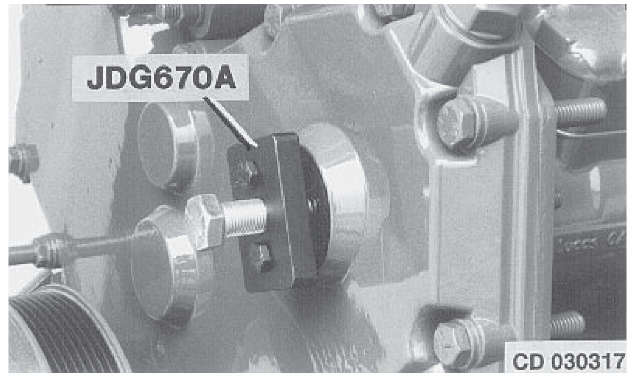
CD03523,000010F -19-07SEP04-3/4

7. Attach special tool JDG1560 (or JDG670A)[1] to gear. Remove the three nuts holding fuel injection pump to engine front plate.
8. Turn cap screw of special tool clockwise until pump shaft is loosened from conical seat of drive gear.
9. Remove center forcing screw from pulling tool and tighten the two screws of the tool until gear is pulled against cover. This will avoid that gear becomes disengaged from upper idler gear.
10. Pull fuel injection pump backward from the three studs.

NOTE: When removing fuel injection pump, be careful not to lose the pump shaft Woodruff key.



CD30317 —UN—17FEB95

Special Tool JDG670A shown

[1]JDG670A is no longer available. Order JDG1560.

CD03523,000010F -19-07SEP04-4/4

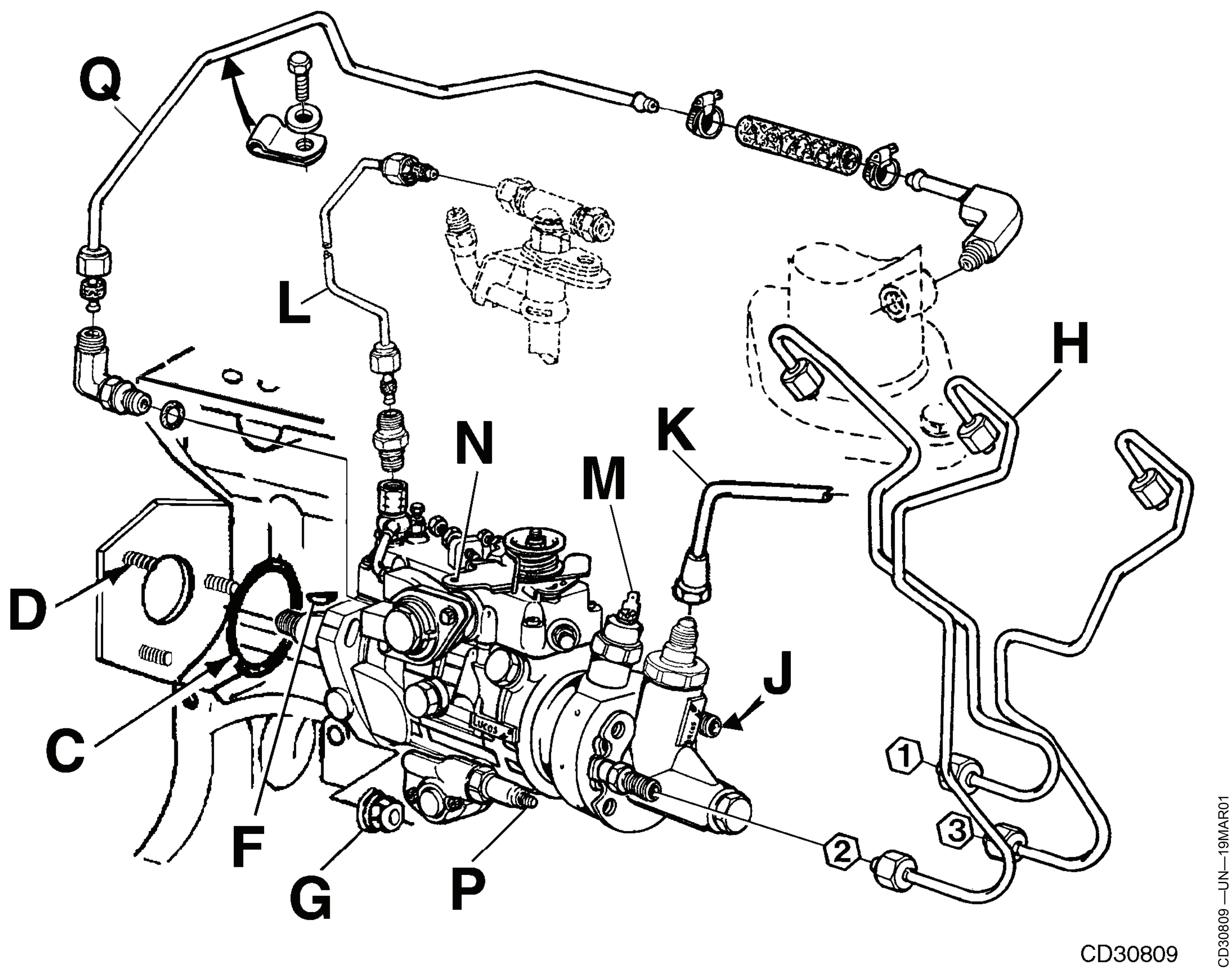
Repairs to DELPHI/LUCAS Fuel Injection Pump

To comply with the exhaust emission regulations, for which this engine may be certified, the repair or adjustment of the injection pump can be only performed by an Authorized Delphi/Lucas workshop.

Only complete injection pump is available for service. When injection pump need to be replaced, perform a dynamic timing during installation on engine.

CD03523,0000110 -19-05FEB01-1/1

Install DELPHI/LUCAS Fuel Injection Pump



A—Timing mark on front plate
B—Timing mark on fuel injection pump flange
C—O-ring or packing
D—Stud
E—Driver gear nut
F—Shaft key
G—Nut
H—High pressure fuel line
J—High pressure outlet connection to no. 1 cylinder
K—Fuel supply line
L—Fuel return line
M—Fuel shut-off terminal
N—Throttle lever
P—Cold start advance system
Q—Aneroid line

1. Using a new O-ring (C), slide housing onto the three studs (D), inserting shaft in drive gear.

NOTE: Make sure that the Woodruff key (F) is seated properly.

2. Screw the three nuts (G) onto studs and hand-tighten at this stage.

Continued on next page

CD05019,0000080 -19-18APR12-1/2

3. Push drive gear firmly onto shaft taper. Install washer and nut (E) then tighten to specification. Install injection pump drive gear nut access plug onto timing gear cover, using a new O-ring, if needed. Tighten to specifications

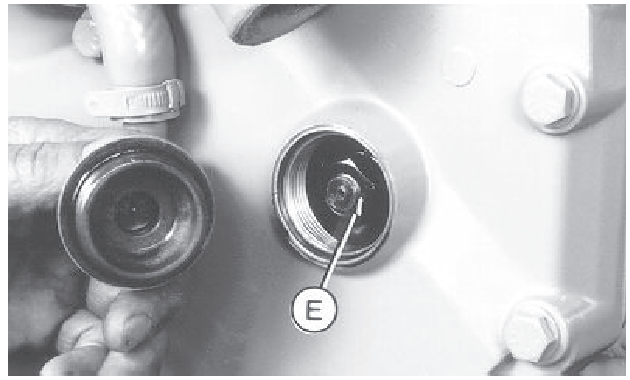
4. Align timing mark on pump flange (B) with timing mark on front plate (A) then tighten nuts (G) to specification.

NOTE: In case of replacement of injection pump, install injection pump with studs in middle of flange slots. Then perform a dynamic timing.

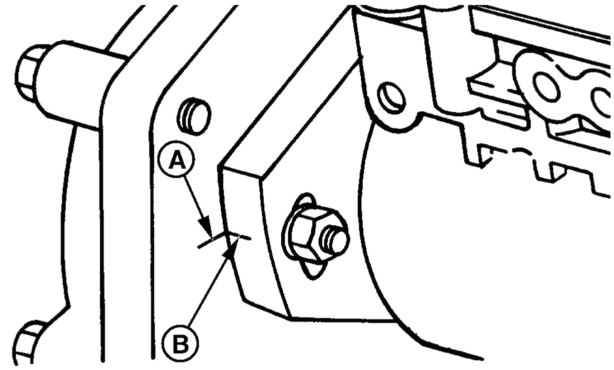
5. Connect injection line No. 1 (H) to outlet (J) and continue counter-clockwise with injection line No. 2. Using JDF22 socket and a backup wrench, tighten to specification.

6. Connect and tighten to specification:

- fuel supply line (K).
- fuel return line (L).
- shut-off system (M) and speed control linkage (N).
- Aneroid line (Q), when equipped.
- cold start advance system (P), when equipped (See "Cold Start Advance System Operation").



CD30671 —UN—20MAY98



RG6293 —UN—03NOV97

DELPHI/LUCAS Fuel Injection Pump—Specification

Drive gear nut—Torque	80 N·m (60 lb.-ft.)
Injection Pump Drive Gear Nut Access Plug—Composite Material Plug	30 N·m (22 lb.-ft.)
Steel Plug	70 N·m (52 lb.-ft.)
Fuel injection line-to-Injection pump—Torque	30 N·m (23 lb.-ft.)
Fuel injection pump-to-front plate, nut—Torque	25 N·m (18 lb.-ft.)
Fuel supply line-to-Injection pump—Torque	30 N·m (23 lb.-ft.)
Fuel return line-to-Injection pump—Torque	15 N·m (11 lb.-ft.)
Engine firing order—3 Cyl	1-2-3

CD05019,0000080 -19-18APR12-2/2

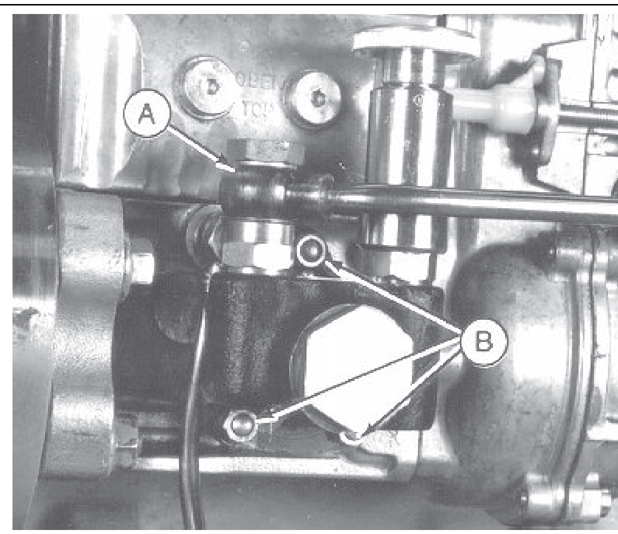
Remove Fuel Supply Pump (MICO - BOSCH in-Line Injection Pump)

Thoroughly clean exterior of supply pump. Also clean around supply pump mounting area on injection pump housing.

1. Disconnect fuel inlet line (removed on picture) and outlet line (A). Cap all line openings so contaminates do not enter fuel system.

2. Remove mounting nuts (B).

3. Pull fuel supply pump straight out from injection pump housing. Cover supply pump mounting bore so debris cannot enter injection pump.



CD30726 —UN—23FEB99

Remove MICO - BOSCH fuel supply pump

CD03523,0000135 -19-21JUN12-1/1

Test Fuel Supply Pump (MICO - BOSCH in-Line Injection Pump)

1. Connect compressed air line (A) to a pressure gauge (B) and to supply inlet fitting. Air line should have a regulating valve to control pressure.
2. Cap or plug supply pump outlet fitting (C).
3. Submerge supply pump in a container of clean diesel fuel. Regulate air pressure to 200 kPa (2 bar; 29 psi).
4. Move tappet in and out by hand. No air bubbles should appear around tappet.

IMPORTANT: Serious injection pump or engine damage could occur, if enough diesel fuel leaks past tappet and seal. Fuel leakage past tappet dilutes engine oil.

NOTE: If bubbles appear, it is an indication that either the seal is defective or tappet is worn.

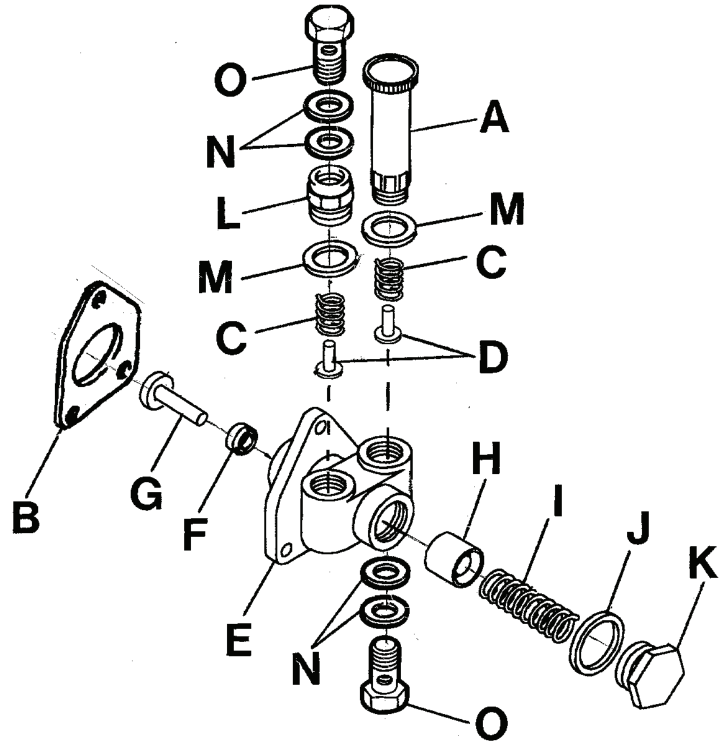
A—Air line
B—Pressure gauge
C—Supply pump outlet fitting

RG5894 —UN—03NOV97

Test MICO - BOSCH fuel supply pump

CD03523,0000136 -19-21JUN12-1/1

Disassemble Fuel Supply Pump (MICO - BOSCH in-Line Injection Pump)



CD30727 —UN—24FEB99

A—Hand primer
B—Gasket
C—Spring (2 used)
D—Valve (2 used)
E—Pump housing
F—Tappet seal
G—Tappet
H—Plunger
I— Spring
J— Seal washer
K—Plug
L—Fitting
M—Seal washer (2 used)
N—Copper washer (4 used)
O—Banjo screw (2 used)

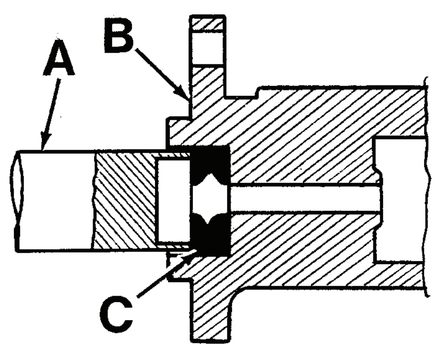
Check parts for excessive wear. If necessary, replace complete supply pump or individual parts when available.

CD03523,0000137 -19-21JUN12-1/1

Assemble Fuel Supply Pump (MICO - BOSCH in-Line Injection Pump)

IMPORTANT: Hands should be wet with diesel fuel when assembling internal components of fuel supply pump.

1. Install new seal (C) into pump housing (B) using JDF15 Driver (A). Be sure seal is started straight in housing bore and drive until driver contacts housing.
2. To assemble supply pump, reverse disassembly procedure using new seal washers.

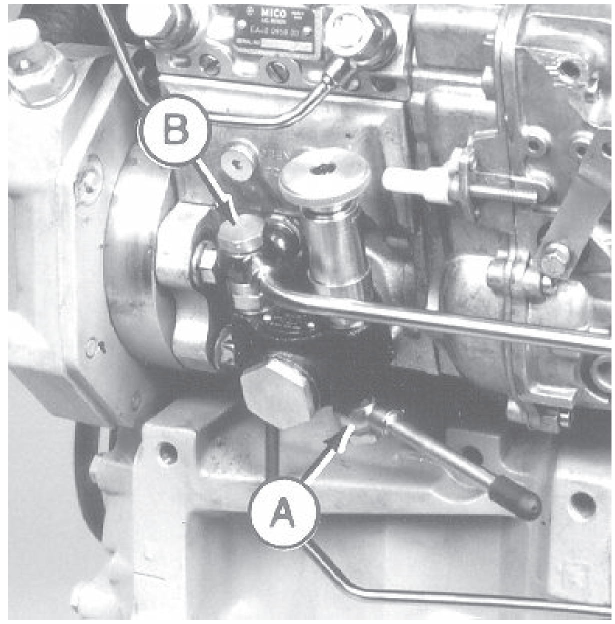


CD30728 —UN—22FEB99

A—JDF15 Driver
B—Pump housing
C—Seal

CD03523,0000138 -19-21JUN12-1/1

Install Fuel Supply Pump (MICO - BOSCH in-Line Injection Pump)



CD30729 —UN—23FEB99

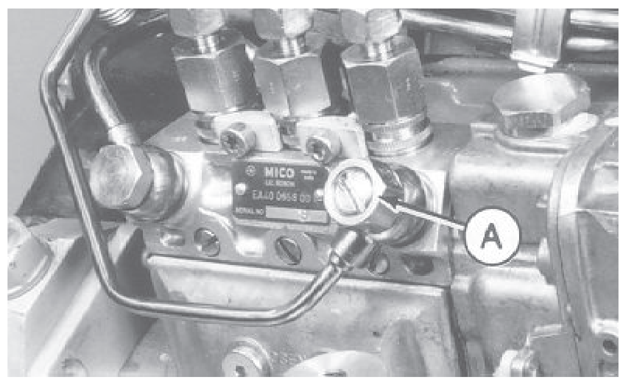
1. Install a new gasket on injection pump flange.
2. Position pump over mounting studs. Tighten nuts to specification.
3. Install fuel inlet (A) and outlet (B) lines. Tighten banjo screws to specification.
4. Bleed fuel system.

MICO - BOSCH Fuel supply pump—Specification

Supply pump-to-Injection pump, nuts—Torque...5—7 N·m (4—5 lb.-ft.)
Fuel inlet and outlet line, banjo—Torque.. 25 N·m (18 lb.-ft.)

CD03523,0000139 -19-21JUN12-1/1

Service Injection Pump Overflow Valve (MICO - BOSCH in-Line Injection Pump)

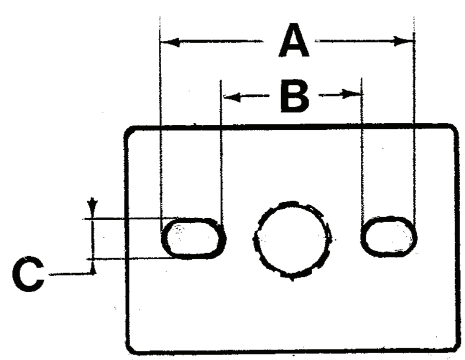


CD30730 —UN—23FEB99

The overflow valve (A) cannot be adjusted. Replace valve in case of leakage or bad operation.

CD03523,000013A -19-06SEP04-1/1

Modification of JDG670A



CD30732 —UN—22FEB99

JDG670A[1] special tool can be used to remove the MICO - BOSCH in-line injection pump when modified as indicated.

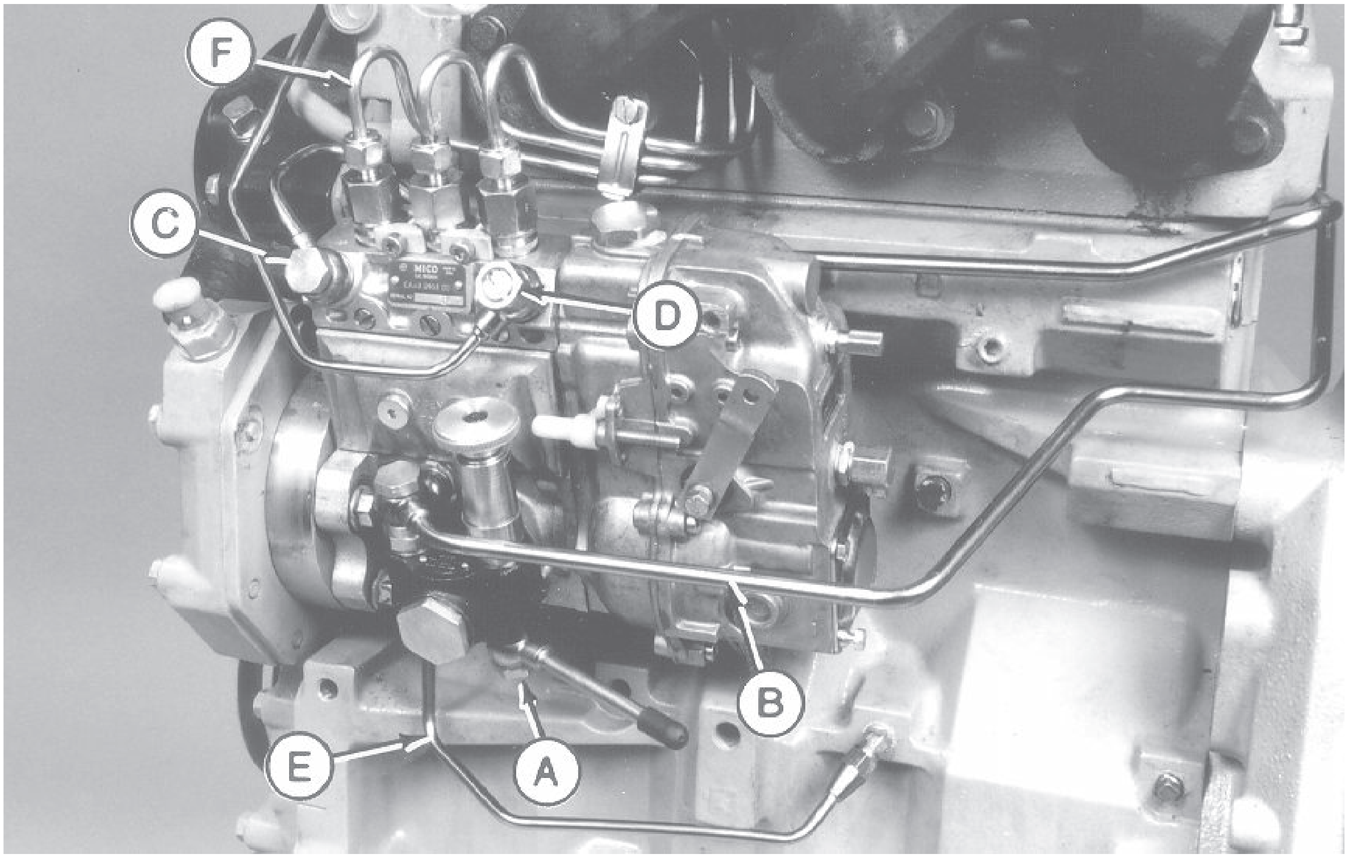
NOTE: JDG1560 Puller can be used without modification.

A—40 mm (1.57 in.)
B—23 mm (0.90 in.)
C—7 mm (0.27 in.)

[1] *JDG670A is no longer available. Order JDG1560.*

CD03523,000013B -19-24SEP04-1/1

Remove MICO - BOSCH in-Line Fuel Injection Pump



IMPORTANT: Never steam clean or pour cold water on a running or warm fuel injection pump. Seizure of internal components can occur.

1. Clean fuel injection pump, lines and area around pump with cleaning solvent or a steam cleaner.
2. Check for the presence of timing marks on front plate, spacer and injection pump flange. If necessary, mark parts before removal.

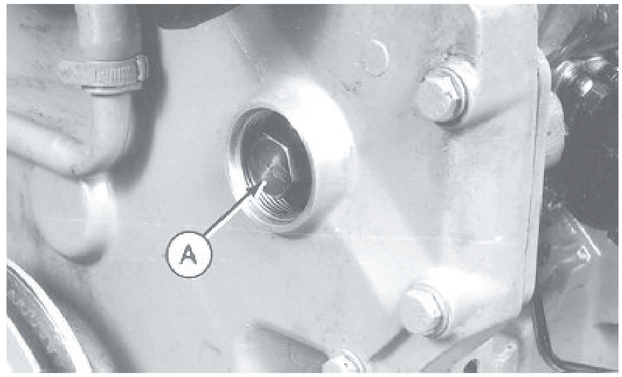
IMPORTANT: Always use a backup wrench when loosening or tightening fuel injection lines at injection pump to prevent rotation of the discharge fitting.

3. Disconnect the following elements:
   - Shut-off system and speed control linkage
   - Fuel inlet line (A) on supply pump
   - Fuel outlet line (B) on supply pump
   - Fuel supply line (C) on injection pump
   - Fuel return line (D)
   - Oil supply line (E)
   - Fuel injection lines (F)
4. Plug all open connections on pump and fuel lines. Do not use fibrous material.

Continued on next page CD03523,000013C -19-17NOV04-1/3

5. Remove plug from mounting hole in timing gear cover.
6. Remove special nut (A) securing the fuel injection pump drive gear to pump shaft.
7. Loosen the four nuts holding fuel injection pump to engine front plate.

NOTE: KJD10213 special wrench can be used for nuts that cannot be accessed easily.



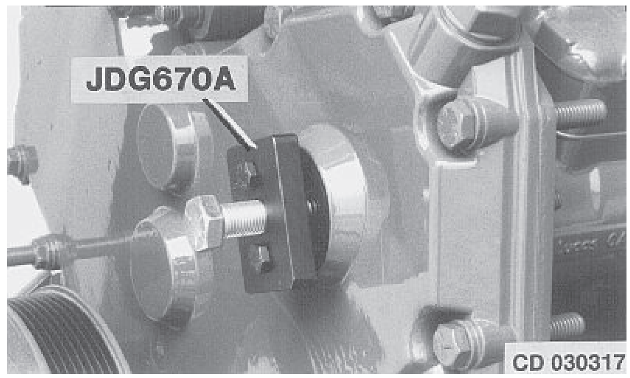
CD30731 —UN—23FEB99

CD03523,000013C -19-17NOV04-2/3

8. Attach special tool JDG1560 (or JDG670A[1] modified), to gear. Remove the three nuts holding fuel injection pump to engine front plate.
9. Turn forcing screw of special tool clockwise until pump shaft is loosened from conical seat of drive gear.
10. Remove center forcing screw from pulling tool and tighten the two screws of the tool until gear is pulled against cover. This will avoid that gear becomes disengaged from upper idler gear.
11. Remove nuts from studs and pull fuel injection pump backward. Remove spacer and O-ring.

NOTE: When removing fuel injection pump, be careful not to lose the shaft key.

[1]JDG670A is no longer available. Order JDG1560.



Special Tool JDG670A shown

CD30317 —UN—17FEB95

CD03523,000013C -19-17NOV04-3/3

Repair MICO - BOSCH in-Line Fuel Injection Pump

IMPORTANT: Do not disassemble fuel injection pump further than necessary for installing available service parts, not even for cleaning.

Be sure that injection pump serial number tag is in place and that all identification numbers are legible so that pump is set to the correct specifications for its intended use.

For injection pump repair and testing, have an authorized diesel injection repair station perform the work. Unauthorized repairs made to the injection pump will void warranty.

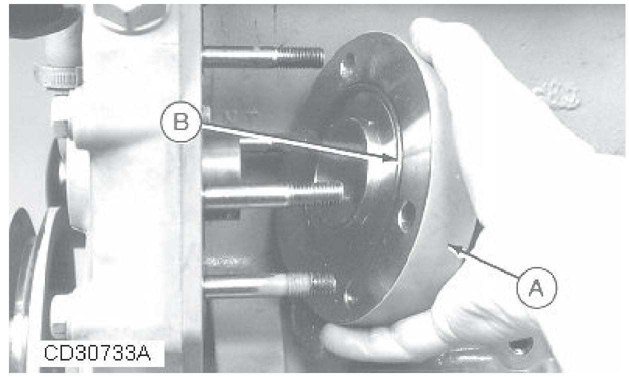
CD03523,000013D -19-07SEP04-1/1

Install MICO - BOSCH in-Line Fuel Injection Pump

NOTE: Before installation, ensure that the injection pump has no engine in the housing. This will allow to fill injection pump with the proper oil quality and quantity.

1. Slide spacer (A) with O-ring (B) over the four studs. Align timing marks.
2. Slide injection pump over studs, inserting shaft in drive gear.

NOTE: Make sure that the shaft key is seated properly.



CD30733A —UN—27SEP04

Install MICO - BOSCH fuel injection pump - Spacer

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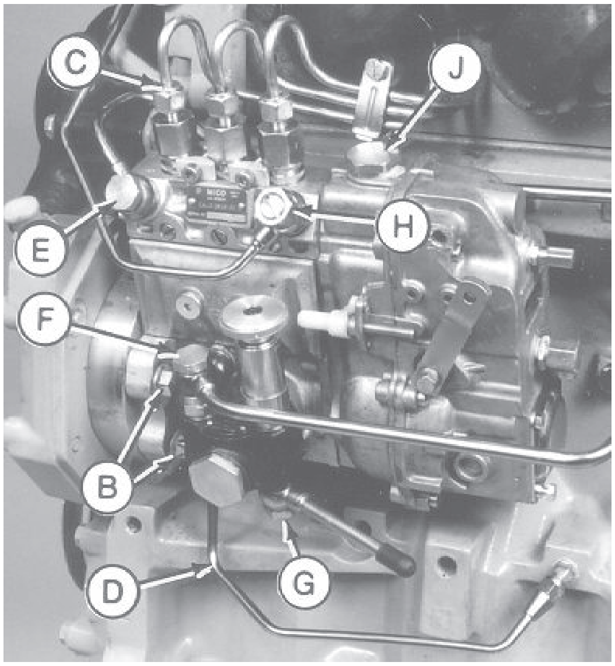
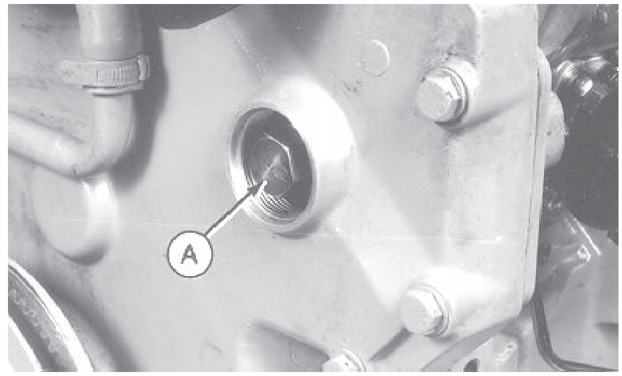
CD05019,0000081 -19-18APR12-1/2



CD30734 —UN—23FEB99



CD30731 —UN—23FEB99

A—Drive gear nut
B—Nut
C—Injection line
D—Oil supply line
E—Fuel supply line
F—Fuel outlet line
G—Fuel inlet line
H—Fuel return line
J—Oil fill plug

3. Screw the four nuts (B) onto studs and hand-tighten at this stage.
4. Push drive gear firmly onto shaft taper. Install special nut (A) then tighten as specified. Install injection pump drive gear nut access plug onto timing gear cover, using a new O-ring, if needed. Tighten to specifications.

NOTE: In case of replacement of injection pump, install injection pump with studs in middle of flange slots. Then perform a dynamic timing.

5. Align timing marks on pump flange, spacer and front plate then tighten nuts (B) to specification.

NOTE: KJD10213 special wrench can be used for nuts that cannot be accessed easily.

6. Connect injection lines. Commence with line No.1 (C) and continue in same order as engine firing (1-2-3). Tighten to specification.

IMPORTANT: DO NOT move delivery valve fittings while tightening line nuts, injection pump delivery will be altered. The injection pump will have to be re-calibrated on a test stand by an authorized diesel injection pump repair station.

Connect:
- Oil supply line (D). Tighten banjo screw to specification.
- Fuel supply line (E) on injection pump. Tighten banjo screw to specification.
- Fuel outlet line (F) on supply pump. Tighten banjo screw to specification.
- Fuel inlet line (G) on supply pump. Tighten banjo screw to specification.
- Fuel return line (H) on injection pump. Tighten banjo screw to specification.
- Shut-off system and speed control linkage.

7. Remove oil fill plug (J) from governor housing and add clean engine oil as specified.

MICO - BOSCH In-Line fuel injection pump—Specification

Drive gear, special nut—Torque	85 N·m (62 lb.-ft.)
Injection Pump Drive Gear Nut Access Plug—Composite Material Plug	30 N·m (22 lb.-ft.)
Steel Plug	70 N·m (52 lb.-ft.)
Pump-to-front plate, nuts—Torque	50 N·m (35 lb.-ft.)
Injection line—Torque	25 N·m (18 lb.-ft.)
Oil supply line—Torque	15 N·m (11 lb.-ft.)
Fuel supply line—Torque	25 N·m (18 lb.-ft.)
Fuel outlet line—Torque	25 N·m (18 lb.-ft.)
Fuel inlet line—Torque	25 N·m (18 lb.-ft.)
Fuel return line—Torque	25 N·m (18 lb.-ft.)
Oil—Quantity	300 ml (10.14 oz)

CD05019,0000081 -19-18APR12-2/2

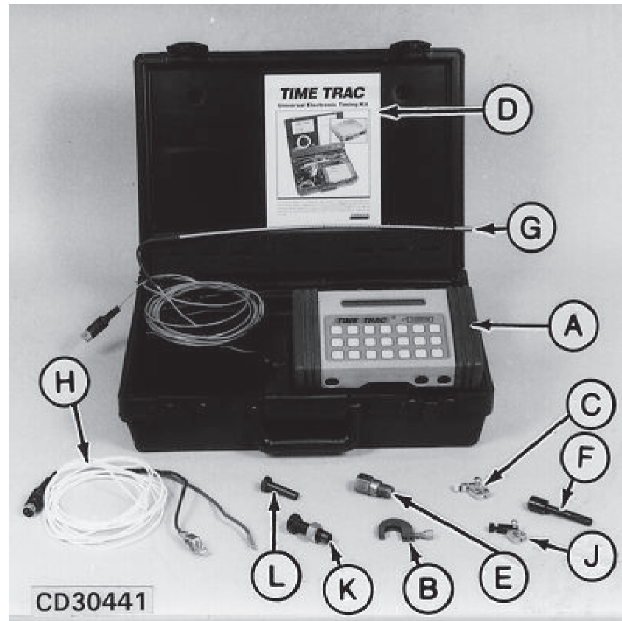
Check and Adjust Rotary Injection Pump Dynamic Timing Using TIME TRAC®

NOTE: JT07158 (or FKM10429A) TIME TRAC kit and related spare parts are no longer available. To check and adjust dynamic timing, order now JDG10534 TACH-N-TIME kit.

The JT07158 (or FKM10429A) TIME TRAC Kit electronically indicates start of injection with respect to piston top dead center (TDC), and allows accurate setting of injection pump timing to provide optimum power, smoke, and exhaust emissions.

Timing engines with this timing kit improves consistency between engines and helps to control cylinder firing pressures, which can be a factor in head gasket failures as well as improve overall engine performance efficiencies.

A—Meter
B—Sensor clamp
C—6 mm clamp-on transducer
D—Instruction manual
E—Timing sensor
F—Timing pin
G—Magnetic probe
H—Transducer cable
J—1/4" clamp-on transducer
K—Magnetic pick-up adapter for tapped timing hole
L—Magnetic pick up adapter for smooth timing hole



CD30441 —UN—10MAY96

TIME TRAC kit

TIME TRAC is a registered trademark of Stanadyne Automotive Corp.

CD03523,00001C9 -19-23JUL13-1/9

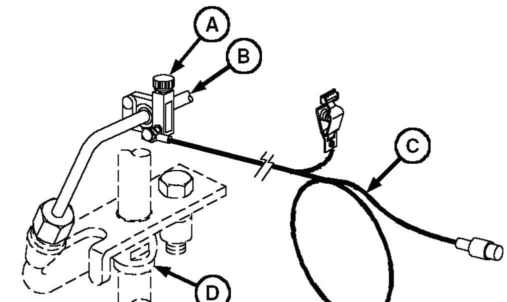
Install JT07158 (or FKM10429A) TIME TRAC Kit:

IMPORTANT: Transducer or timing sensor must be installed at nozzle end of No. 1 fuel injection line.

Remove all paint from injection line where clamp-on transducer will be installed and be sure this location is thoroughly clean.

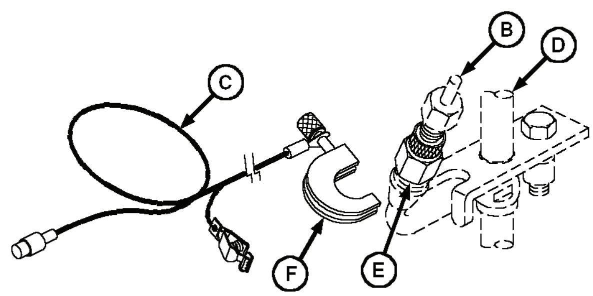
1. On engines with optional timing sensor (E) installed between injection nozzle and fuel delivery line, install sensor clamp (F) onto clean sensor and tighten securely.
2. On engines without optional timing sensor, install the 6 mm (green) clamp-on transducer (A) onto clean, paint-free injection line and tighten securely.
3. Assemble red lead of transducer cable (C) onto in-line sensor or transducer, however equipped.
4. Attach spring clip to a solid ground. Plug connector into meter port marked SR.

A—6 mm (Green) Clamp-On Transducer
B—Fuel Injection Delivery Line
C—Transducer Cable
D—No. 1 Injector
E—Timing Sensor
F—Sensor Clamp



RG10725 —UN—20APR00

Transducer



RG10724 —UN—20APR00

Timing Sensor

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CD03523,00001C9 -19-23JUL13-2/9

IMPORTANT: Use JDG1571 (or JDG81-4) timing pin (A) in flywheel housing timing hole (B) to ensure engine is NOT stopped at TOP DEAD CENTER. Failing this, flywheel timing hole will damage the magnetic pick up (D) when engine is started.

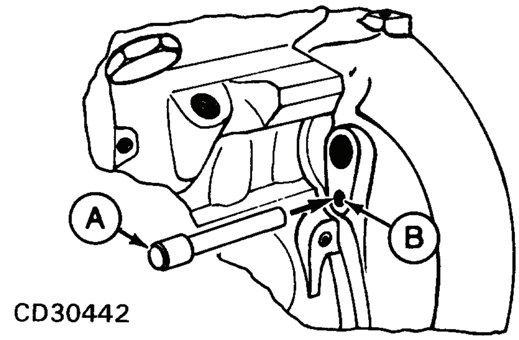
5. Install magnetic pick-up adapter as follows:

   a. On flywheel housing with tapped timing hole, install JDG793 Threaded Magnetic Pick-Up Adapter (C) into timing hole (B) until it bottoms. Insert probe of magnetic pick-up (D) into adapter until it contacts flywheel. Back out hex head of adapter two flats and tighten lock nut; this will provide recommended air gap.

   b. On flywheel housing with smooth timing hole, install JDG821 Tapered Magnetic Pick-Up Adapter (F) into timing hole (B). Lightly tap adapter to lock into position. Insert probe magnetic pick-up (D) into adapter until it contacts the flywheel. Pull probe back out to provide 0.64 mm (0.025 in.) gap.

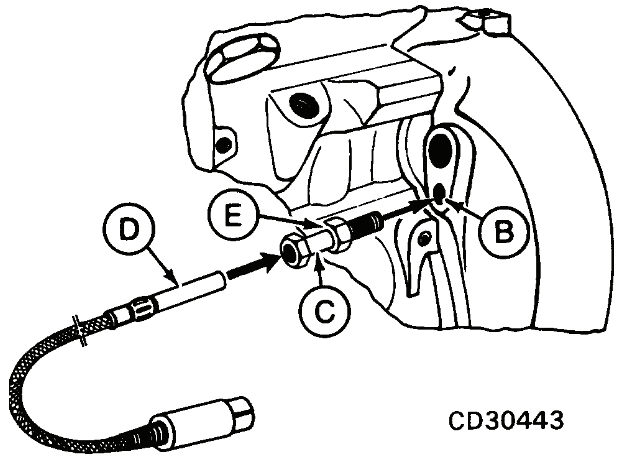
6. Plug magnetic pick-up connector into meter port marked MP.

A—Timing pin
B—Flywheel housing timing hole
C—JDG793 Threaded magnetic pick-up adapter
D—Magnetic pick-up
E—Nut
F—JDG821 Tapered magnetic pick-up adapter



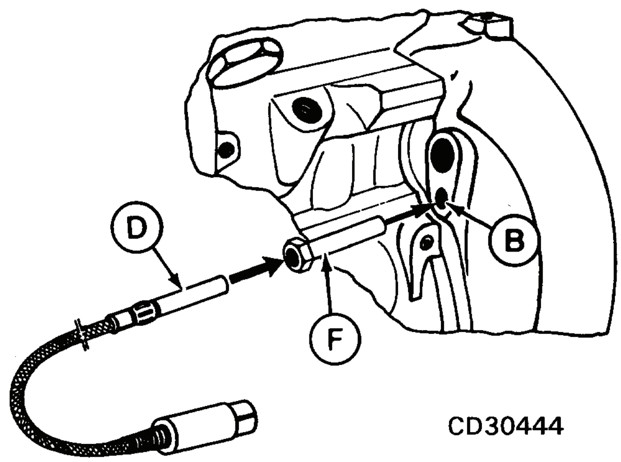
CD30442 —UN—10MAY96

Timing pin and timing hole



CD30443 —UN—10MAY96

Threaded magnetic pick-up adapter



CD30444 —UN—10MAY96

Smooth magnetic pick-up adapter

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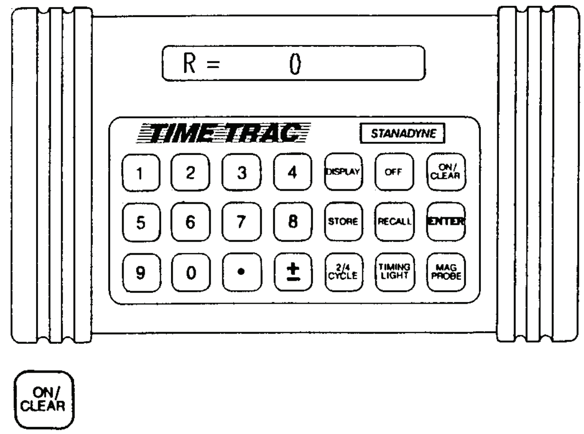
CD03523,00001C9 -19-23JUL13-3/9

Check Rotary Injection Pump Rated Load Dynamic Timing:

1. Engine OFF. Push ON/CLEAR button.

   Display shows: R=0



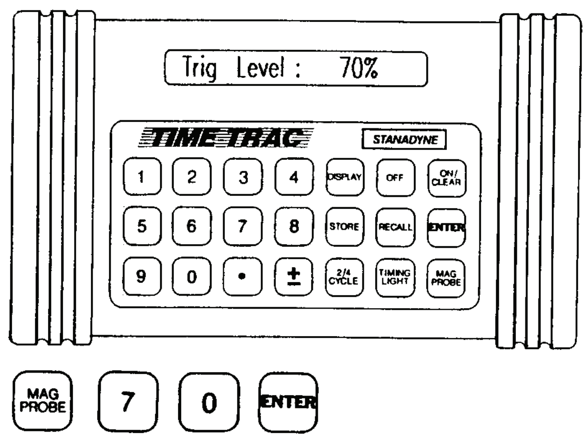
TIME TRAC®Display Shows R=0

TIME TRAC is a registered trademark of Stanadyne Automotive Corp.

CD03523,00001C9 -19-23JUL13-4/9

2. Push MAG PROBE button.

   Display shows: Trig Level: 30%
3. Change to 70% and push ENTER.



TIME TRAC®Display Shows Trig Level: 70%

TIME TRAC is a registered trademark of Stanadyne Automotive Corp.

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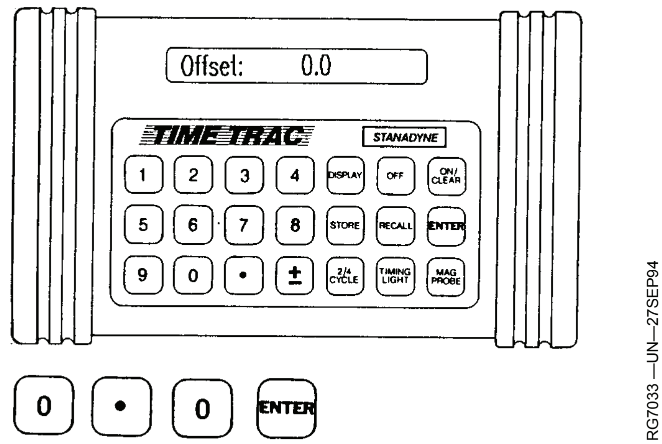
CD03523,00001C9 -19-23JUL13-5/9

4. Display shows: Offset: 20.0°

   Change to offset 0° and push ENTER.



TIME TRAC®Display Shows Offset: 0.0

TIME TRAC is a registered trademark of Stanadyne Automotive Corp.

CD03523,00001C9 -19-23JUL13-6/9

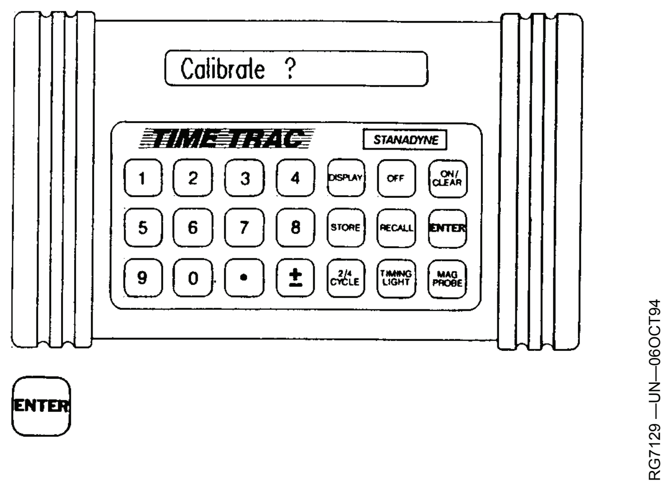
5. Display shows: Calibrate?

   Start engine and push ENTER.

6. Run engine at 1300 rpm. Push ENTER. Display shows: Calibrating then Engine rpm and timing.

NOTE: If display shows NO PROBE, the magnetic pick-up probe has not been installed properly [air gap exceeds 0.64 mm (0.025 in.)] or there is debris on the back of the flywheel. Check for proper air gap or clean the back side of the flywheel by inserting a soft wooden dowel into the engine timing pin hole with the engine running at low idle speed.

7. Warm engine to normal operating temperature; check slow and fast idle rpm. (See Specifications). Adjust speeds as necessary.



TIME TRAC®Display Shows Calibrate ?

TIME TRAC is a registered trademark of Stanadyne Automotive Corp.

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CD03523,00001C9 -19-23JUL13-7/9

IMPORTANT: Many machines have hydraulic pumps that have adequate flow to load engine well below rated load rpm. Some equipment may need to be driven in high gear or pull a load to bring engine speed to rated load rpm.

8. Run engine at wide open throttle (WOT) and load engine down gradually to rated speed rpm.
9. Record engine speed (rpm) and timing degrees.
10. Compare recorded speeds and timing degrees with specifcations.

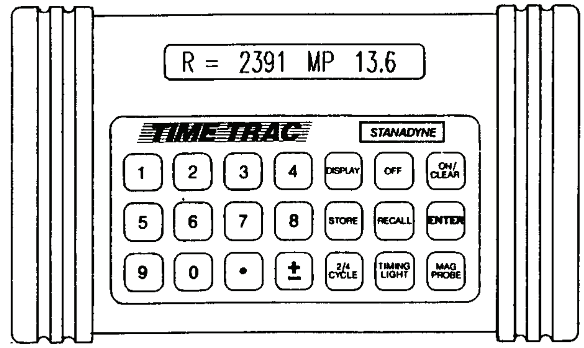
IMPORTANT: Stop engine prior to making timing adjustments. Injection pump can seize if adjustment is made with engine running.

11. Stop engine.

If dynamic timing reading is more than 8 degrees retarded with pump flange and front plate timing marks at original location as shipped from factory, this may indicate the pump advance is not functioning. Check the following:

- Change fuel filter(s).

TIME TRAC is a registered trademark of Stanadyne Automotive Corp.



RG7037 —UN—27SEP94

TIME TRAC®Display Shows R=? MP=?

- Check transfer pump for positive fuel pressure to injection pump.
- Check camshaft movement on injection pumps with rectangular timing window.
- Check pump drive shaft-to-gear key or pin to ensure key or pin has not sheared.
- If none of the above checks are conclusive, remove pump and have necessary repairs made at an authorized diesel repair station.

CD03523,00001C9 -19-23JUL13-8/9

Adjust Rotary Injection Pump Dynamic Timing:

1. Loosen injection pump mounting flange nuts and adjust pump timing.

   To advance pump timing, rotate top of pump clockwise, viewed from rear (flywheel end) of engine. To retard timing, rotate top of pump counterclockwise. Pump flange movement of 1.5 mm (0.060 in.) is equivalent to 2 degrees of engine timing.

2. Tighten injection pump mounting flange nuts to specifications.

Specification

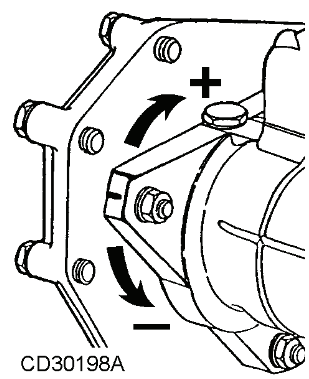
Rotary Injection Pump	
Mounting Nuts—Torque	27 N·m (20 lb.-ft.)

3. Start engine and check injection pump dynamic timing again. Adjust timing as needed.
4. After all adjustments are made and engine is performing to specification, perform the following:

   a. Grind away the original timing mark (A) on front plate.

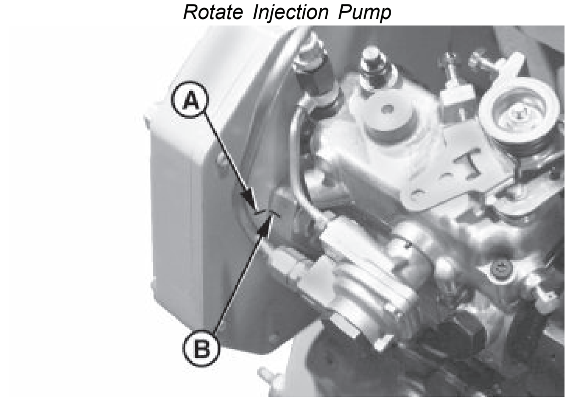
   b. Stamp a new timing mark (A) on front plate, aligned with timing mark (B) on injection pump flange.

A—Front Plate Timing Mark **B—Pump Timing Mark**



CD30198A —UN—30JAN09

Rotate Injection Pump



RG7723A —UN—07NOV97

Injection Pump Timing Marks

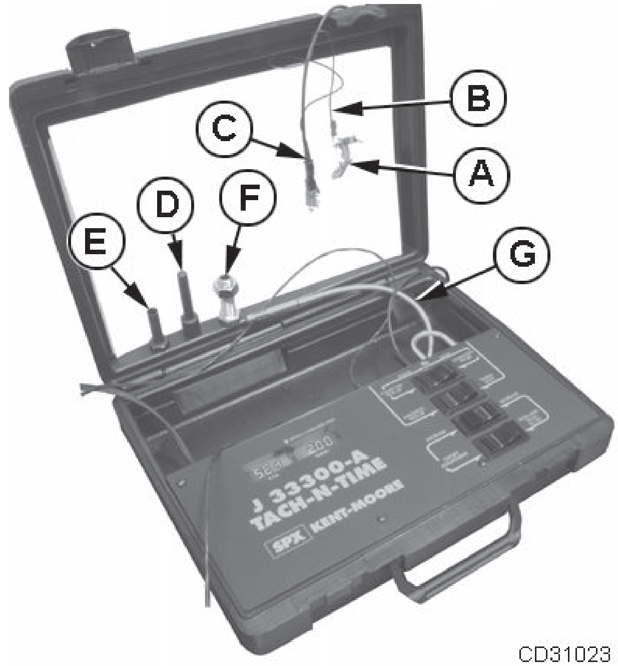
CD03523,00001C9 -19-23JUL13-9/9

Check and Adjust Rotary Injection Pump Dynamic Timing Using TACH-N-TIME™ (JDG10534)

NOTE: JDG10534 TACH-N-TIME Dynamic Timing Tool is no longer available. It is replaced by JDG11411 TACH-N-TIME kit. JDG10534 meter does not allow the dealer to adjust the dynamic timing of the injection pump when the value is close to zero or negative (fuel injected after TDC). For such engines, JDG11411 is required.

The JDG10534 TACH-N-TIME™ Kit electronically indicates start of injection with respect to piston top dead center (TDC), and allows accurate setting of injection pump timing to provide optimum power, smoke, and exhaust emissions.

Timing engines with this timing kit improves consistency between engines and helps to control cylinder firing pressures, which can be a factor in head gasket failures as well as improve overall engine performance efficiencies.



CD31023 —UN—04FEB09

TACH-N-TIME Kit (JDG10534)

A—Clamp-on transducer
B—Transducer cable
C—Ground cable
D—Timing pin
E—Magnetic pick-up adapter for smooth timing hole
F—Magnetic pick-up adapter for tapped timing hole
G—Magnetic pick-up

TACH-N-TIME is a trademark of SPX Corp.

CD03523,00001CA -19-16AUG12-1/6

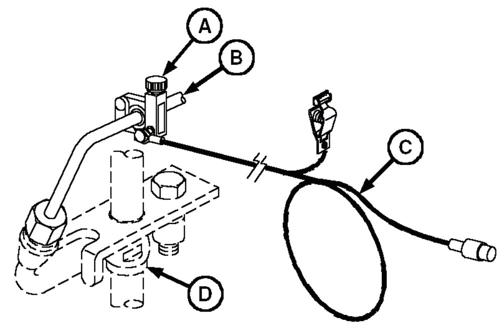
Install JDG10534 TACH-N-TIME Kit:

IMPORTANT: Transducer must be installed at nozzle end of No. 1 fuel injection line.

Remove all paint from injection line where clamp-on transducer will be installed and be sure this location is thoroughly clean.

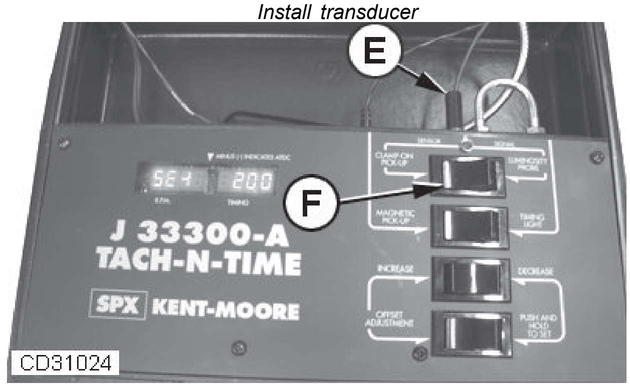
1. Install transducer (A) on high-pressure fuel delivery line (B) close to No. 1 injector (D) and connect spring clip to a solid ground.
2. Connect transducer cable (C) to meter port marked SENSOR SIGNAL (E).
3. Set injection monitoring method switch to the CLAMP-ON PICK-UP position (F).

A—Clamp-on transducer
B—Fuel injection delivery line
C—Transducer cable
D—No. 1 Injector
E—SENSOR SIGNAL port
F—CLAMP-ON PICK-UP position



RG10725 —UN—20APR00

Install transducer



CD31024 —UN—04FEB09

Connect transducer cable

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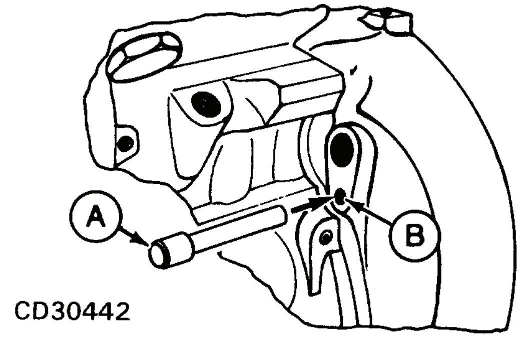
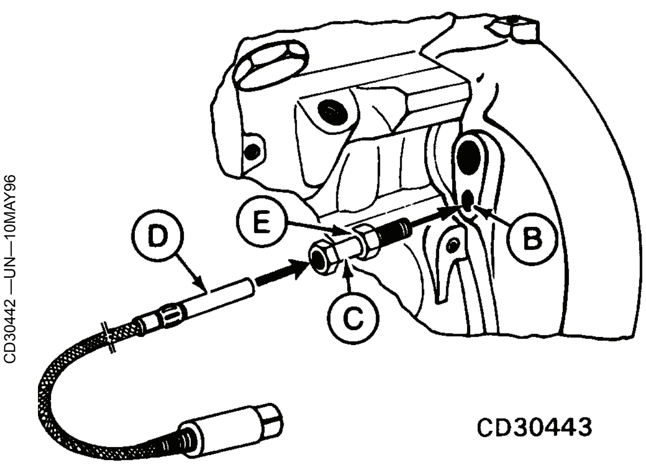
CD03523,00001CA -19-16AUG12-2/6



Timing pin and timing hole

CD30442 —UN—10MAY96



Threaded magnetic pick-up adapter

CD30443 —UN—10MAY96

IMPORTANT: Use JDG1571 (or JDG81-4) timing pin (A) in flywheel housing timing hole (B) to ensure engine is NOT stopped at TOP DEAD CENTER. Failing this, flywheel timing hole will damage the magnetic pick up (D) when engine is started.

4. Install magnetic pick-up adapter as follows:

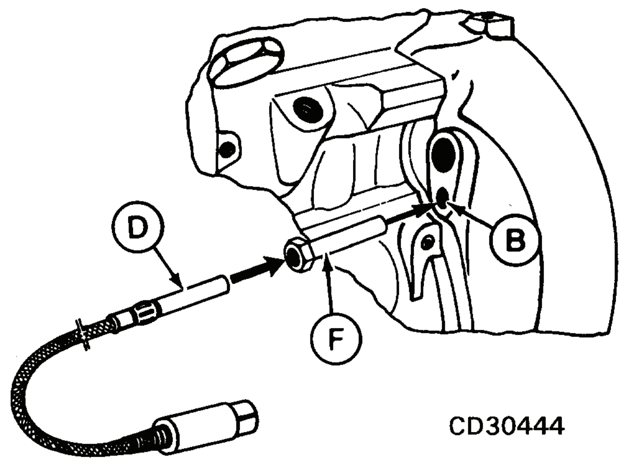
   a. On flywheel housing with tapped timing hole, install JDG793 Threaded Magnetic Pick-Up Adapter (C) into timing hole (B) until it bottoms. Insert probe of magnetic pick-up (D) into adapter until it contacts flywheel. Back out hex head of adapter two flats and tighten lock nut; this will provide recommended air gap.

   b. On flywheel housing with smooth timing hole, install JDG821 Smooth Magnetic Pick-Up Adapter (F) into timing hole (B). Lightly tap adapter to lock into position. Insert probe magnetic pick-up (D) into adapter until it contacts the flywheel. Pull probe back out to provide 0.64 mm (0.025 in.) gap.

5. Plug magnetic pick-up connector into meter port (G).

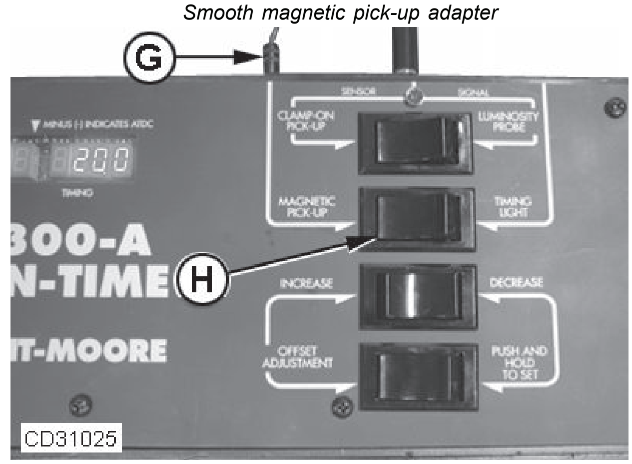
6. Set crankshaft monitoring method switch to MAGNETIC PICK-UP position (H).

A—Timing pin
B—Flywheel housing timing hole
C—Threaded magnetic pick-up adapter
D—Magnetic pick-up
E—Nut
F—Smooth magnetic pick-up adapter
G—Magnetic pick-up port
H—MAGNETIC PICK-UP position



Smooth magnetic pick-up adapter

CD30444 —UN—10MAY96



Connect magnetic pick-up

CD31025 —UN—04FEB09

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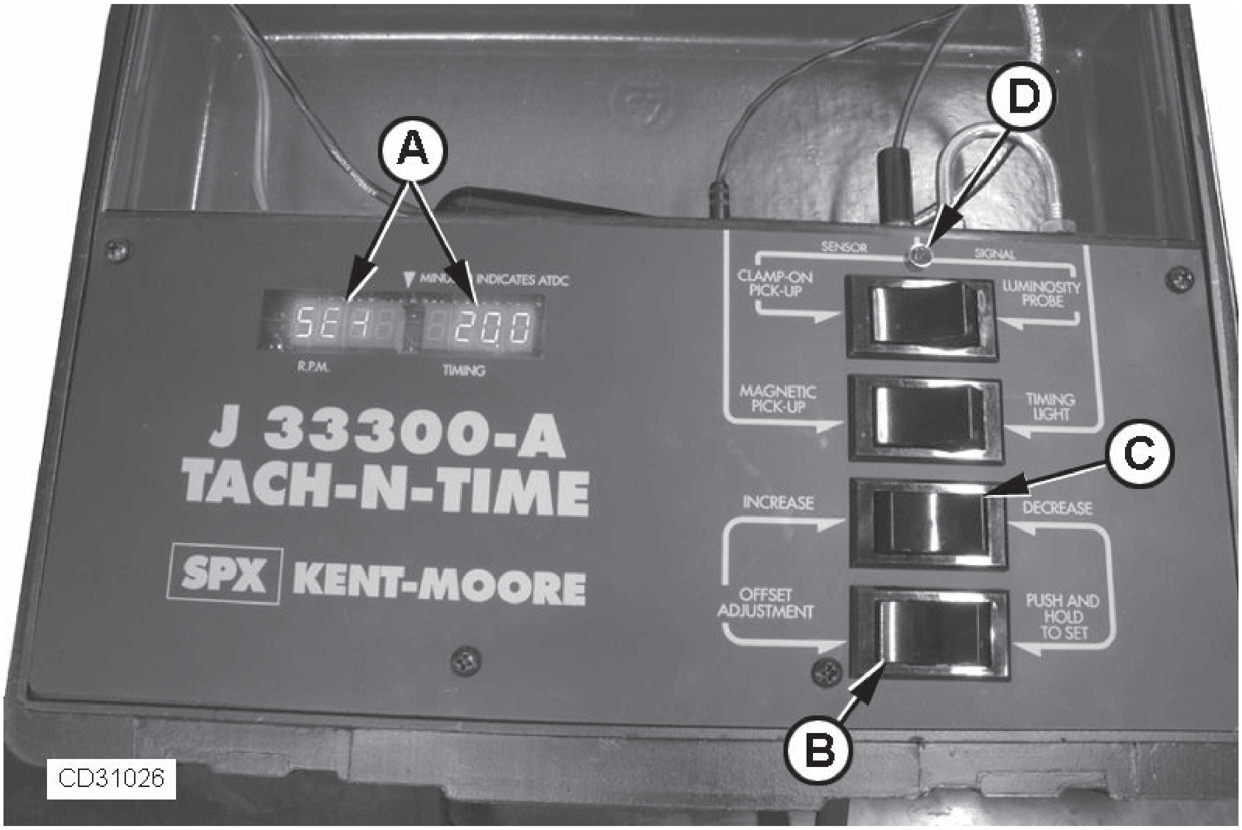
CD03523,00001CA -19-16AUG12-3/6

Check Rotary Injection Pump Rated Load Dynamic Timing:



Connect TACH-N-TIME

A—Display shows SE-1 200
B—Timing OFFSET ADJUSTMENT switch
C—Timing offset INCREASE/DECREASE switch
D—SENSOR SIGNAL light

CAUTION: Do not connect TACH-N-TIME meter to 24 volt systems. Connect directly to the positive and negative terminals of the injection pump itself or other 12 volt system source.

1. Connect the TACH-N-TIME battery leads to a 12 volt power source. Red to positive (+) and black to negative (-).
2. Digital display should light up and display SE-1 200 (A).
3. Set timing offset display angle as follows:
   a. If timing offset display shows 20°, depress and release OFFSET ADJUSTMENT switch (B). Display should now read 0000.......0.0
   b. If timing offset display shows value other than 20°, depress and hold switch (B). While holding down on switch use the INCREASE or DECREASE switch (C) until 0° is displayed. Release switch (B) and display should now read 0000.......0.0.
4. Make sure all cables and wires are clear of fan, belts or any other moving parts. Keep wires away from exhaust manifolds.
5. Start engine. SENSOR SIGNAL light (D) should be blinking steadily, indicating proper clamp-on transducer installation.
6. Warm engine to normal operating temperature; check slow and fast idle rpm (See Specifications). Adjust speeds as necessary.

IMPORTANT: Many machines have hydraulic pumps that have adequate flow to load engine well below rated load rpm. Some equipment may need to be driven in high gear or pull a load to bring engine speed to rated load rpm.

7. Run engine at wide open throttle (WOT) and load engine down gradually to rated speed rpm.
8. Record engine speed (rpm) and timing degrees.

NOTE: Minus (-) on display indicates that timing is after Top Dead Center.

9. Compare recorded speeds and timing degrees with specifications..

Continued on next page
CD03523,00001CA -19-16AUG12-4/6

IMPORTANT: Stop engine prior to making timing adjustments. Injection pump can seize if adjustment is made with engine running.

10. Stop engine.

If dynamic timing reading is more than 8 degrees retarded with pump flange and front plate timing marks at original location as shipped from factory, this may indicate the pump advance is not functioning. Check the following:

- Change fuel filter(s).
- Check transfer pump for positive fuel pressure to injection pump.
- Check camshaft movement on injection pumps with rectangular timing window.
- Check pump drive shaft-to-gear key or pin to ensure key or pin has not sheared.
- If none of the above checks are conclusive, remove pump and have necessary repairs made at an authorized diesel repair station.

CD03523,00001CA -19-16AUG12-5/6

Adjust Rotary Injection Pump Dynamic Timing:

1. Loosen injection pump mounting flange nuts and adjust pump timing.

   To advance pump timing, rotate top of pump clockwise, viewed from rear (flywheel end) of engine. To retard timing, rotate top of pump counterclockwise. Pump flange movement of 1.5 mm (0.060 in.) is equivalent to 2 degrees of engine timing.

2. Tighten injection pump mounting flange nuts to specifications.

Specification

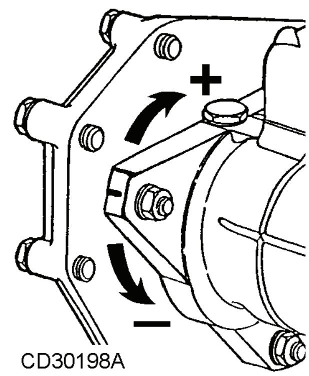
Rotary Injection Pump Mounting Nuts—Torque	27 N·m (20 lb.-ft.)

3. Start engine and check injection pump dynamic timing again. Adjust timing as needed.
4. After all adjustments are made and engine is performing to specification, perform the following:

   a. Grind away the original timing mark (A) on front plate.

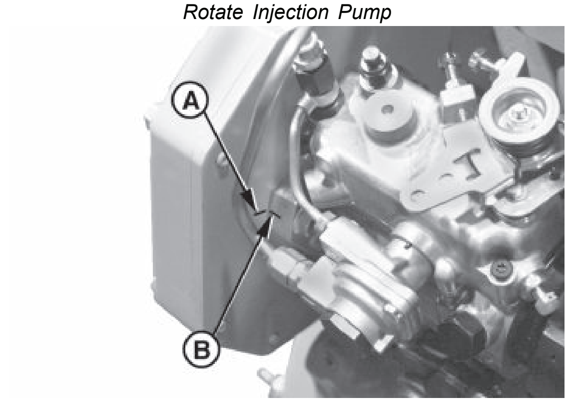
   b. Stamp a new timing mark (A) on front plate, aligned with timing mark (B) on injection pump flange.

A—Front Plate Timing Mark **B—Pump Timing Mark**



Rotate Injection Pump

CD30198A —UN—30JAN09



Injection Pump Timing Marks

RG7723A —UN—07NOV97

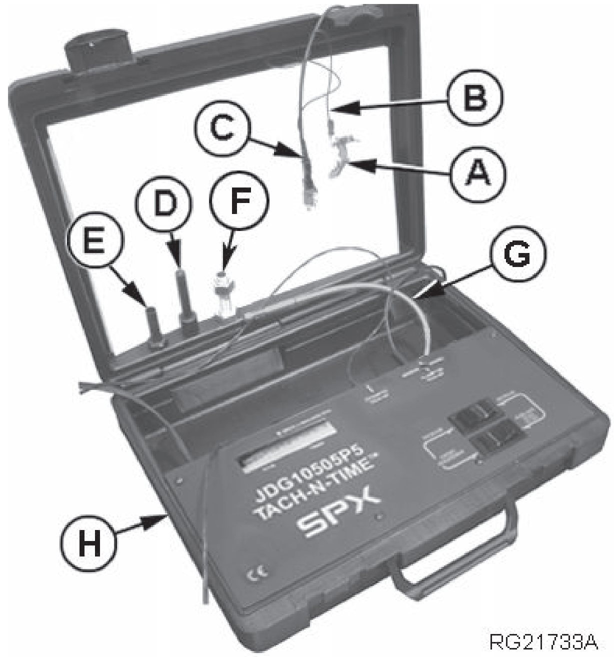
CD03523,00001CA -19-16AUG12-6/6

Check and Adjust Rotary Injection Pump Dynamic Timing Using TACH-N-TIME™ (JDG11411)

The JDG11411 TACH-N-TIME™ Kit electronically indicates start of injection with respect to piston top dead center (TDC), and allows accurate setting of injection pump timing to provide optimum power, smoke, and exhaust emissions.

Timing engines with this timing kit improves consistency between engines and helps to control cylinder firing pressures, which can be a factor in head gasket failures as well as improve overall engine performance efficiencies.

A—Clamp-on Transducer
B—Transducer Cable
C—Ground Cable
D—Timing Pin
E—Smooth Magnetic Pick-up Adapter
F—Threaded Magnetic Pick-up Adapter
G—Magnetic Pick-up
H—Meter



RG21733A —UN—23AUG12

JDG11411 Tach-N-Time Kit

TACH-N-TIME is a trademark of SPX Corp.

CD03523,0000382 -19-23AUG12-1/9

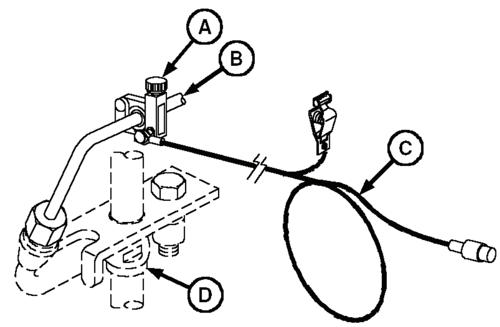
Install JDG11411 TACH-N-TIME Kit:

IMPORTANT: Transducer must be installed at nozzle end of No. 1 fuel injection line.

Remove all paint from injection line where clamp-on transducer will be installed and be sure this location is thoroughly clean.

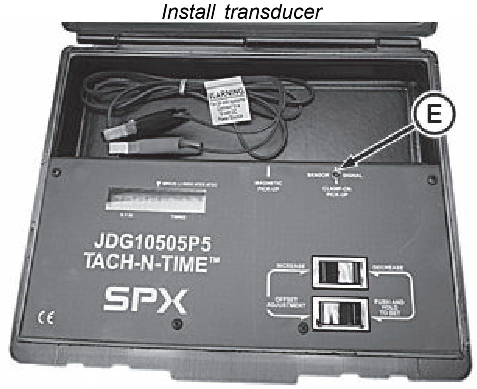
1. Remove paint and thoroughly clean approximately 19 mm (.75 in.) of the No. 1 high-pressure line just above the injection nut to which the clamp-on transducer is to be attached.
2. Select correct size transducer for the engine injection line: .25 in. (black), 5 mm (red) or 6 mm (gray).
3. Install transducer (A) on high-pressure fuel delivery line (B) close to No. 1 injector (D) and connect spring clip to a solid ground.
4. Connect transducer cable (C) to meter port marked SENSOR SIGNAL (E).

A—Clamp-on Transducer
B—Fuel Injection Delivery Line
C—Transducer Cable
D—No. 1 Injector
E—SENSOR SIGNAL Port



RG10725 —UN—20APR00

Install transducer



RG21820 —UN—14AUG12

Connect Transducer Cable to Meter

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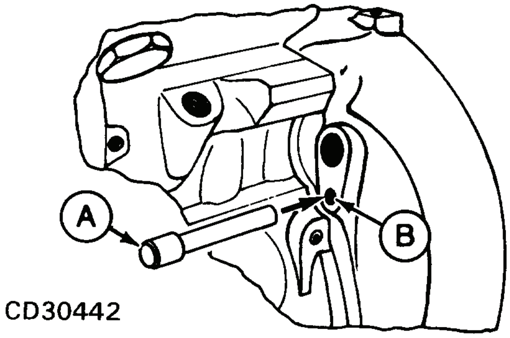
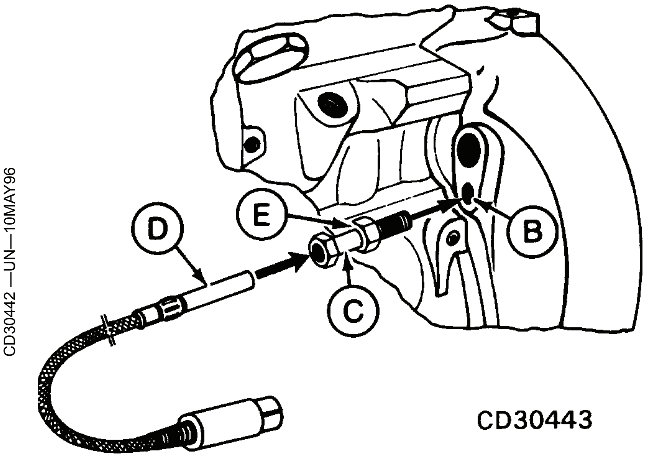
CD03523,0000382 -19-23AUG12-2/9



CD30442 —UN—10MAY96

Timing pin and timing hole



CD30443 —UN—10MAY96

Threaded magnetic pick-up adapter

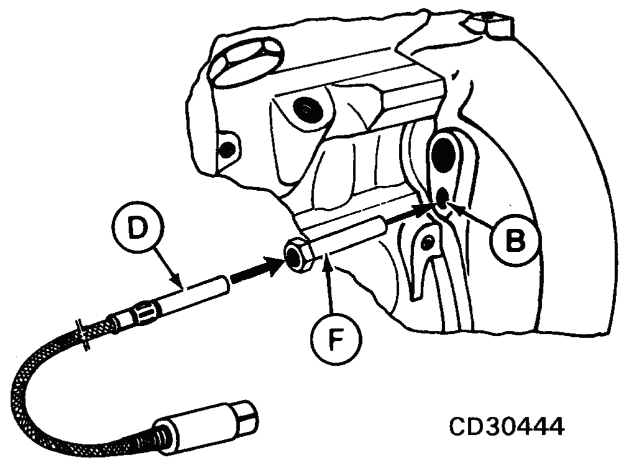
IMPORTANT: Use JDG1571 (or JDG81-4) timing pin (A) in flywheel housing timing hole (B) to ensure engine is NOT stopped at TOP DEAD CENTER. Failing this, flywheel timing hole will damage the magnetic pick up (D) when engine is started.

5. Install magnetic pick-up adapter as follows:

   a. On flywheel housing with tapped timing hole, install JDG793 Threaded Magnetic Pick-Up Adapter (C) into timing hole (B) until it bottoms. Insert probe of magnetic pick-up (D) into adapter until it contacts flywheel. Back out hex head of adapter two flats and tighten lock nut (E); this will provide recommended air gap.

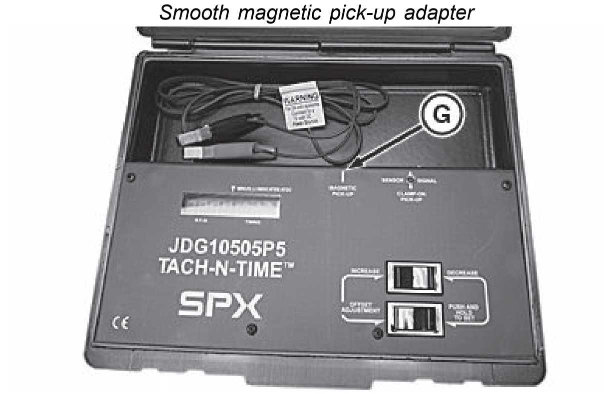
   b. On flywheel housing with smooth timing hole, install JDG821 Smooth Magnetic Pick-Up Adapter (F) into timing hole (B). Lightly tap adapter to lock into position. Insert probe magnetic pick-up (D) into adapter until it contacts the flywheel. Pull probe back out to provide 0.64 mm (0.025 in.) gap.

6. Plug magnetic pick-up connector into meter port (G).



CD30444 —UN—10MAY96

Smooth magnetic pick-up adapter



RG21819 —UN—14AUG12

Connect magnetic pick-up

A—Timing Pin
B—Flywheel Housing Timing Hole
C—Threaded Magnetic Pick-up Adapter
D—Magnetic Pick-up
E—Nut
F—Smooth Magnetic Pick-up Adapter
G—Magnetic Pick-up Port

Continued on next page

CD03523,0000382 -19-23AUG12-3/9

Check Rotary Injection Pump Rated Load Dynamic Timing:

RG21821 —UN—14AUG12

Connect TACH-N-TIME

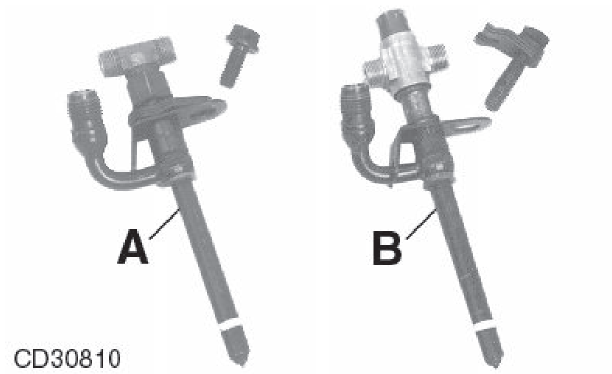
A—Display
B—Timing OFFSET ADJUSTMENT Switch
C—Timing Offset INCREASE/DECREASE Switch
D—SENSOR SIGNAL Light

CAUTION: Do not connect TACH-N-TIME meter to 24 volt systems. Connect directly to the positive and negative terminals of the injection pump itself or other 12 volt system source.

1. Connect the TACH-N-TIME battery leads to a 12 volt power source. Red to positive (+) and black to negative (-).
2. Digital display (A) should light up and display 0000 ... (blinking).

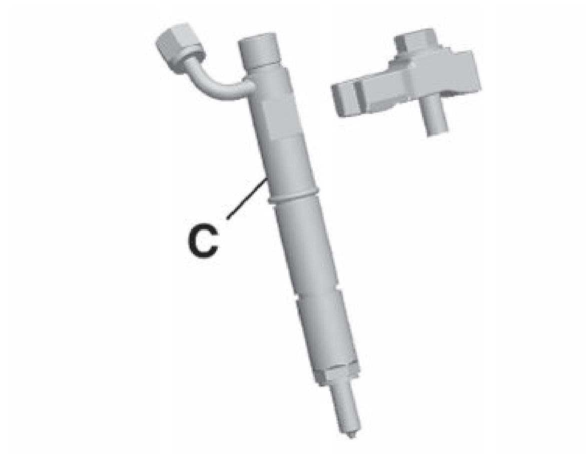
Continued on next page

CD03523,0000382 -19-23AUG12-4/9



CD30810 —UN—17APR01

9 mm Nozzle



RG15528 —UN—11SEP07

17 mm Nozzle

A—Conventional 9.5 mm Nozzle **B—Rate Shaping 9.5 mm Nozzle (RSN)** **C—17 mm Nozzle**

3. Determine timing offset display angle as follows:

   a. Identify engine injection nozzle type. There are three different types of injection nozzles for the 3029 engines.

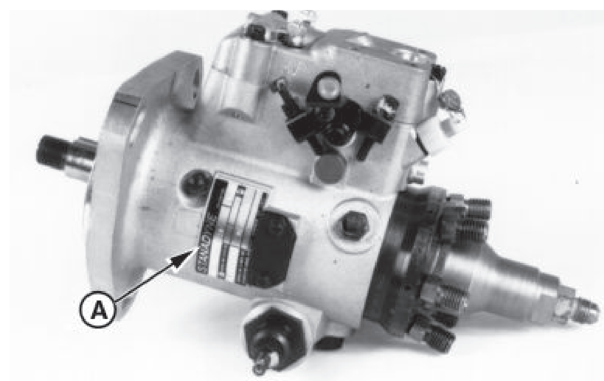
      - Conventional 9.5 mm Nozzle (A)
      - Rate Shaping 9.5 mm Nozzle (B)
      - 17 mm Nozzle (C)

The Rate Shaping Nozzle (RSN) allows engines to comply with Tier 2 exhaust emission regulations. The 17 mm Nozzle allows engines to comply with the most recent exhaust emission regulations.

CD03523,0000382 -19-23AUG12-5/9

   b. Determine the engine full load rated speed. This information is located on the fuel injection pump serial plate (A).

A—Fuel Injection Pump Serial Plate



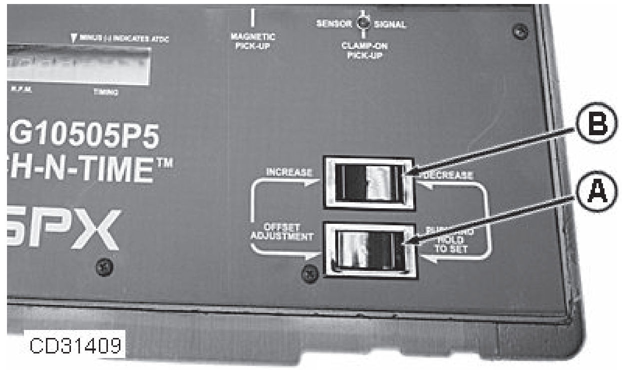
RG5724 —UN—31OCT97

Fuel Injection Pump Serial Plate

Continued on next page

CD03523,0000382 -19-23AUG12-6/9

c. Determine timing offset shown in the timing table based on the injection nozzle type, engine model and engine full load rated speed.
If 0° offset is specified for the engine being tested, depress OFFSET ADJUSTMENT switch (A) and release. RPM/timing display should now read: 0000 .... (blinking).
If other than 0° is specified for the engine being tested, depress and hold OFFSET ADJUSTMENT switch. Operate INCREASE/DECREASE switch (B) until correct offset is displayed. Release OFFSET ADJUSTMENT switch. RPM/timing display should now read: 0000 .... (blinking).



CD31409 —UN—23AUG12

Timing OFFSET ADJUSTMENT Switches

A—Timing OFFSET ADJUSTMENT Switch
B—Timing Offset INCREASE/DECREASE Switch

Engines with 9.5 mm injection nozzles		**Engines with 17 mm injection nozzles**	
Engine RPM at Full Load	OffSet (Degrees)	Engine RPM At Full Load	OffSet (Degrees)
2600	0	3000	+5.5
2500	0	2500	+2.0
2400	0	2400	+2.0
2300	+1.0	2300	+2.0
2200	+1.0	2200	+3.0
2100	+1.0	2100	+3.0
2000	+1.0	2000	+3.0
1800	+2.0	1800	+3.0
1500	+2.0	1500	+4.0

Timing Offset

Continued on next page

CD03523,0000382 -19-23AUG12-7/9

4. Make sure all cables and wires are clear of fan, belts or any other moving parts. Keep wires away from exhaust manifolds.
5. Start engine. SENSOR SIGNAL light (A) should be blinking steadily, indicating proper clamp-on transducer installation.
6. Warm engine to normal operating temperature; check slow and fast idle rpm (See Specifications). Adjust speeds as necessary.

IMPORTANT: Many machines have hydraulic pumps that have adequate flow to load engine well below rated load rpm. Some equipment may need to be driven in high gear or pull a load to bring engine speed to rated load rpm.

7. Run engine at wide open throttle (WOT) and load engine down gradually to rated speed rpm.
8. Record engine speed (rpm) and timing degrees.

NOTE: Minus (-) on display indicates that timing is after Top Dead Center.

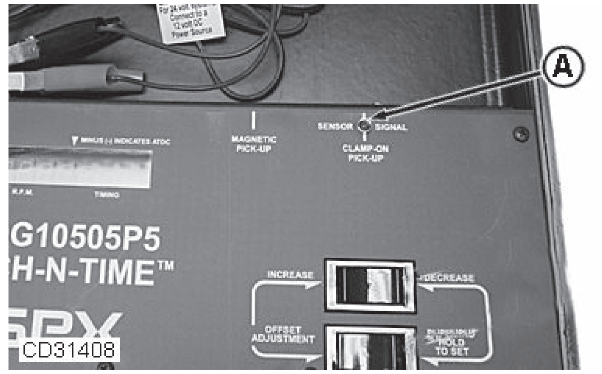
9. Compare recorded speeds and timing degrees with specifications..

IMPORTANT: Stop engine prior to making timing adjustments. Injection pump can seize if adjustment is made with engine running.

10. Stop engine.

If dynamic timing reading is more than 8 degrees retarded with pump flange and front plate timing marks at original location as shipped from factory, this may indicate the pump advance is not functioning. Check the following:

- Change fuel filter(s).
- Check transfer pump for positive fuel pressure to injection pump.
- Check camshaft movement on injection pumps with rectangular timing window.
- Check pump drive shaft-to-gear key or pin to ensure key or pin has not sheared.
- If none of the above checks are conclusive, remove pump and have necessary repairs made at an authorized diesel repair station.



CD31408 —UN—23AUG12

Sensor Signal Light

A—Sensor Signal Light

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CD03523,0000382 -19-23AUG12-8/9

Adjust Rotary Injection Pump Dynamic Timing:

1. Loosen injection pump mounting flange nuts and adjust pump timing.

   To advance pump timing, rotate top of pump clockwise, viewed from rear (flywheel end) of engine. To retard timing, rotate top of pump counterclockwise. Pump flange movement of 1.5 mm (0.060 in.) is equivalent to 2 degrees of engine timing.

2. Tighten injection pump mounting flange nuts to specifications.

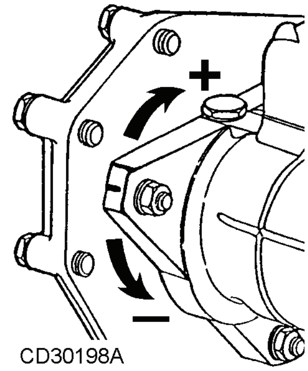
Specification

Rotary Injection Pump
Mounting Nuts—Torque.. 27 N·m (20 lb-ft)

3. Start engine and check injection pump dynamic timing again. Adjust timing as needed.
4. After all adjustments are made and engine is performing to specification, perform the following:

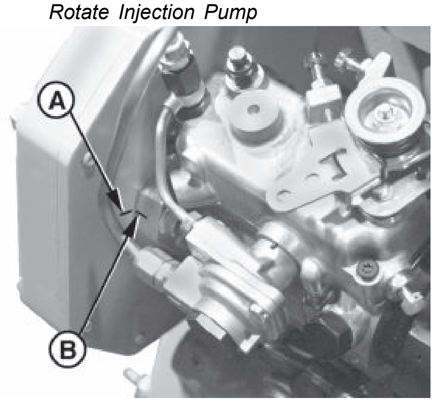
   a. Grind away the original timing mark (A) on front plate.

   b. Stamp a new timing mark (A) on front plate, aligned with timing mark (B) on injection pump flange.



Rotate Injection Pump

CD30198A —UN—30JAN09



Injection Pump Timing Marks

RG7723A —UN—07NOV97

A—Front Plate Timing Mark **B—Pump Timing Mark**

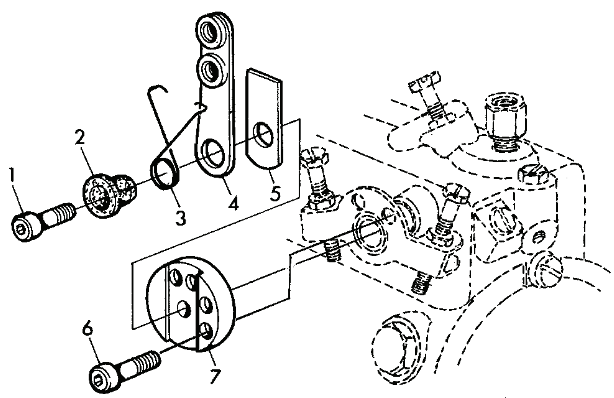
CD03523,0000382 -19-23AUG12-9/9

Replace Throttle Lever (STANADYNE)

1. Remove parts.
2. Inspect parts. Replace as necessary.
3. Tighten position screw (6) and spring screw (1) to specification.

Throttle lever (STANADYNE)—Specification

Position screw—Torque.............................. 3—3.5 N·m (2.2—2.6 lb.-ft.)
Spring screw—Torque.................................... 4—4.5 N·m (3—3.3 lb.-ft.)



CD30724 —UN—22FEB99

1—Spring screw
2—Spring retainer
3—Spring
4—Lever
5—Arm
6—Throttle lever position screw
7—Throttle lever adjustment spacer

CD03523,000010E -19-23APR12-1/1

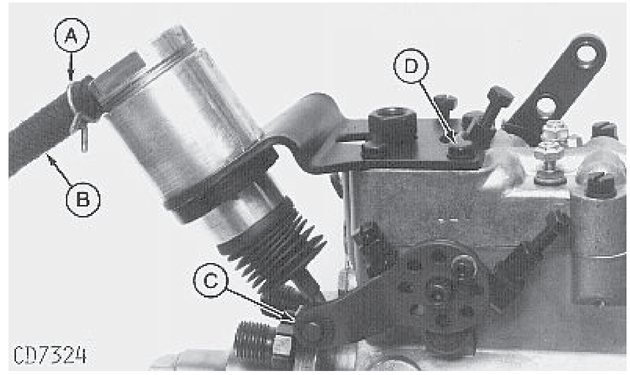
Aneroid Replacement (STANADYNE)

NOTE: It is not necessary to remove fuel injection pump when replacing an aneroid.

1. Remove clamp (A) and hose (B). Remove retaining ring (C) and attaching screws (D).
2. Remove aneroid and bracket assembly from pump.
3. Prepare and adjust new aneroid. (See “Aneroid Field Adjustment” or “Aneroid Workshop Adjustment” in this group).
4. Attach operating rod to pump lever with retaining ring (C) and fasten bracket to injection pump cover with screws (D). Tighten screws to specification.

Specification

Aneroid bracket-to-Injection pump, screws—Torque............ 5 N·m (4.6 lb.-ft.)



CD7324 —UN—23MAY95

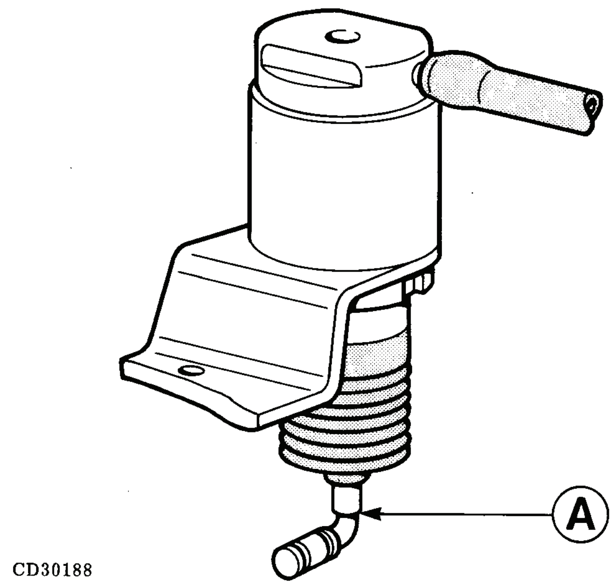
A—Clamp
B—Hose
C—Retaining ring
D—Attaching screw

5. Connect hose (B) to aneroid inlet with clamp (A).

CD03523,0000112 -19-20APR12-1/1

Aneroid Field Adjustment (STANADYNE)

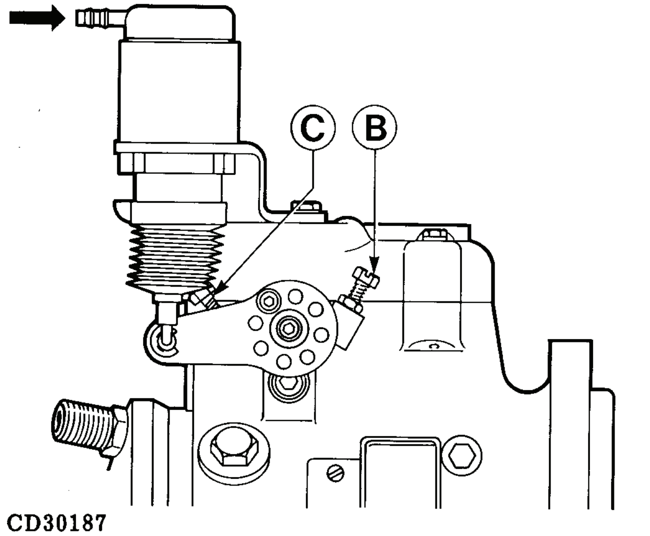
1. On an inoperative aneroid, screw in operating rod (A) and count the number of turns until it bottoms.
2. Take the new aneroid, screw in operating rod (A) until it bottoms then back off by the same number of turns as were needed for the previous aneroid.
3. Install adjusted aneroid on injection pump.



CD30188 —UN—08MAR95

CD03523,0000113 -19-06FEB01-1/1

Aneroid Workshop Adjustment (STANADYNE)



1. Install a new aneroid on the injection pump.
2. Connect a regulated air pressure source to aneroid inlet and use a mercury manometer in preference to a gauge, as operating pressures are very low.
3. Note the pressure at which shut-off lever lifts off forward screw (B) and the pressure required to obtain full travel until rear screw (C) bottoms and compare with specification.

Specification

Aneroid lever lift-off (Stanadyne)—Pressure.................................. 76—102 mm Hg (3—4 in. Hg) 10—14 kPa (1.5—2.0 psi)

Aneroid lever at full travel (Stanadyne)—Pressure............................ 330—380 mm Hg (13—15 in. Hg) 44—51 kPa (6.4—7.4 psi)

NOTE: Lift-off pressure can be checked by inserting a shim of 0.05 mm (0.002 mm) thickness between lever and front screw; the shim will slip out as soon as the lever starts to move.

4. If lever travel requires more pressure than specified, lengthen the operating rod; if less pressure is required, shorten operating rod.

IMPORTANT: During aneroid adjustment, do not touch the forward/rear screw, as these devices have been adjusted on the test stand.

5. Once aneroid is set, repeat test to check adjustment.
6. Install injection pump on engine.

CD03523,0000114 -19-06FEB01-1/1

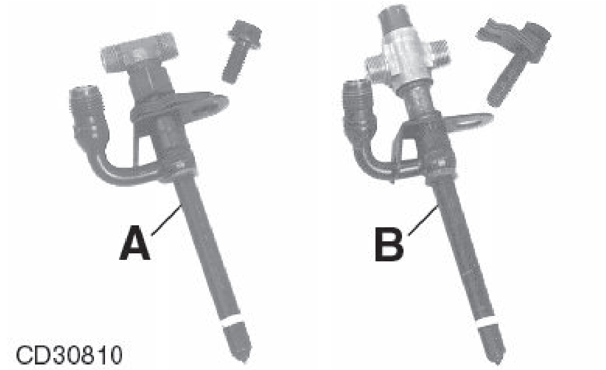
Fuel Injection Nozzle Identification

Three types of fuel injection nozzles can be found on PowerTech 2.9 L engines.

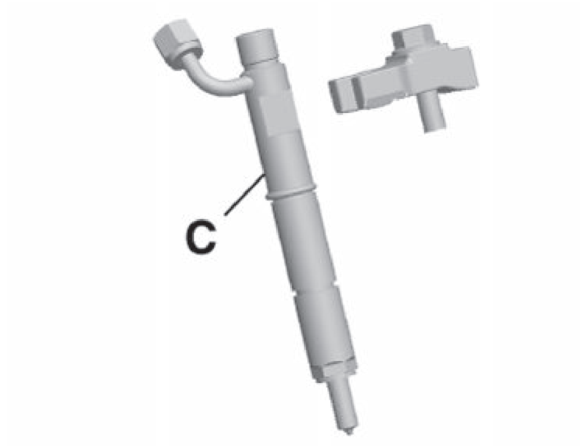
- Conventional Nozzle 9.5 mm (A)
- Rate Shaping Nozzle 9.5 mm (B)
- VCO Nozzle 17 mm (C)

The Rate Shaping Nozzle (RSN) allows some engines to comply with Tier 2 exhaust emission regulations.

The VCO Nozzle allows some engines to comply with Tier 3 exhaust emission regulations.



CD30810 —UN—17APR01



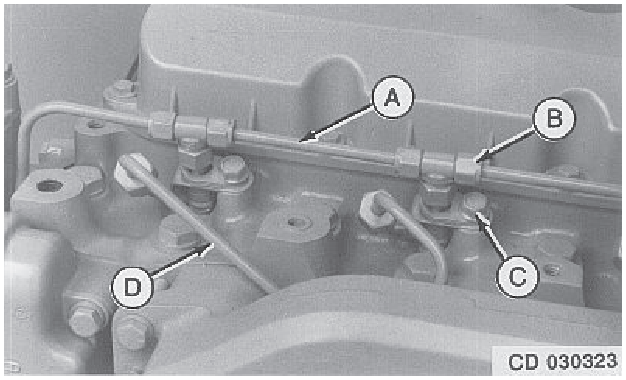
RG15528 —UN—11SEP07

Nozzle Identification

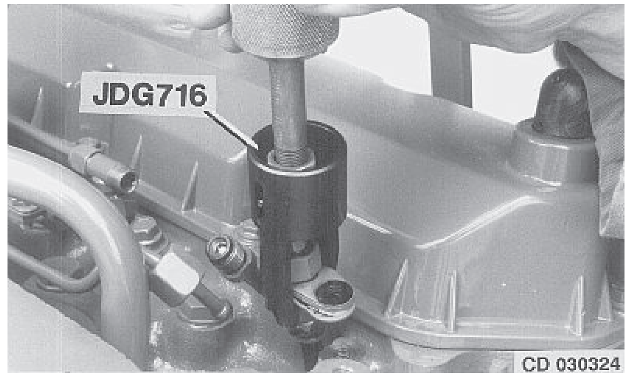
A—Conventional Nozzle 9.5 mm
B—Rate Shaping Nozzle (RSN) 9.5 mm
C—VCO Nozzle 17 mm

CD05019,000007E -19-17APR12-1/1

Remove Fuel Injection Nozzle (9.5mm)

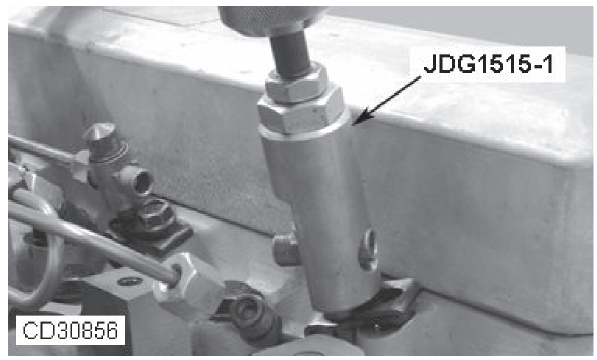


CD30323 —UN—17FEB95



CD30324 —UN—17FEB95

JDG716 Adapter for conventional nozzles



CD30856 —UN—01MAR06

JDG1515-1 Adapter for RSN nozzles

A—Leak-off line
B—Nut
C—Fuel injection nozzle-to-Cylinder head cap screw
D—Fuel injection line

Important Notes

Before removal, carefully remove all dirt from the cylinder head around fuel injection nozzles and blow clean with compressed air in order to prevent any dirt entering the cylinder or valve seats. Plug the bore in the cylinder head after fuel injection nozzle has been removed. Cap fuel line openings as soon as they are removed.

Fit protecting caps immediately over the nozzle tips and the line connections to avoid damage to the nozzles when handling them.

Do not bend the fuel pressure lines, as this may affect their durability and breakdowns may occur. When loosening the fuel pressure lines, hold male union of nozzle line.

Removal

1. Loosen nuts (B) to remove leak-off lines (A).
2. Disconnect fuel injection lines (D) from nozzles.
3. Remove cap screw (C).
4. Pull injection nozzles out of cylinder head, using JDE38B injection nozzle puller with JDG716 Adapter for conventional nozzles or JDG1515-1 for RSN nozzles.

CD,CTM125,197 -19-18APR12-1/1

Clean Fuel Injection Nozzle (9.5 mm)

IMPORTANT: When removing sealing rings and cleaning the nozzle, take care not to damage the TEFLON® coating of the nozzle body above the groove for the carbon stop seal.

NOTE: Before testing a fuel injection nozzle with a nozzle tester, remove both sealing rings and thoroughly clean outside of injection nozzle.

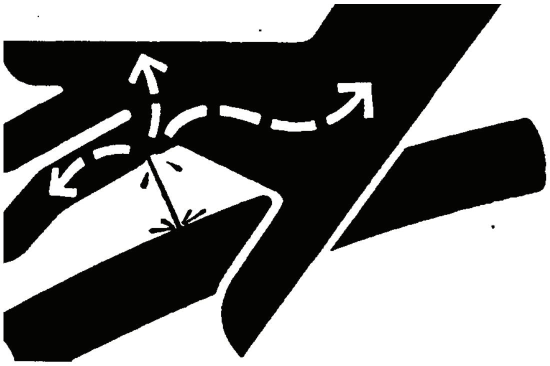
TEFLON is a trademark of Du Pont Co.

Remove the carbon stop seal from groove in nozzle body using suitable pliers. Pull seal washer from the nozzle body and discard carbon stop seal and seal washer.

Place fuel injection nozzle in solvent or clean Diesel fuel until accumulated deposits are saturated. Clean body and tip with brass wire brush. NEVER use a steel wire brush or scraper for this purpose.

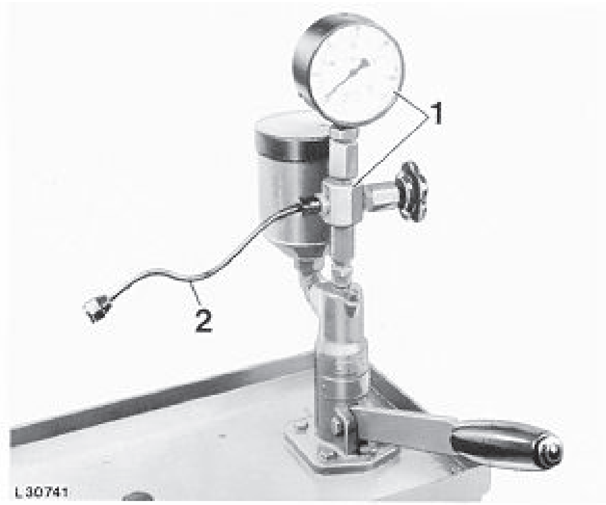
CD,CTM125,198 -19-18APR12-1/1

Fuel Injection Nozzle Test (9.5 mm)



High Pressure Fluid

X9811 —UN—23AUG88



L30741 —UN—08AUG89

CAUTION: The nozzle tip must always point away from the operator. The fuel issuing from an orifice can penetrate clothes and skin and thus cause severe infection.

NOTE: Testing the performance of a nozzle while the engine is running is just a rough test. To obtain a true check of nozzle performance, use a nozzle tester JT25510 (1) and pressure line KJD10109 (2), as shown under Special Tools.

Use only carefully filtered diesel fuel for testing the injection nozzles, since dirty fuel will severely damage the precision parts of a nozzle.

Connect the nozzle to the tester so that the axis of the nozzle forms an angle of approx. 30° to the vertical and the spray of fuel is directed downwards. Check all connections for leaks. Close the gauge shut-off valve and flush (bleed) the nozzle by operating test pump rapidly.

Spray Pattern Test

Close gauge shut-off valve and operate the pump lever at 60 strokes per minute. If the fuel injection nozzle is working properly, the fuel should issue through all nozzle orifices in a fine, evenly shaped spray cone. This spray cone is inclined from the centerline of the nozzle body, but should be distributed. For a better check, place a piece of paper or cardboard at a suitable distance below the nozzle and check the appearance of the damp circular spots made by the fuel. Deviations from the regular spray pattern or angle may be due to the complete or partial clogging of a nozzle orifice. In this case the fuel issues in a jet rather than in a fine spray.

Chatter Test

NOTE: The Rate Shaping Nozzle (RSN) is not concerned by this test as its has a different needle design which do not chatter.

Make sure nozzle orifices are free. When working pump of fuel injection nozzle tester at 60 strokes per minute (gauge shut-off valve closed), a definite characteristic “chatter” should be heard on conventional nozzle (non RSN). If this is not the case, the nozzle valve may be bent or tight in its guide because of the lacquer deposits which have accumulated. This can be corrected only by disassembling the nozzle.

Checking Valve Stem and Guide Wear

Connect fuel injection nozzle to the nozzle tester with the tip raised a little higher than its opposite end.
Cover the tip and pump the tester to a pressure of 10300 kPa (103 bar; 1500 psi). Keep the pressure constant and observe how much fuel leaks out of the nozzle return end. After the first drop has formed, count the drops for 30 seconds and compare with specification.

Fuel Injection Nozzle—Specification

Nozzle all types—Return
leakage at 10300 kPa
(103bar; 1500 psi).................................1 to 14 drops within 30 seconds

Checking Valve Seat

Connect the nozzle to tester in horizontal position. Operate the pump lever rapidly to bleed the nozzle and allow the valve to seat. Dry the tip of the nozzle thoroughly. Now operate the pump lever slowly until the indicated pressure is approx. 2800 to 3500 kPa (28 to 35 bar; 400 to 500 psi) below opening pressure (see specification for opening pressure). Keep watching the nozzle. Under these conditions the fluid should not drip out of the nozzle tip. However some weeping or light moisture on the tip is considered acceptable. Work the pump lever quickly several times in succession to make the nozzle spray in the normal way. After the last stroke of the pump, observe again. If the nozzle is not quite leakproof, disassemble for servicing.

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CD05019,0000083 -19-20APR12-1/2

Opening Pressure Test

NOTE: Absolute opening pressure is less important than equal opening pressure of all nozzles.

Close gauge shut-off valve and actuate the pump several times to allow the nozzle valve to seat properly. Open gauge shut-off valve. Pump the pressure up to the point where the pressure gauge needle falls rapidly. This point (take reading) is the nozzle valve opening pressure. Compare this point with specifications (see Fuel Injection NozzlesSpecifications).

If spray pattern, leakage test, and valve wear test are good but the opening pressure test is unsatisfactory, adjust opening pressure.

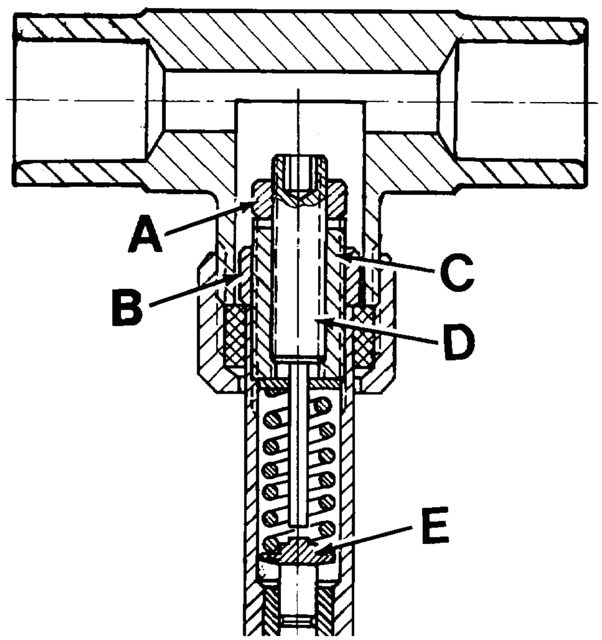
CD05019,0000083 -19-20APR12-2/2

Fuel Injection Nozzle Disassembly

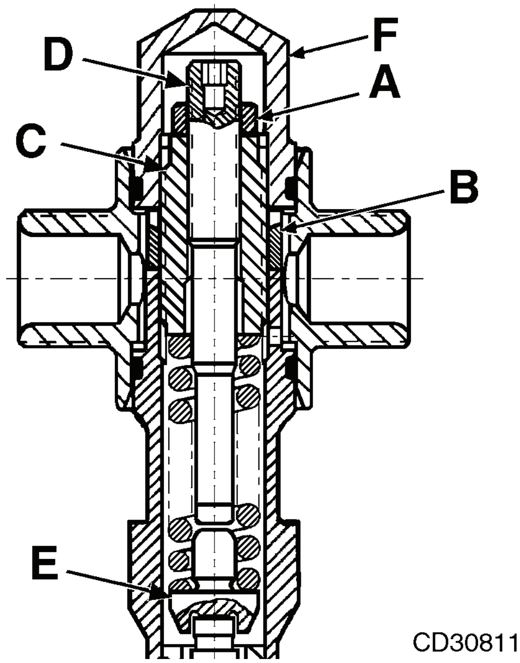
NOTE: If all tests prove that the nozzle performs properly, no further service is necessary and the nozzle can be reinstalled. If an injection nozzle is not operating properly and must be disassembled for cleaning and/or reconditioning, see your “Stanadyne” dealer.

CD,3274,G40,46 -19-01FEB94-1/1

Adjust Fuel Injection Nozzle (9.5 mm)



Conventional Nozzle



Rate Shaping Nozzle

A—Lift adjusting screw lock nut
B—Pressure adjusting screw lock nut
C—Pressure adjusting screw
D—Lift adjusting screw
E—Spring seat
F—Spring chamber cap (RSN nozzle)

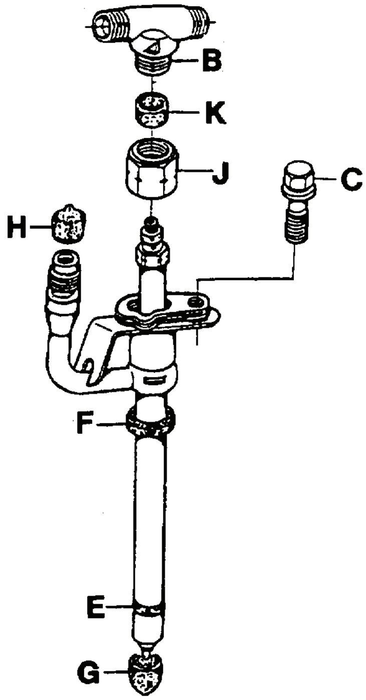
1. On RSN nozzles, unscrew spring chamber cap (F) using JDG1521.
2. Loosen and remove lock nut (A) of lift adjusting screw (D).
3. Loosen lock nut (B) of pressure adjusting screw (C) using JDG1515-2 Special Wrench on RSN nozzle.
4. Connect nozzle to tester, then adjust opening pressure to specifications by turning the pressure adjusting screw (C). Use JDG949 Special Wrench on conventional nozzles and JDG1522 on RSN nozzles.
5. Tighten lock nut (B) to specification, then recheck opening pressure.
6. Carefully screw lift adjusting screw (D) until it bottoms on spring seat (E).
7. Unscrew lift adjusting screw with the number of turns as specified.
8. Tighten lock nut of lift adjusting screw to specification.
9. Recheck opening pressure.

Fuel injection nozzle—Specification

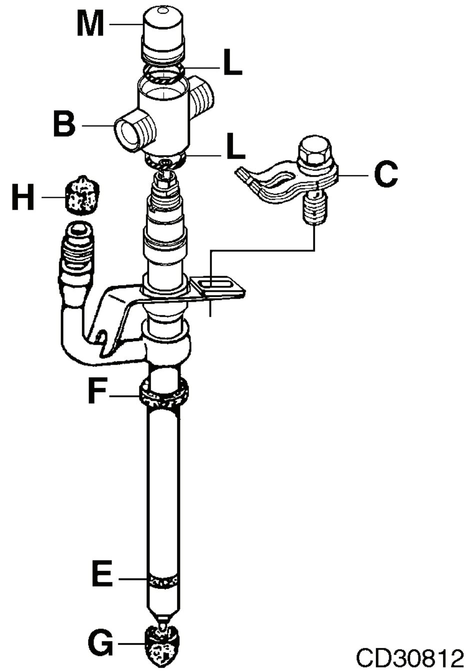
Pressure adjusting screw lock nut—Torque	10 N·m (7 lb.-ft.)
Lift adjusting screw lock nut—Torque	5 N·m (3.5 lb.-ft.)
Valve (Conventional nozzle)—Lift (3029D - Non Certified engines)	1/2 turn
Lift (3029T - Non Certified engines)	3/4 turn
Lift (3029 - Certified and Non Certified engines)	3/4 turn
Valve (RSN nozzle)—Lift (3029D - Certified engines)	7/8 turn

CD,CTM125,199 -19-20APR12-1/1

Install Fuel Injection Nozzle (9.5 mm)



Conventional nozzle



Rate Shaping Nozzle

A—Leak-off line
B—T-fitting
C—Cap screw
D—Fuel injection line
E—Carbon stop seal
F—Seal washer
G—Protection cap
H—Protection cap
J—Tube nut
K—Rubber sleeve (Conventional nozzle)
L—O-ring (RSN nozzle)
M—Cap (RSN nozzle)

IMPORTANT: Each time an injection nozzle is removed from cylinder head, replace the carbon stop seal (E).

[1]*Order JD-258 when tool is ordered from European Parts Distribution Center (EPDC).*

1. Slide seal washer (F) onto nozzle body. Using JD258 (JD-258)[1] pilot tool, slide the new carbon stop seal until it fits properly into the groove.

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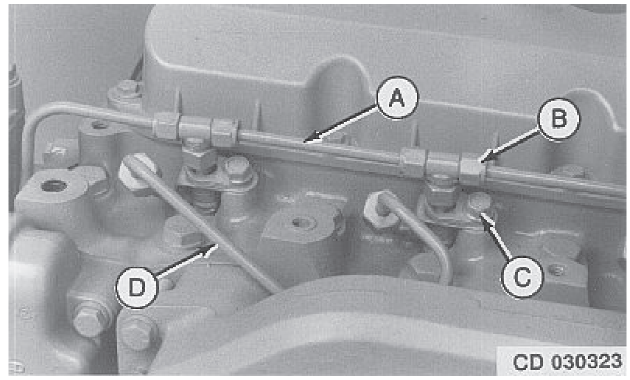
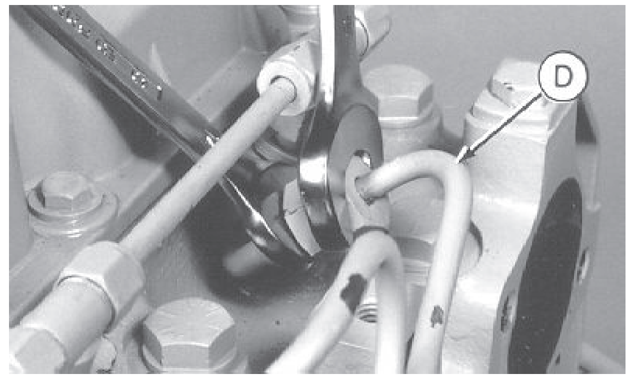
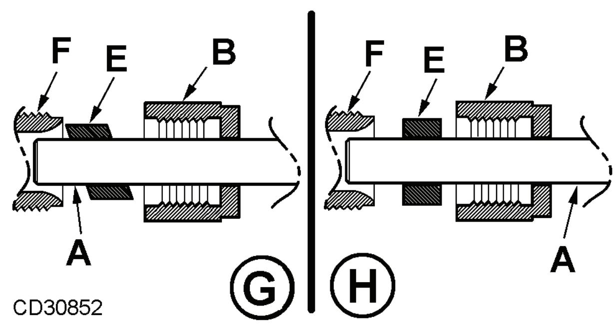
CD,CTM125,200 -19-20APR12-1/2



CD30323 —UN—17FEB95



CD30676 —UN—20MAY98



Fuel leak-off line

CD30852 —UN—27SEP04

IMPORTANT: Before installation, make sure nozzle is clean and free from oil or grease.

2. Install nozzle in cylinder head. Screw cap screw (C). Do not tighten at this stage.
3. Connect fuel injection line (D) to nozzle. Tighten pressure line to specification using two wrenches as shown.
4. Tighten cap screws (C) to specification.
5. Install leak-off lines (A) on T-fittings. Tighten nut (B) to specification.

NOTE: Do not try to overtighten the leak-off line nuts in order to prevent a leak. If leak occurs, remove leak-off line nut (B) and reposition seal (E) properly on the tube (A) . The face of the seal must be perpendicular to the tube.

Fuel injection nozzle—Specification

Injection line-to-nozzle—Torque... 30 N·m (23 lb.-ft.)
Fuel injection nozzle-to-Cylinder head, cap screw—Torque... 37 N·m (27 lb.-ft.)
Leak-off lines, nut—Torque.. 5 N·m (3.5 lb.-ft.)

A—Fuel leak-off line
B—Fuel leak-off line nut
C—Cap screw
D—Fuel injection line
E—Seal
F—Nozzle T-fitting
G—Fuel leak-off line - Bad seal installation
H—Fuel leak-off line - Correct seal installation

CD,CTM125,200 -19-20APR12-2/2

Remove Fuel Injection Nozzles (17 mm)

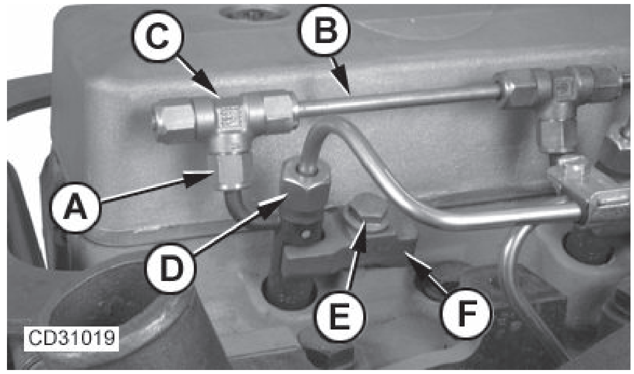
General Nozzle Service Precautions

Before removal, thoroughly remove all dirt from the cylinder head around fuel injection nozzles. Clean with compressed air to prevent dirt from entering the cylinders. Plug the bore in the cylinder head after each nozzle has been removed. Cap fuel line openings as soon as they are disconnected.

Immediately fit protective caps over the nozzle tips and the line connections to avoid handling damage and getting debris in fuel system.

Do not bend the fuel delivery lines, as this may affect their durability. When loosening the fuel lines, hold male union of nozzle line stationary with a backup wrench.

NOTE: When all fuel injection nozzles have to be removed, disconnect leak-off line and remove as a complete assembly. For individual nozzle removal, remove only the section of leak-off line necessary for nozzle removal.



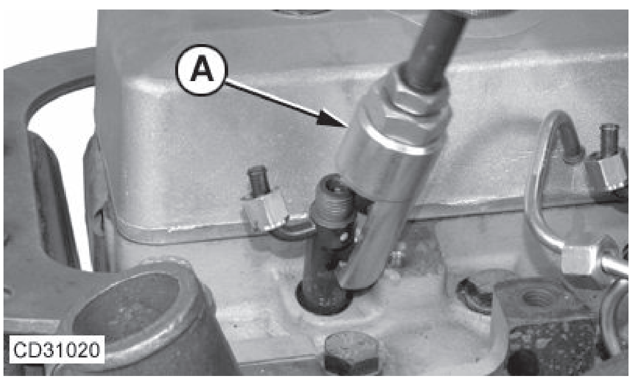
CD31019 —UN—26SEP08

Remove Fuel Injection Nozzles (17 mm)

A—Leak-off Line Nut
B—Leak-off Line Tube
C—Leak-off T-Fitting
D—Fuel Injection Line
E—Cap Screw
F—Hold Down Clamp

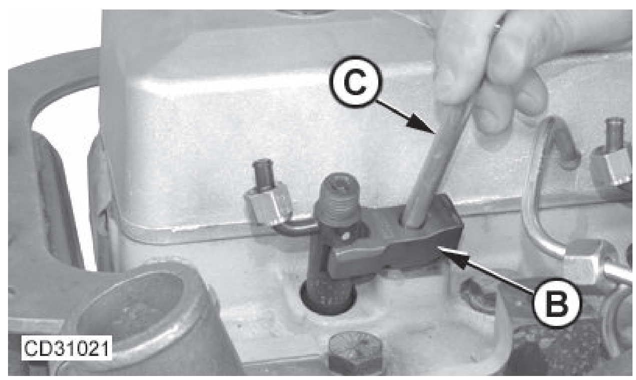
1. Loosen tube nuts (A) at each nozzle to remove leak-off line tubes (B) and T-fittings (C) as an assembly.
2. Disconnect fuel injection line (D) at nozzle.
3. Remove cap screw (E) and hold down clamp (F) securing nozzle in cylinder head nozzle bore.

CD05019,0000084 -19-07SEP12-1/2



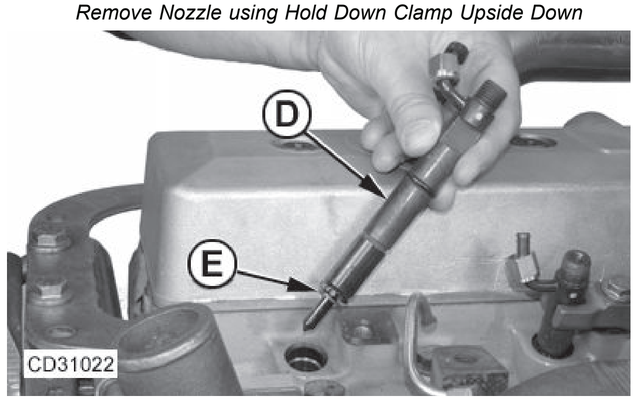
CD31020 —UN—26SEP08

Remove Nozzle using JDG1515-1



CD31021 —UN—26SEP08

Remove Nozzle using Hold Down Clamp Upside Down



CD31022 —UN—26SEP08

Remove Nozzle from Cylinder Head

4. Pull injection nozzle out of cylinder head using JDG1515-1 adapter (A).

NOTE: Nozzle can be also pulled out using the hold down clamp upside down (B) with a rod (C) as a lever.

5. Remove nozzle (D) from bore. Ensure that the carbon stop seal washer (E) is still on nozzle end. Otherwise, remove it from cylinder head bore.

A—JDG1515-1 Adapter
B—Hold Down Clamp used as Puller
C—Rod
D—Fuel Injection Nozzle
E—Carbon Stop Seal Washer

CD05019,0000084 -19-07SEP12-2/2

Clean Fuel Injection Nozzle Bore (17 mm)

Clean injection nozzle bore. Blow debris from bore using compressed air, and plug the bore to prevent entry of foreign material.

CD05019,0000085 -19-10SEP12-1/1

Clean Fuel Injection Nozzles (17 mm)

1. Remove snap ring (A), seal (B) and tube nut (C). Discard snap ring, seal and tube nut.
2. Remove carbon stop seal washer (E) from nozzle and remove upper sealing O-ring (D). Discard seal washer and O-ring.
3. Place nozzle in solvent or clean diesel fuel and soak for a while.

IMPORTANT: Do not use a motor-driven brush to clean nozzle body.

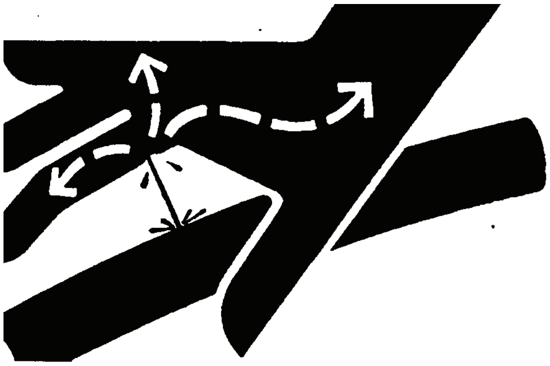
4. After soaking, clean nozzle tip with brass wire brush. Never use a steel wire brush or scraper.

Clean Fuel Injection Nozzle

A—Snap Ring
B—Seal
C—Tube Nut
D—O-Ring
E—Carbon Stop Seal Washer

CD05019,0000086 -19-07SEP12-1/1

Test Fuel Injection Nozzles (17 mm)



High Pressure Fluid

Injection Nozzle Tester

A—Nozzle Tester
B—Fuel Line
C—Adapters
D—Beaker

CAUTION: The nozzle tip should always be directed away from the operator. Fuel from the spray orifices can penetrate clothing and skin causing serious personal injury. Enclosing the nozzle in a clear glass beaker is recommended.

Before applying pressure to the nozzle tester, be sure that all connections are tight, and that the fittings are not damaged. Fluid escaping from a very small hole can be almost invisible. To search for suspected leaks, use a piece of cardboard or wood, rather than hands.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

1. Connect injection nozzle to nozzle tester.
2. Use appropriate adapters (C) and fuel line (B) from D01110AA Fuel Injection Nozzle Tester Adapter Set to connect nozzles to D01109AA OTC Portable Nozzle Tester (A).
3. Position tip of nozzle below top of beaker (D) to contain all spray in beaker, as nozzle spray pattern is at an angle to the nozzle centerline. Leave connections slightly loose and gauge shut-off valve closed.
4. Pump handle several strokes to flush air from lines and fittings. Tighten all connections securely after all air has been expelled.

IMPORTANT: Make sure that nozzle tester is in good condition and that gauge works properly. Service nozzle tester as recommended in the operating instructions provided with tester.

Opening Pressure Test

NOTE: Actual nozzle opening pressure is less important than equal opening pressure of all nozzles. For maximum variation between nozzles, see specifications below.

1. Actuate the nozzle tester rapidly several times to allow the valve to seat rapidly and to determine the pumping rate required for proper fuel atomization.

Continued on next page

CD05019,0000087 -19-07SEP12-1/2

NOTE: Rapid operation of pump handle will result in inaccurate opening pressure readings and cause undue wear on gauge.

2. Open gauge valve, actuate the tester slowly and raise the pressure to a point where the gauge needle falls rapidly. Note value. This is the nozzle opening pressure, and should be as specified for a new or used nozzle.

   A new nozzle should open at the following pressure.

Specification

New Injection Nozzle (17 mm)—Opening Pressure .... 25 500—26 300 kPa (255—263 bar) (3698—3815 psi)

   On nozzles that have been in service, the spring and other components will have taken a normal set. In this case, opening pressure is satisfactory if it meets or exceeds the used nozzle minimum opening pressure given below, but does not exceed the new nozzle opening pressure given above.
   Used nozzle minimum opening pressure is.

Specification

Used Injector Nozzle (17 mm)—Opening Pressure .... 21 000 kPa (210 bar) (3050 psi)

   The difference in nozzle opening pressures between cylinders in an engine should not exceed specification.

Specification

Maximum Difference Between Cylinders (17 mm)—Opening Pressure .... 700 kPa (7 bar) (100 psi)

Leakage Test

1. Operate pump handle rapidly to firmly seat valve. Wipe the nozzle tip dry with a clean, lint-free cloth.

2. Slowly raise pressure at nozzle to about 2000 kPa (20 bar) (300 psi) under the measured opening pressure and hold at that pressure. Watch for an accumulation of fuel around the nozzle tip orifices.

   Leakage is unacceptable if a drop falls from the nozzle tip within 10 seconds

Specification

Nozzle (17 mm) Condition at Pressure Test of 2000 kPa (20 bar) (300 psi) —Leakage .... No drip within 10 seconds

3. Check for external leakage around the top of the nozzle retaining nut.

4. If leakage is observed, tighten nozzle retaining nut to maximum specification.

Specification

Nozzle Retaining Nut (17 mm)—Torque .... 40 N·m (30 lb.-ft.) Maximum

   If leakage continues, replace injection nozzle.

Chatter and Spray Pattern Test

1. Close gauge shut-off valve and operate nozzle tester at a pumping rate that will cause the nozzle to chatter. Nozzle should chatter softly, and spray pattern should be broad and finely atomized.

   Failure to chatter is an indication that the valve is not moving freely or there is a seat problem. Chatter is desirable but not a necessary characteristic.

2. Using the pumping rate for proper atomization, operate tester for ten strokes. The nozzle must atomize, from all orifices, on at least eight of the ten strokes without consecutive misses.

NOTE: Partially clogged, chipped, or eroded orifices will cause the spray to deviate from the correct angle. Spray will be streaky, rather than finely atomized.

   If the nozzle fails to meet this requirement, repeat procedure. Nozzles that do not meet the requirement after a second test should be replaced.

After testing, immediately fit protective caps over nozzle tip and line connections to avoid damage from handling and getting dirt into fuel system.

CD05019,0000087 -19-07SEP12-2/2

Install Seals on Fuel Injection Nozzle (17 mm)

IMPORTANT: Each time an injection nozzle is removed from the cylinder head, replace seals and tube nut with new.

Snap ring (A) must be properly installed in the retaining groove with both ends of ring even.

1. Install tube nut (C), seal (B) and snap ring (A). Ensure that snap ring (A) is properly seated in the retaining groove.
2. Install a new O-ring (D) onto nozzle body until it seats in its groove.
3. Position a new carbon stop seal washer (E) on nozzle.

NOTE: If nozzle is not going to be installed at this time, install a protector cap over nozzle tip. Plug all other openings in nozzle to prevent contamination.

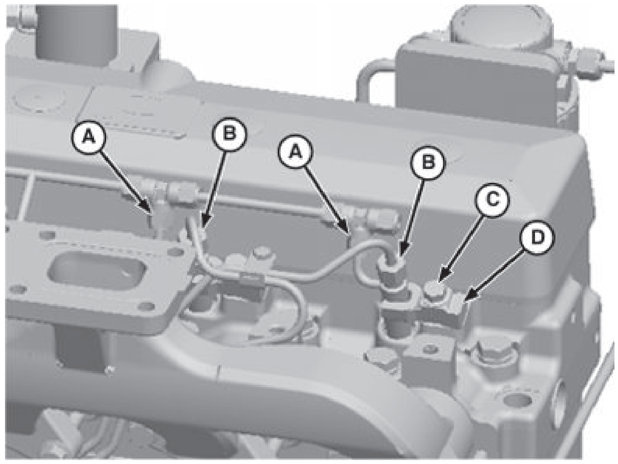
RG15541 —UN—05OCT07

Fuel Injection Nozzle Seals

A—Snap Ring
B—Seal
C—Tube Nut
D—O-Ring
E—Carbon Stop Seal Washer

CD05019,0000088 -19-07SEP12-1/1

Install Fuel Injection Nozzles (17 mm)



RG15529 —UN—11SEP07

Injection Nozzle in Cylinder Head

A—Leak-Off Line Tube Nut
B—Fuel Injection Line
C—Cap Screw
D—Hold Down Clamp

IMPORTANT: Before installing injection nozzles, make sure nozzles are clean and free from oil or grease.

1. Remove plug (if installed previously) from nozzle bore in cylinder head and blow out bore with compressed air.

NOTE: Make sure that the sealing surface of the cylinder head (on which the seal washer will be resting) is smooth and free of damage or dirt. This could prevent proper sealing. Dirt and roughness could also cause nozzle to be distorted when the attaching screw is tightened, making the valve stick.

2. Install nozzle with clamp (D) in cylinder head using a slight twisting motion as nozzle is seated in bore. Illustration shows relationship of parts required for proper installation.
3. Align nozzle clamp (D) and install cap screw (C). Do not tighten cap screw at this stage.
4. Connect fuel injection line (B) to nozzle. Leave connection slightly loose until air is bled from system.
5. Tighten nozzle hold-down clamp cap screw to specification.

Specification

Fuel Injection Nozzle (17 mm) Hold-Down Clamp Cap Screw—Torque.. 35 N·m (26 lb.-ft.)

IMPORTANT: Avoid machine damage. Do NOT overtighten fuel leak-off lines.

6. Install leak-off line assembly. Tighten leak-off line tube nut (A) to specification.

Specification

Fuel Leak-Off Line Hex Nut (17 mm)—Torque.. 5 N·m (44 lb.-ft.)

7. Bleed air from loose injection line connection. Tighten connection (B) to specification.

Specification

Fuel Injection Nozzle Delivery Line—Torque.. 27 N·m (20 lb.-ft.)

(See BLEED THE FUEL SYSTEM in this group.)

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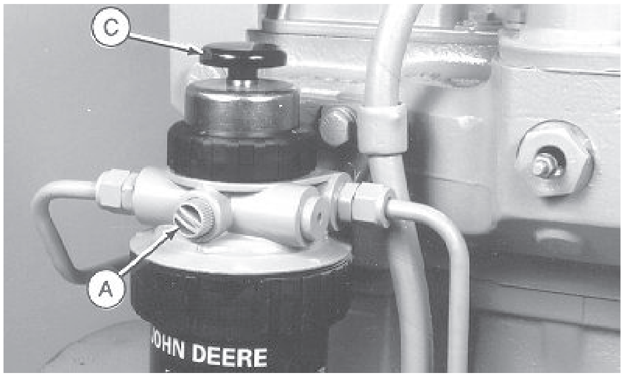
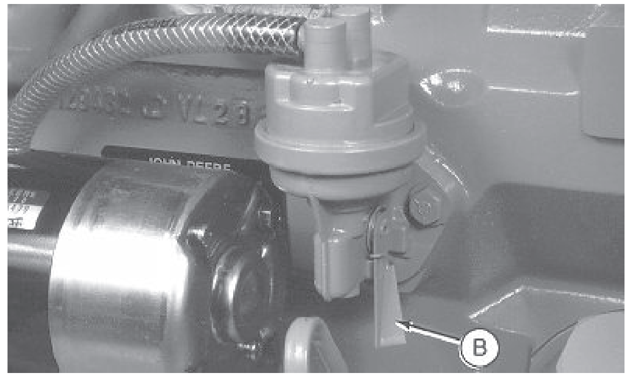
Bleed Fuel System



CD30677 —UN—20MAY98



CD30678 —UN—20MAY98

A - In Area of Fuel Filter (Rotary fuel injection pump)

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury.

If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

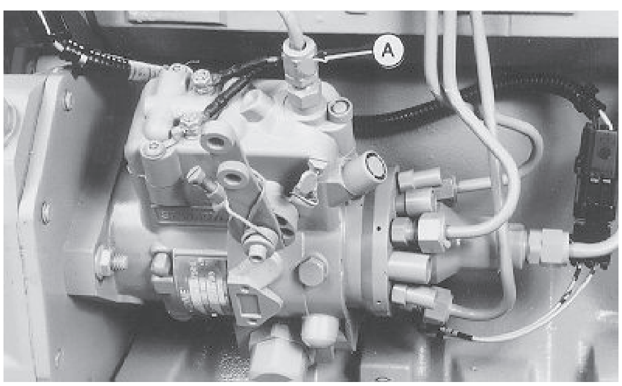
1. Loosen air bleed screw (A).
2. Operate primer lever of fuel supply pump (B) or hand primer on fuel filter (C) until fuel flow is free from air bubbles.

NOTE: On applications with electrical supply pump, switch on ignition to activate the pump.

3. Tighten bleed screw (A) by hand or using a coin.

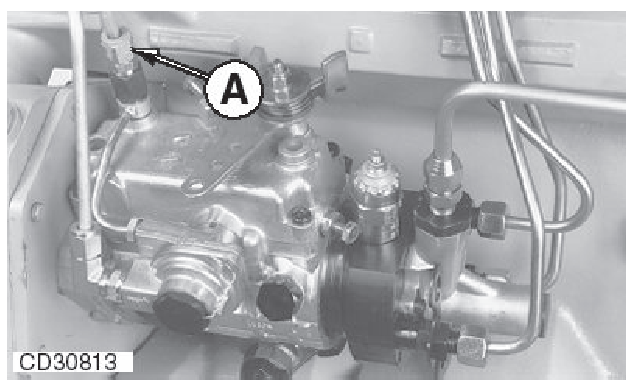
CD,CTM125,203 -19-20APR12-1/4

B - In Area of Fuel Injection Pump (Rotary fuel injection pump)



CD30679 —UN—04MAY98

Bleed STANADYNE fuel injection pump



CD30813 —UN—17APR01

Bleed DELPHI/LUCAS fuel injection pump

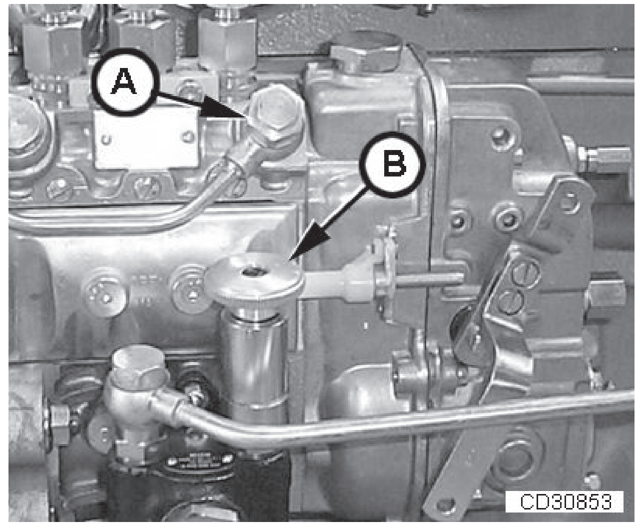
1. Loosen fuel return line (A) at fuel injection pump.
2. Operate the primer lever of fuel supply pump or the hand primer on fuel filter or switch on the ignition for application with electric supply pump.
3. As soon as fuel flow is free from air bubbles tighten fuel return line.

Continued on next page

CD,CTM125,203 -19-20APR12-2/4

C - In Area of MICO - BOSCH in-Line Fuel Injection Pump

1. Loosen fuel return line (A).
2. Unscrew hand primer (B) on fuel supply pump until it can be pulled by hand.
3. Operate the hand primer until fuel flow is free from air bubbles.
4. Simultaneously stroke the hand primer down and close the fuel return port. This prevents air from entering the system. Tighten securely.
5. Lock hand primer in position.



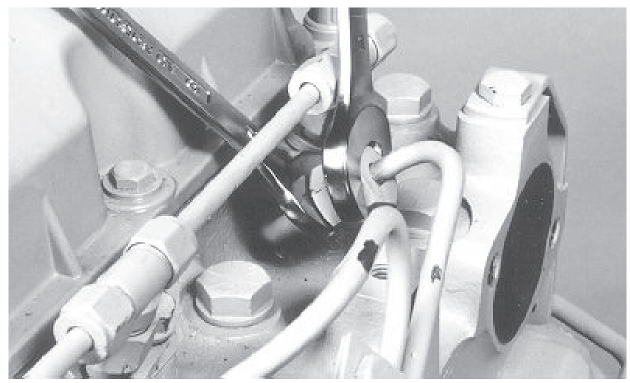
CD30853 —UN—27SEP04

CD,CTM125,203 -19-20APR12-3/4

D - In Area Behind Fuel Injection Pump

If engine will not start after the bleeding procedures described above, continue as follows:

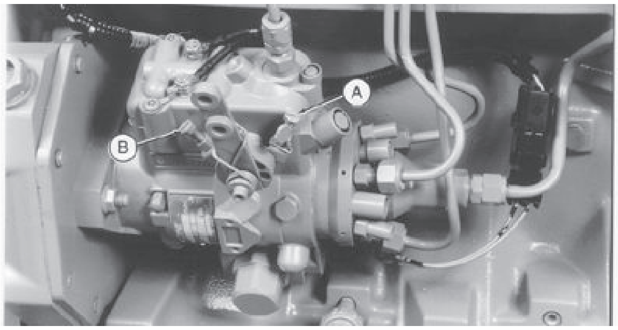
1. Place throttle lever in fast idle position.
2. Using two open-end wrenches, loosen fuel line on at least three nozzles.
3. Turn over engine with starter motor until fuel flows free from bubbles out of loosened fuel nozzle connections. Retighten connections.



CD30680 —UN—04MAY98

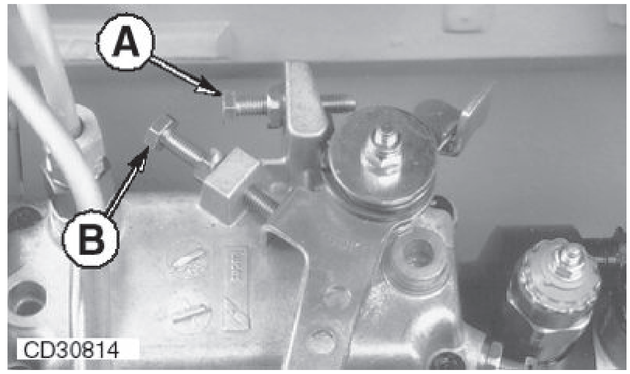
CD,CTM125,203 -19-20APR12-4/4

Check Engine Speed on Rotary Fuel Injection Pump



CD30681A —UN—20APR01

STANADYNE Pump



CD30814 —UN—17APR01

DELPHI/LUCAS pump

A—Fast idle adjusting screw **B—Slow idle adjusting screw**

NOTE: Before checking engine speed, make sure engine has reached its normal operating temperature.

All speeds indicated apply to an engine not under load. The maximum permissible speed variation is ± 50 rpm for slow idle speed and + 50 rpm for fast idle speed.

Fast Idle Checking

1. Disconnect speed control rod at fuel injection pump.
2. Move pump throttle lever against pump fast idle adjusting screw (A). Check engine speed and compare with specifications.

NOTE: Fast idle is settled by the factory then the fast idle adjusting screw (A) is sealed to prevent from tampering. Fast idle adjustment can only be done by an authorized fuel system agent.

Slow Idle Checking

1. Disconnect speed control rod at fuel injection pump.
2. Move pump throttle lever in slow idle position against slow idle adjusting screw (B). Check engine speed and compare with specifications.

NOTE: Most engines for generator set application (1500 rpm for 50 Hz or 1800 rpm for 60 Hz) run only at fast idle and therefore they do not have slow idle.

3. In case of incorrect engine speed, turn screw (B) clockwise to increase and counterclockwise to decrease engine speed.

CD,CTM125,204 -19-22JUN12-1/1

Check Engine Speed on MICO - BOSCH in-Line Fuel Injection Pump

NOTE: Before adjusting engine speed, make sure engine has reached its normal operating temperature.

All speeds indicated apply to an engine not under load. The maximum permissible speed variation is ± 50 rpm for slow idle speed and + 50 rpm for fast idle speed.

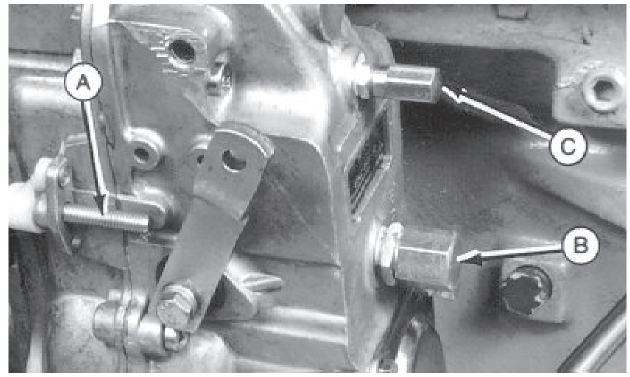
Fast Idle Checking

Move pump throttle lever against pump fast idle adjusting screw (A). Check engine speed and compare with specifications. .

NOTE: Fast idle is settled by the factory then the fast idle adjusting screw (A) is sealed to prevent from tampering. Fast idle adjustment can only be done by an authorized fuel system agent.

Slow Idle Checking

NOTE: Both the slow idle spring screw (B) and the slow idle speed screw (C) are used to adjust the slow idle speed. Remove the threaded caps to access these adjusting screws.



CD30738 —UN—23FEB99

MICO - BOSCH in-line pump

A—Fast idle adjusting screw
B—Slow idle spring screw
C—Slow idle speed screw

1. Loosen slow idle spring screw (B) as much as possible.
2. Adjust slow idle speed screw (C) to the specifications minus 20 rpm.
3. Retighten slow idle spring screw (B) until engine slow idle speed specification is obtained.

CD03523,000013F -19-06SEP04-1/1

Section 03
Theory of Operation

Contents

Preliminary Engine Testing

The following preliminary tests will help determine if the engine can be tuned-up to restore operating efficiency, or if engine overhaul is required.

After engine has stopped for several hours, loosen crankcase drain plug and watch for any water to seep out. A few drops due to condensation is normal, but more than this would indicate problems which require engine repair.

With engine stopped, inspect engine coolant for oil film. With engine running, inspect coolant for air bubbles. Either condition would indicate problems which require engine repairs rather than just a tune-up.

Perform compression test. Pressure below specifications indicates that engine need to be repaired.

CD,CTM125,207 -19-01DEC97-1/1

General Tune-Up Recommendations

As a general rule, an engine tune-up is not necessary if all recommended Operator's Manual hourly service procedure are performed on schedule. If your engine performance is not within the rated application guidelines and if engine condition does not require overhaul, the following service procedures are recommended to help restore engine to normal operating efficiency.

- Change engine oil and filter.
- Replace fuel filter and water separator.
- Clean crankcase vent tube.
- Clean and flush cooling system.
- Test thermostat and pressure cap.
- Check condition of coolant hoses and fan belt.
- Check air intake system. Replace air cleaner elements.
- Check exhaust system.
- Inspect turbocharger and check boost pressure.
- Check fuel injection system:
  - Have injection pump checked by an Authorized Diesel workshop.
  - Clean injection nozzles and adjust opening pressure.
  - Adjust slow idle speed and perform a dynamic timing
- Check engine oil pressure
- Check engine valve clearance
- Check electrical system

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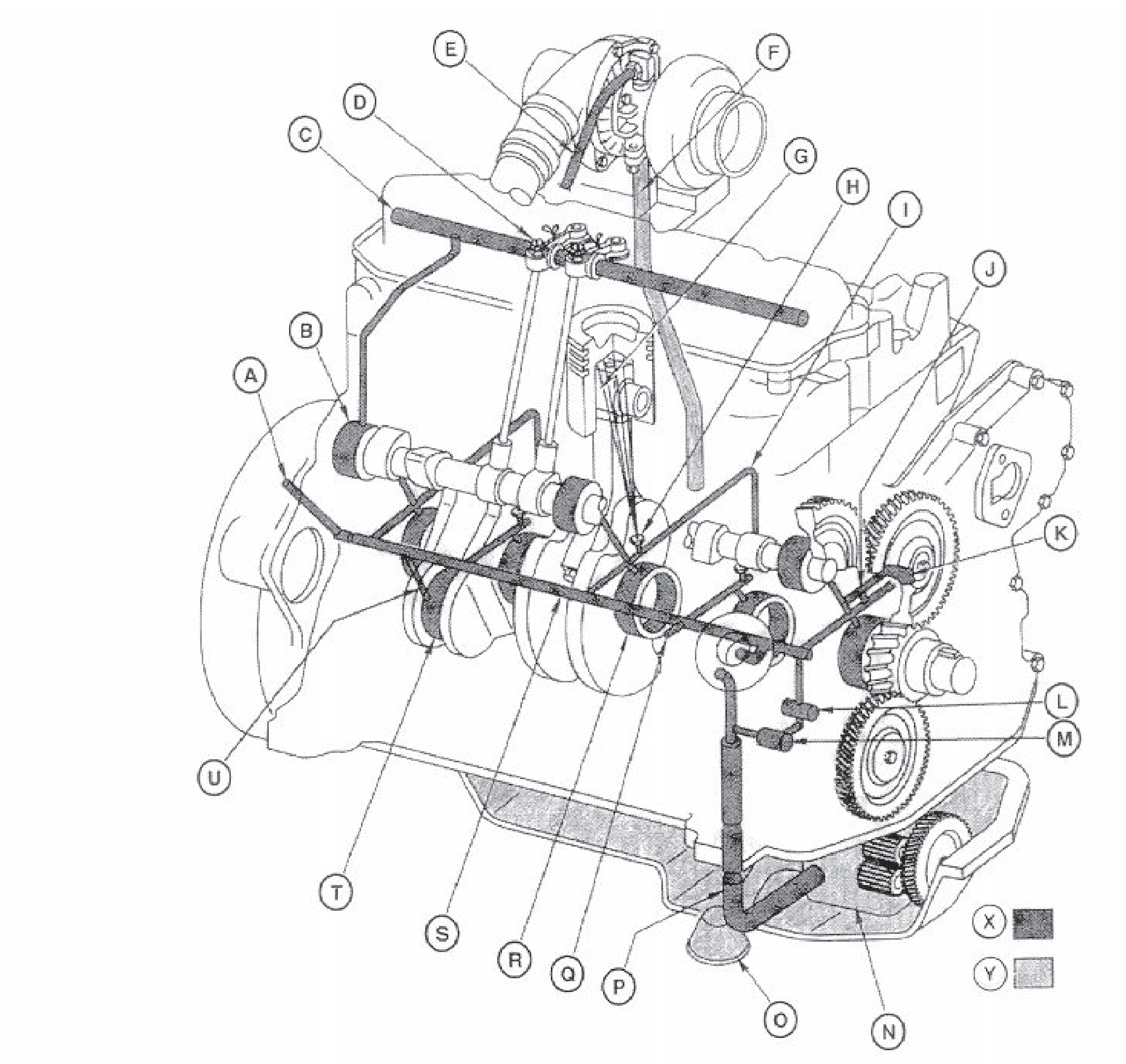
Lubrication System



CD30683 —UN—23JUN98

A—Connection to engine lubricating oil
B—Camshaft bearings
C—Rocker arm shaft
D—Rocker arm
E—Turbocharger oil supply line
F—Turbocharger oil drain line
G—Piston
H—Spray jet (1 per cylinder)
I— Oil gallery
J— Oil passage - Upper idler gear
K—Upper idler gear
L—Oil pressure regulating valve
M—Oil by-pass valve
N—Oil pump
O—Oil strainer
P—Oil outlet tube
Q—Connection to engine lubricating oil
R—Main bearings
S—Main oil gallery
T—Connecting rod bearings
U—Main-to-rod cross drilling
X—Engine lubricating oil
Y—Pressure-free oil

The engine has a pressure lubrication system. In the main it consists of the gear pump (N), filter strainer in the suction pipe, full flow oil filter, oil cooler, oil pressure regulating valve (L), oil by-pass valve (M) and an electrical pressure warning switch (connected to A or Q).

The pump draws lubricating oil from the crankcase through a strainer (O) and suction line and pumps it through an oil line via the oil cooler to the oil filter and to the main oil gallery (S) of the cylinder block.

From here oil is forwarded under pressure to the main bearings (R) and spray jets (H) to cool the pistons. Drilled cross passages in the crankshaft (U) distribute oil from the main bearings to connecting rod bearings (T).

Lube oil holes in Nos. 1, 2, 3 main bearing oil grooves are provided to direct oil to the camshaft bearings (B). The lower idler gear is lubricated by splash oil.

A drilled passage from the rear camshaft bearing through the cylinder block and cylinder head supplies lubricating oil to the rocker arm shaft (C).

Turbocharger shaft is lubricated by an external oil line connected to the main oil gallery (port A or Q).

Continued on next page

CD,3274,G205,3 -19-03NOV92-1/2

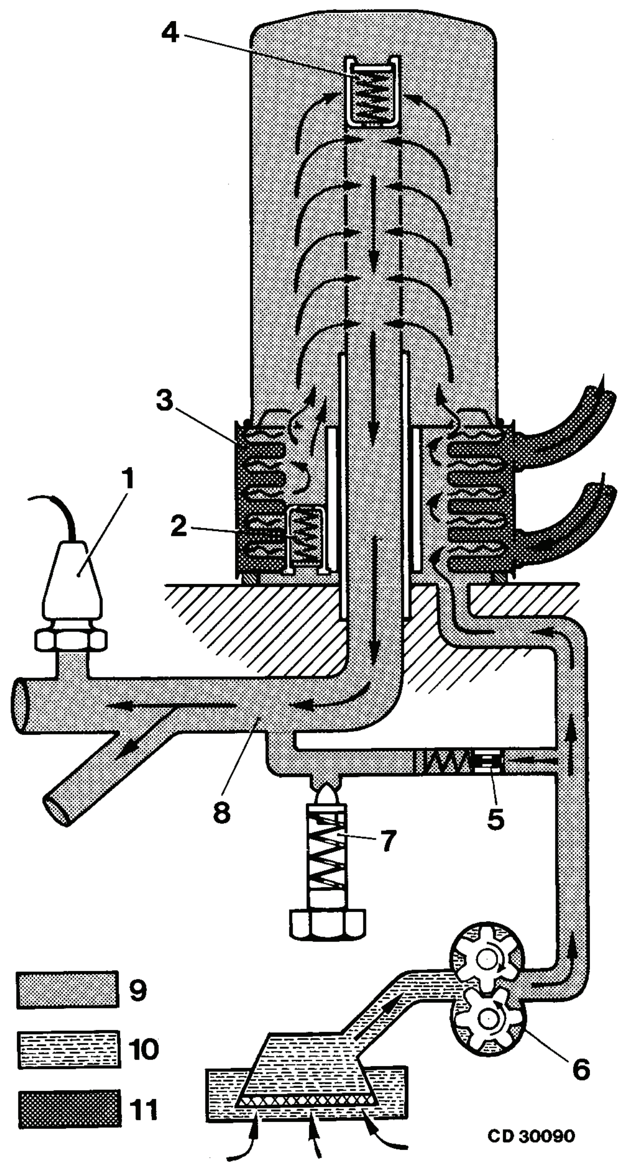
An externally adjustable pressure regulating valve is located at the front of the cylinder block in the oil gallery. It controls the oil pressure and provides constant pressure in the main gallery and in the complete lubrication system.

The valve consists of a valve cone held against a seat by means of a spring and plug. Pressure may be adjusted by changing the number of shims behind the valve plug. If oil pressure exceeds spring pressure, the valve cone is raised from the seat, permitting oil to bypass to the crankcase and maintain constant pressure.

An oil by-pass valve is located in the cylinder block behind the front plate and near the oil pressure regulating valve. Should the difference between the pressures in the main oil gallery and oil pump become excessive, this valve would open and let oil by-pass the filter and oil cooler to reach the main gallery faster. This valve has a permanent setting which cannot be changed.

The oil filter is mounted on the right-hand side of the engine. It is a full-flow type with a spin-on type replaceable element. If the filter clogs, a by-pass valve in the element opens to keep a full flow of oil to vital engine parts.

NOTE: Some high output engines are equipped with high flow oil coolers.

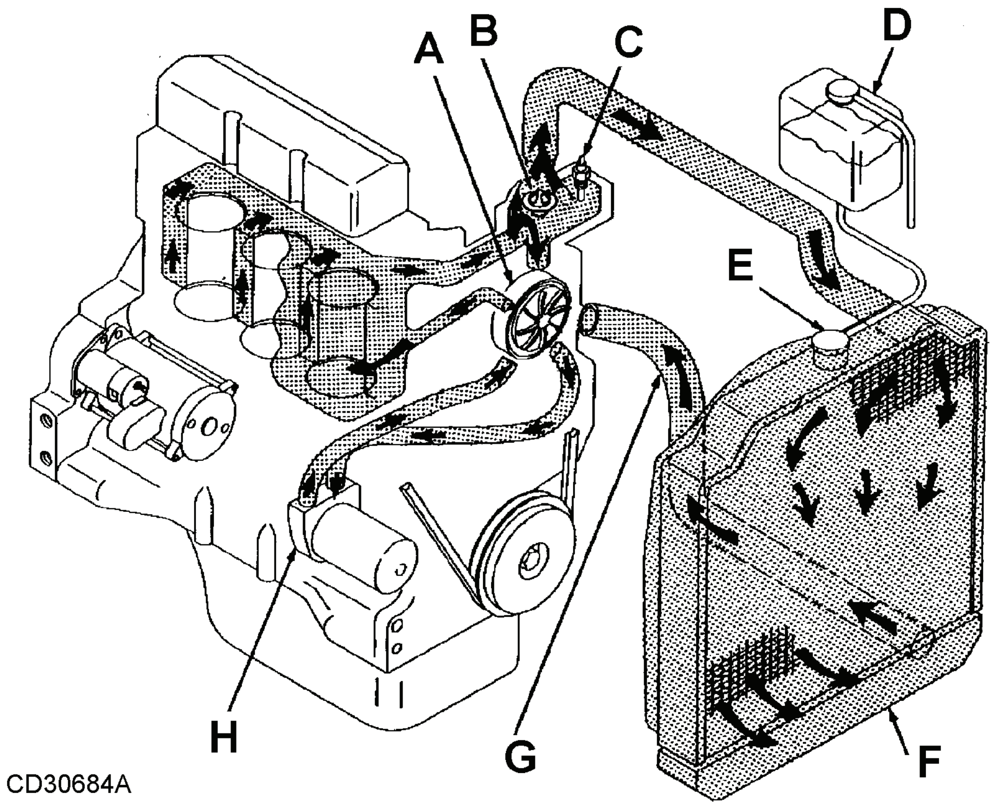


1— Oil pressure warning switch
2— Oil cooler by-pass valve
3— Oil cooler
4— Oil filter by-pass valve
5— By-pass valve
6— Oil pump
7— Oil pressure regulating valve
8— Main oil gallery
9— Lubricating oil
10— Pressure-free oil
11— Coolant from cooling system

CD30090 —UN—08MAR95

CD,3274,G205,3 -19-03NOV92-2/2

Cooling System



CD30684A —UN—27SEP04

A—Water pump
B—Thermostat
C—Coolant temperature sender
D—Coolant recovery tank (when equipped)
E—Radiator cap
F—Radiator
G—Lower radiator hose
H—Engine oil cooler

The principal components of the pressure cooling system are the radiator, water pump, multi-blade fan and thermostats.

During the warm-up period, thermostat (B) remains closed and coolant is directed through a by-pass to suction side of water pump (A). The coolant then circulates through the cylinder block and water pump only to provide a uniform and fast warm-up period.

Once the engine has reached operating temperature, the thermostats open and coolant is pumped from bottom of radiator via bottom hose into the cylinder block.

Here it circulates through the block and around the cylinder liners. From the cylinder block, coolant is then directed through the cylinder head and into thermostat housing. With the thermostat open, coolant passes through the housing and upper radiator hose into top of radiator (F) where it is circulated to dissipate heat.

On some engines the water pump has two further hose connectors which lead to the engine oil cooler (H).

CD,CTM125,211 -19-09SEP04-1/1

Section 04
Diagnostics and Tests

Contents

Diagnose Engine Malfunctions

Engine Will Not Crank

- Empty batteries
- Bad battery connections
- Defective main switch or start safety switch
- Starter solenoid defective
- Starter defective

Engine Hard to Start or Will Not Start

- Loose or corroded battery connections
- Low battery output
- Excessive resistance in starter circuit
- Too high viscosity crankcase oil
- Water, dirt or air in fuel system
- Fuel filter restricted
- Stuck shut-off knob
- Dirty or faulty fuel injection nozzles
- Defective fuel injection pump
- Defective fuel transfer pump
- Fuel injection pump incorrectly timed

Engine Runs Irregularly or Stalls Frequently

- Coolant temperature too low
- Insufficient fuel supply
- Fuel injection nozzles defective or leaking
- Fuel filter or fuel lines restricted
- Defective fuel transfer pump
- Fuel injection pump incorrectly timed
- Improper valve clearance
- Cylinder head gasket leaking
- Worn or broken compression rings
- Valves stuck or burnt
- Exhaust system restricted
- Engine compression too low
- Engine overheated
- Defective fuel injection pump

Engine Misfiring

- Water in fuel
- Mixture of petrol and diesel fuel
- Air in fuel system
- Defective fuel injection nozzles
- Defective fuel injection pump
- Fuel injection nozzles improperly installed
- Leaking fuel injection nozzle seals
- Engine overheated
- Lobes of camshaft worn
- Weak valve springs
- Worn or defective fuel transfer pump
- Pre-ignition
- Fuel injection pump incorrectly timed
- Engine compression too low
- Improper valve clearance
- Burnt, damaged or stuck valves

Lack of Engine Power

- Air cleaner restricted or dirty
- Excessive resistance in air intake system
- Fuel filter restricted
- Defective fuel transfer pump
- Defective fuel injection pump
- Defective fuel injection nozzles
- Improper crankcase oil
- Engine overheated
- Engine clutch slipping
- Defective cylinder head gasket
- Lobes of camshaft worn
- Improper valve clearance
- Improper valve timing
- Burnt, damaged or stuck valves
- Weak valve springs
- Fuel injection pump incorrectly timed
- Piston rings and cylinder liners excessively worn
- Engine compression too low
- Improper coolant temperature

Engine Overheats

- Lack of coolant in cooling system
- Radiator core and/or side screens dirty
- Loose or defective fan belt
- Defective thermostat
- Cooling system limed up
- Engine overloaded
- Fuel injection pump delivers too much fuel
- Damaged cylinder head gasket
- Fuel injection pump incorrectly timed
- Defective water pump
- Too low crankcase oil level
- Defective radiator cap

High Oil Consumption

- Oil control rings worn or broken
- Scored cylinder liners or pistons
- Excessive resistance in air intake system
- Oil flow through oil passages restricted
- Worn valve guides or stems
- Too low viscosity crankcase oil
- Excessive oil pressure
- Piston ring grooves excessively worn
- Piston rings sticking in ring grooves
- Insufficient piston ring tension
- Piston ring gaps not staggered
- Insufficient main or connecting rod bearing clearance
- Crankcase oil level too high
- External oil leaks
- Front and/or rear crankshaft oil seal faulty
- Glazed cylinder liners (insufficient load during engine break-in)

Low Oil Pressure

- Low crankcase oil level
- Leakage at internal oil passages
- Defective oil pump
- Excessive main and connecting rod bearing clearance
- Improper regulating valve adjustment
- Improper crankcase oil

Continued on next page

VP98307,0000162 -19-23MAY13-1/2

- Defective oil pressure warning switch or engine oil pressure indicator light

High Oil Pressure

- Oil pressure regulating valve bushing loose
- Stuck or improperly adjusted regulating valve
- Stuck or damaged filter by-pass valve

Excessive Fuel Consumption

- Engine overloaded
- Compression too low
- Leaks in fuel system
- Air cleaner restricted or dirty
- Fuel injection nozzles dirty or faulty
- Fuel injection pump defective (delivers too much fuel)
- Fuel injection pump incorrectly timed

Black or Grey Exhaust Smoke

- Excess fuel
- Engine overloaded
- Air cleaner restricted or dirty
- Defective muffler (causing back-pressure)
- Fuel injection nozzles dirty or faulty
- Incorrect engine timing

White Exhaust Smoke

- Engine compression too low
- Defective fuel injection nozzles
- Fuel injection pump incorrectly timed
- Defective thermostat (does not close)

Coolant in Crankcase

- Cylinder head gasket defective
- Cylinder head or block cracked
- Cylinder liner seals leaking

Abnormal Engine Noise

- Fuel injection pump incorrectly timed
- Worn main or connecting rod bearings
- Excessive crankshaft end play
- Loose main bearing caps
- Foreign material in combustion chamber
- Worn connecting rod bushings and piston pins
- Scored pistons
- Worn timing gears
- Excessive valve clearance
- Worn cam followers
- Bent push rods
- Worn camshaft
- Worn rocker arm shaft
- Insufficient engine lubrication
- Worn turbocharger bearings

Detonation or Pre-Ignition

- Oil picked up by intake air stream (intake manifold)
- Dirty or faulty fuel injection nozzles
- Incorrect fuel injection pump timing
- Fuel injection nozzle tip holes enlarged
- Fuel injection nozzle tips broken
- Carbon build-up in compression chamber

Water Pump Leaking

- Seal ring or pump shaft worn

Coolant Temperature Below Normal

- Defective thermostat
- Coolant temperature gauge defective

Engine Vibrating

- Fan blades bent
- Pump shaft worn

Soot or Sludge in the Oil

Sludge in Oil

Sludge is a result of oxidation / chemical reaction of the engine oil. Common causes of sludge are:

- Overheating of the engine oil
- Coolant in Oil
- Inadequate oil change intervals

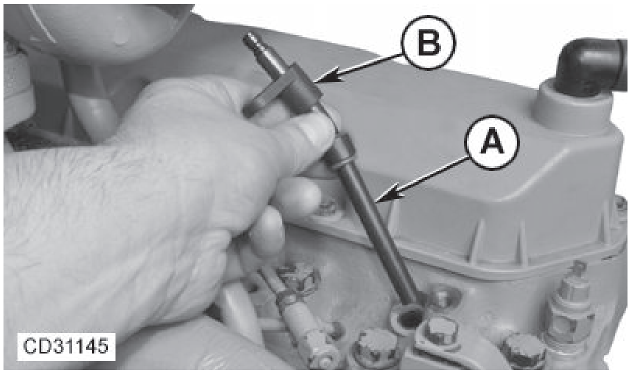
Soot in Oil

Soot is a result of incomplete combustion (partially burned fuel in the engine oil). Common causes of soot are:

- Operating the engine at light loads
- Thermostats failed in the open position
- Improper engine timing
- High elevation operation
- Failed injector
- Poor fuel quality

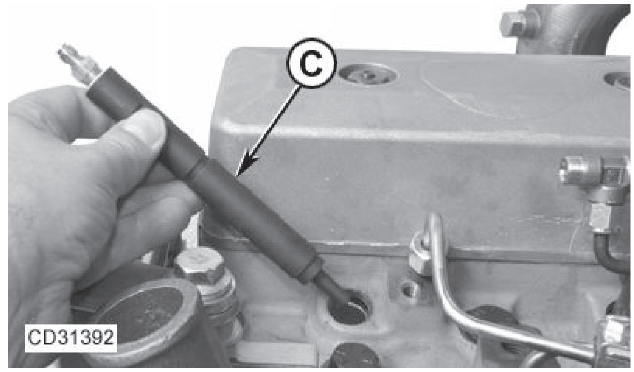
VP98307,0000162 -19-23MAY13-2/2

Check Engine Compression using JT01674A Tool (9.5 and 17 mm Injector)



CD31145 —UN—18MAR10

Install JT01679 Adapter and JT02017 Clamp



CD31392 —UN—13APR12

Install JDG11064 Adapter

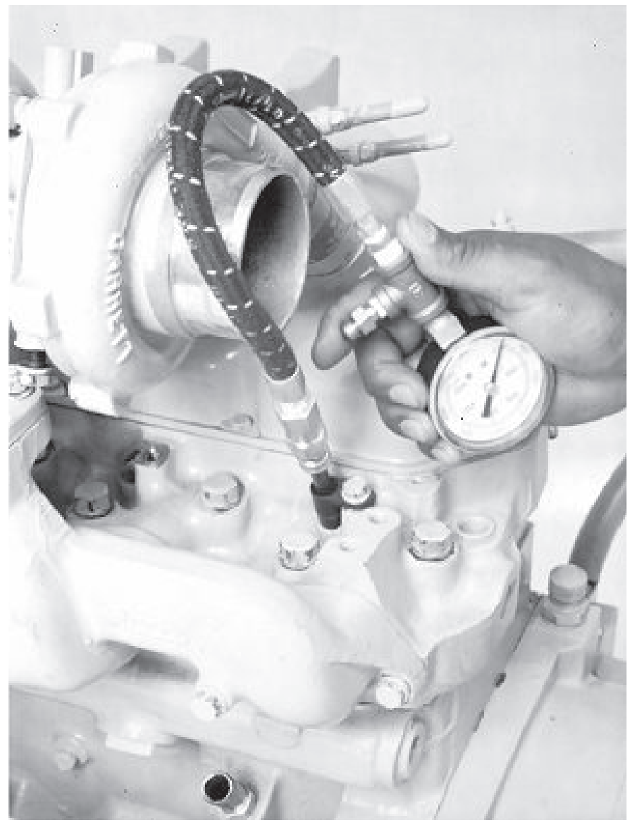
IMPORTANT: Compression pressures are affected by the cranking speed of the engine. Before beginning test, ensure that batteries are fully charged and injection nozzle area is thoroughly cleaned.

1. Start and warm engine up.
2. For 9.5 mm injector, install JT01679 adapter (A) using JT02017 holding clamp (B). Tighten hold down screw to 37 N·m (27 lb-ft).
3. For 17 mm injector, install JDG11064[1] adapter (C).
4. Attach JT07042 600 psi gauge or JT01682A 400 psi gauge to adapter.
5. Making engine not able to start, crank engine for 10—15 seconds with starter motor (minimum cranking speed 150—200 rpm).
6. Compare readings from all cylinders with specifications.

Specification

Engine Compression—Pressure	2379—2792 kPa (24—28 bar) (345—405 psi)
Maximum Difference between Cylinders	350 kPa (3.5 bar) (50 psi)

A—JT01679 Adapter
B—JT02017 Clamp
C—JDG11064[1]



RG5646 —UN—02APR90

Attach Compression Test Gauge

[1]*Not included in JT01674A Compression Test Kit.*

CD03523,000037A -19-18APR12-1/1

Check Engine Compression using FKM10021 Tool (9.5 mm Injector only)

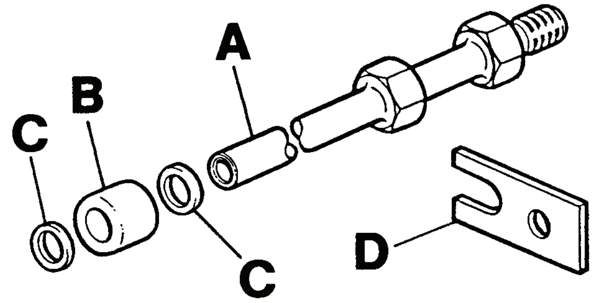
IMPORTANT: Compression pressures are affected by the cranking speed of the engine. Before beginning test, ensure that batteries are fully charged and injection nozzle area is thoroughly cleaned.

1. Start and warm engine up.
2. Install 19.58—90.578 Adapter (A) in injection nozzle bore with R73788 Nozzle Spacer (B) and two R92352 Nozzle Seals (C).
3. Secure the assembly with holding plate (D).
4. Attach FKM10022 Test Gauge (E) to adapter.
5. Making engine not able to start, crank engine for 10—15 seconds with starter motor (minimum cranking speed 150—200 rpm).
6. Compare readings from all cylinders with specifications.

Specification

Engine Compression—Pressure	2379—2792 kPa (24—28 bar) (345—405 psi)
Maximum Difference between Cylinders	350 kPa (3.5 bar) (50 psi)

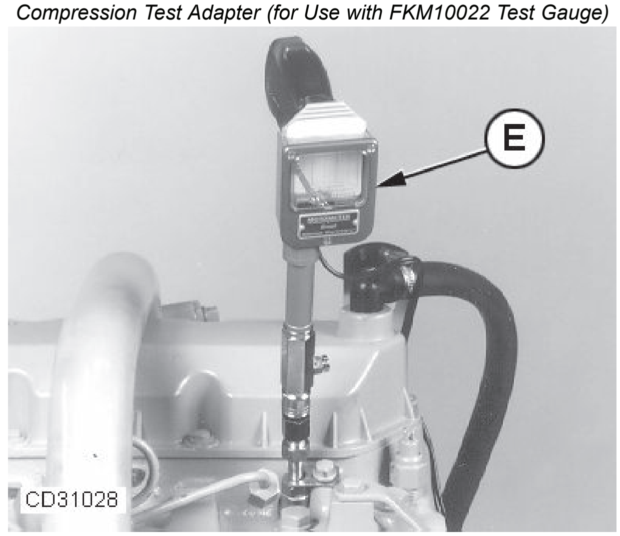
A—19.58-90.578 adapter
B—R73788 nozzle spacer
C—R92352 nozzle seal
D—Holding plate
E—FKM10022 Test gauge



CD30432

CD30432 —UN—10MAY95

Compression Test Adapter (for Use with FKM10022 Test Gauge)



CD31028 —UN—10FEB09

Check Engine Compression Using FKM10022 Test Gauge

CD03523,000037B -19-18APR12-1/1

Check Engine Oil Pressure

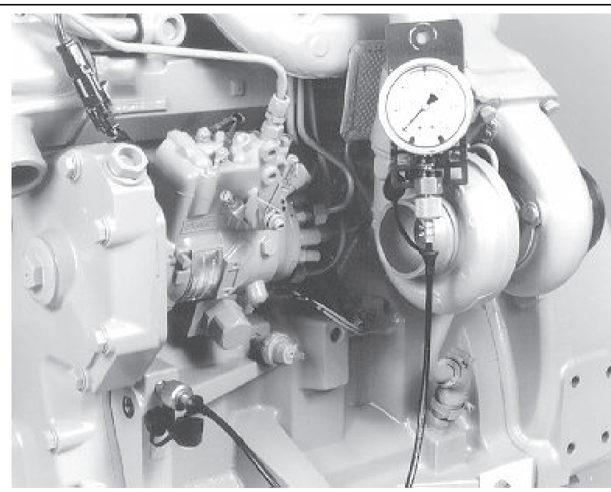
1. Before checking oil pressure, warm up engine to allow the lubricating oil to reach operating temperature.
2. Attach pressure gauge.

NOTE: Use gauge from FKM10002 or JT05470 Universal pressure test kit if available. Otherwise, use gauge with a reading range of 0—600 kPa (0—6 bar; 0—87 psi) minimum.

3. At 93°C (200°F) operating temperature, gauge should show a minimum pressure as specified.

Engine oil pressure (minimum)—Specification

At 800 rpm—Pressure	100 kPa (1 bar; 15 psi)
At rated speed (1500 or 1800 rpm)—Pressure	275 kPa (2.75 bar; 40 psi)
At rated speed (more than 1800 rpm)—Pressure	350 kPa (3.5 bar; 50 psi)



CD30686 —UN—04MAY98

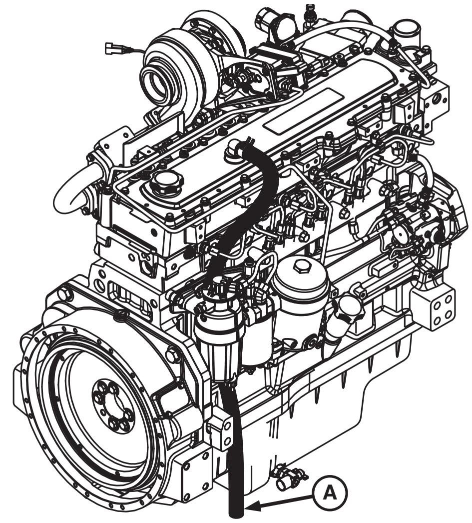
CD,CTM125,217 -19-16FEB01-1/1

Check for Excessive Engine Crankcase Pressure (Blow-By) (Base Pressure)

1. Combustion gas or air entering the crankcase creates higher than normal crankcase pressure.
2. Symptoms: Excessive amount of fluid or gas is exiting the crankcase breather tube (A).
3. Maximum crankcase pressure specification (open vent system) : 50.8 mm (2 in.) water.
4. Excessive blow-by coming out of the crankcase breather tube (A) indicates an issue with one of the following :
   - Piston ring to cylinder liner sealing
   - Cylinder head valve guide wear
   - Turbocharger sealing (if equipped)
   - Auxiliary air compressor (if equipped)
   - Intake manifold boost leak (4024 and 5030 Engines Only)

NOTE: There are multiple ways of measuring crankcase pressure based on engine oil fill / dipstick configurations and tool availability.

- JT05697A manometer.



Crankcase Breather Tube

RG14156 —UN—18APR05

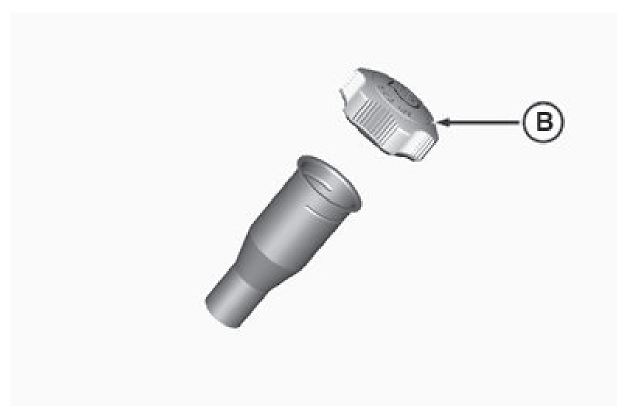
A—Breather Tube

- Clear, flexible tubing, dimensions 6.35 mm (1/4 in.) inner dimension (ID) diameter, minimum 91.44 cm (3 ft.).

RK82052,0000130 -19-21AUG12-1/13

- DFRG9 oil fill cap adapter (see TM11119) if the engine is configured with threaded oil fill cap (B).

B—Threaded Oil Fill Cap



Threaded Oil Fill Cap

RG21751 —UN—03AUG12

RK82052,0000130 -19-21AUG12-2/13

Crankcase Pressure (Blow-By) Diagnostic Procedure

RK82052,0000130 -19-21AUG12-3/13

1 Check Engine Oil Level	*NOTE: Excessive fluid in the oil pan sump allows the crankshaft to dip resulting in excessive fluid exiting the breather tube, known as Oil Carry Over.* Does the oil level register above the full marks on the dipstick?	**YES:** Determine source of excessive fluid and correct issue. Overfill of engine oil, see Observable Diagnostics and Test Section of CTM : Coolant in oil, Fuel in oil. **NO:** GO TO 2.

Continued on next page RK82052,0000130 -19-21AUG12-4/13

❷ **Dirt Ingestion Inspection**	*NOTE: Dirt ingestion also know as "dusted engine" identifiable by looking for dirt in the intake manifold or turbo compressor inlet. Dirt ingestion leads to piston liner wear. See Turbo inspection, Mechanical compression test.* Are there signs of dirt ingestion?	**YES:** Repair engine per the CTM. **NO:** GO TO 3.

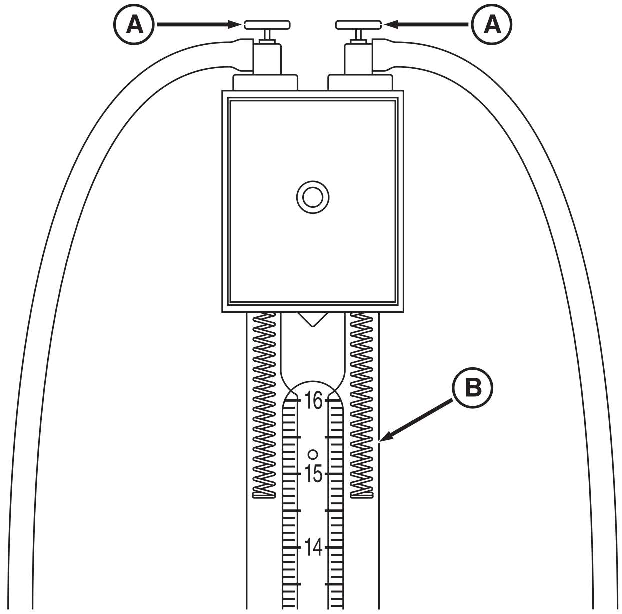
Continued on next page RK82052,0000130 -19-21AUG12-5/13

3 Perform Measure Crankcase Pressure Test

NOTE: This test can be performed using JT05697A manometer or with a clear, flexible plastic tubing.

Manometer crankcase pressure test

1. Disconnect the vent line between the rocker arm cover and the crankcase ventilation filter unit if equipped.



RG18176 —UN—09MAR10

JT05697A Manometer

A—Valves Built Into Hose Adapter
B—Manometer Scale

2. Prepare the JT05697A manometer with the appropriate water/dye mix using the directions supplied with the manometer.
3. Attach the manometer securely in an upright position next to the engine.
4. Install the DFRG9 threaded oil fill cap adaptor in place of the oil fill cap on the engine if equipped and connect one of the plastic hoses from the manometer to the adaptor. If not then use a 12 in. (300 mm) piece of 3/8 in. internal diameter clear tube and a 3/8 in. to 1/4 in. barb fitting to connect the manometer to the dipstick tube.

IMPORTANT: Make sure that the manometer valve attached to the oil fill or dipstick tube is closed before starting the engine. Failure to do so could allow the water in the manometer to be sucked into the engine while starting. Close both valves when the testing is completed to avoid losing the water/dye mix.

NOTE: Fluid travel is calculated by adding the travel of the fluid on both sides of the manometer. If the fluid travel exceeds 50.8 mm (2 in) at any time during the test discontinue test.

5. Ignition ON, Engine running.
6. Open both valves on the manometer. Let the engine stabilize at low idle. Observe the fluid travel in the manometer.
7. Slowly load the engine in small increments. If not possible to load the engine, slowly advance the idle speed in approximately 350—400 rpm increments instead. Stabilize the engine at each increment and record the amount of fluid travel in manometer. Continue to as near as possible full load or high idle.
8. Ignition OFF, Engine OFF.

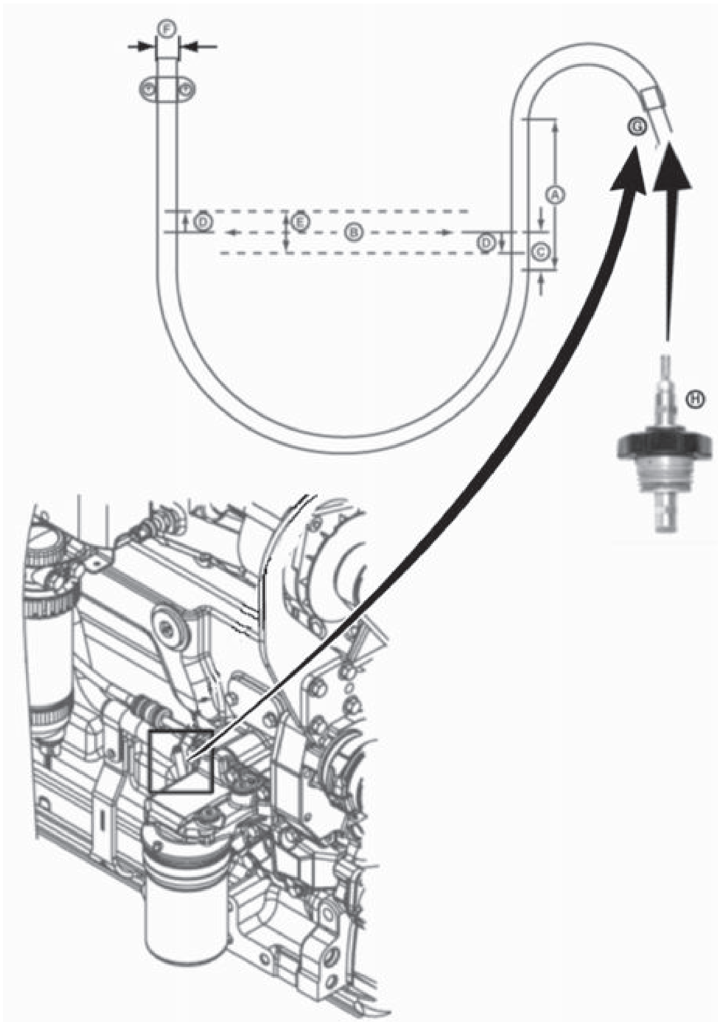
YES: Close the valve on the manometer that is connected to the flexible tubing. GO TO 4

Continued on next page

RK82052,0000130 -19-21AUG12-6/13

	At any time during test, did total fluid travel exceed 50.8 mm (2 in.)?	**NO:** The crankcase pressure meets John Deere application guidelines. Either return to original diagnostic procedure, or return to customer.

Clear Plastic Tube Crankcase Pressure Test



RG21741 —UN—06AUG12

Pressure Test

A—30.5 cm (12 in.) Vertical Tubing, Both Sides
B—Fluid Level Prior to Start of Test
C—Minimum 76.2 mm (3 in.) Vertical Fluid Prior to Start of Test
D—Maximum Allowable Vertical Fluid Travel 25.4 mm (1.0 in.) Each Side
E—Max. Allow. Total Vertical Fluid Travel 50.8 mm (2.0 in.) Both Sides
F—9.5 mm (0.375 in.) outer dimension, 6.35 mm (1/4 in.) inner dimension Tubing (minimum length 91.4 cm (3 ft..))
G—Oil Dipstick Tube
H—DFRG9 Oil Filler Cap Adapter

1. Disconnect the vent line between the rocker arm cover and crankcase ventilation filter unit if equipped.
2. Remove dipstick and attach tubing (F) to dipstick tube (G) or install DFRG9 oil filler cap adapter (H) and attach tubing (F) to barbed fitting.
3. Attach other end of tubing to a fixed panel, brace, or other firm surface, forming a "U", as shown above. On both sides, and opposite each other, the tubing must be vertical (A) for 30.5 cm (12 in.). Ensure that tubing is completely open, with no kinks or pinches in it.

Continued on next page

RK82052,0000130 -19-21AUG12-7/13

	4. Pour enough liquid into tube to allow a level of from 76.2 mm (3 in.) to 152.4 mm (6 in.) up both vertical sides of the tube (C). Mark the fluid level. Measure down 25.4 mm (1 in.) from fluid level in tube side nearest to the dipstick tube, and mark it. Measure up 25.4 mm (1 in.) from fluid level in tube side farthest from the dipstick tube, and mark it (D). *NOTE: If at any time during this test, prior to the end, fluid travel exceeds the total (50.8 mm (2.0 in.) both sides) maximum allowable travel, it is not necessary to continue this test.* Perform crankcase pressure test, as follows: 5. Ignition ON, engine ON. Let engine stabilize, at low idle, and observe total fluid travel for both sides (E). 6. Slowly load the engine in small increments. If possible to load the engine, slowly advance the idle speed in approximately 350—400 rpm increments instead. Stabilize the engine at each increment and record the amount of fluid travel in manometer. Continue to as near as possible full load or high idle. 7. Ignition OFF, Engine OFF.	
	At any time during test did total fluid travel exceed 50.8 mm (2 in.) ?	**YES:** GO TO 4 **NO:** The crankcase pressure meets John Deere application guidelines. Either return to original diagnostic procedure, or return to customer.

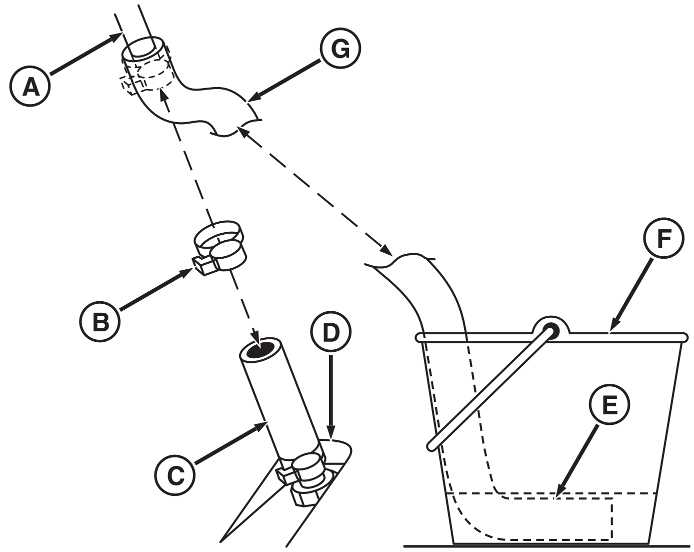
Continued on next page RK82052,0000130 -19-21AUG12-8/13

4 Turbocharger Seal Leakage Diagnostic Test (If Equipped). If there is no turbocharger GO TO 5

If the turbocharger oil seals are leaking, intake air or exhaust pressure can be passing through the seals, through the oil drain line, and into the crankcase. This would add to the overall crankcase blow-by reading.

IMPORTANT: Test turbocharger carefully watching the oil level in the engine and the bucket.

NOTE: Check turbocharger one at a time in case engines is equipped with dual turbochargers (series turbochargers).

1. 

RG15142A —UN—01OCT08

Remove Turbocharger Oil Return Flexible Hose

A—Turbocharger Oil Return Rigid Tubing
B—Clamp
C—Turbocharger Oil Return Flexible Tubing
D—Crankcase
E—Clean Engine Oil, 3.8 Liters (1.0 gallon)
F—19 Liter (5-gallon) Bucket
G—Test Flexible Tubing

Ignition OFF, Engine OFF.

2. Remove the turbocharger oil drain line (C) where it connects to the engine block.
3. Install a flexible tube on the end of the oil drain line just disconnected.
4. Block the turbo charger oil drain line opening on the engine block.
5. Obtain a bucket (F) and place it on the ground or floor near the turbocharger oil drain line.
6. Install the free end of the flexible tubing (G) into the bucket making sure that the tubing lies at the bottom of the bucket.

IMPORTANT: Be very careful to assure that the flexible tubing does not kink or restrict the oil flow in the turbocharger oil drain line at any time. If the line is restricted, the turbocharger could be damaged.

IMPORTANT: Fill the engine oil to the correct level. The turbocharger oil drains into the bucket when you run the engine so make sure that the engine does not run low on oil during this test. Also, make sure that the bucket does not overflow or spill. Shut down the engine and add oil back into the engine from the bucket if necessary as the testing continues.

7. With either manometer or clear flexible line connected. Ignition ON, Engine ON.
8. Slowly load the engine in small increments. If not possible to load the engine, slowly advance the idle speed in approximately 350—400 rpm increments instead. Stabilize the engine at each increment and record the amount of fluid travel in manometer. Continue to as near as possible full load or high idle.
9. Monitor crankcase pressure and check for bubbles appearing in the bucket.

Continued on next page

RK82052,0000130 -19-21AUG12-9/13

	10. Ignition OFF, Engine OFF. 11. Refill engine oil level. 12. Re-configure engine to specification. At any time during test did total fluid travel exceed 50.8 mm (2 in.) and excessive amount of bubbles observed in the bucket?	**YES:** GO TO 5. **NO:** Replace Turbocharger.

RK82052,0000130 -19-21AUG12-10/13

5 Auxiliary Air Compressor Test (If equipped). If there is no air compressor GO TO 6	1. Remove air compressor. 2. Ignition On, Engine On. 3. Slowly load the engine in small increments. If not possible to load the engine, slowly advance the idle speed in approximately 350—400 rpm increments instead. Stabilize the engine at each increment and record the amount of fluid travel in manometer. Continue to as near as possible full load or high idle. 4. Remove load and turn to low idle. 5. Ignition OFF, Engine OFF. At any time during test did total fluid travel exceed 50.8 mm (2 in.)?	**YES:** GO TO 6. **NO:** Replace air compressor.

RK82052,0000130 -19-21AUG12-11/13

6 Rocker-Arm Cover Inspection (4024 and 5030 ONLY). If the engine is not a 4024 or 5030 GO TO 7	1. Remove rocker arm cover inspect areas that indicate poor sealing or pressurized air leaking into crankcase. If there is an indication of poor sealing or a leak path: 1. Clean surface of rocker arm cover and head. 2. Apply sealant and reassemble. 3. Allow sealant to completely cure and perform Measure Crankcase Pressure Test. 2. Inspect for oil coking or carbon build-up near injectors. 1. Replace injector seals on injectors that have coking or carbon build-up. 2. Clean surface of rocker arm cover and head. 3. Apply sealant and reassemble. 4. Allow sealant to completely cure and perform Measure Crankcase Pressure Test. Did the rocker-arm cover inspection correct the issue?	**YES:** Return engine to service. **NO:** GO TO 7

RK82052,0000130 -19-21AUG12-12/13

7 Perform Compression Test. Refer to the appropriate manual and perform compression test	*NOTE: Engine can have low compression and not have dirt ingestion due to:* • *Improper engine break-in (Glazed liners)* • *Broken piston rings* • *Piston ring installed on piston with wrong side facing up* • *Piston ring gaps aligned* • *Liner wear* • *Piston ring wear* Did engine pass compression test?	**YES:** Refer to the appropriate Base Engine Manual on procedure for measuring valve stems and valve guides. **NO:** Repair per CTM.

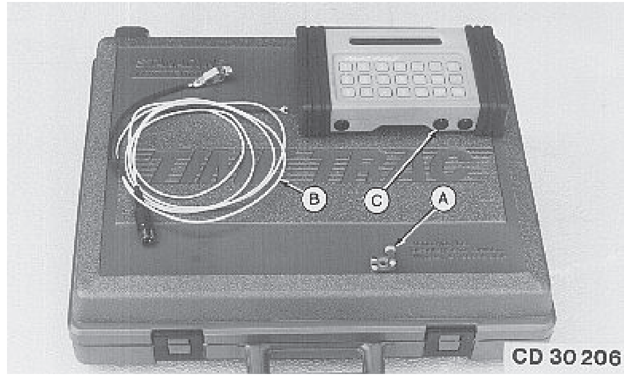
RK82052,0000130 -19-21AUG12-13/13

Using Stanadyne “TIME-TRAC” as Tachometer

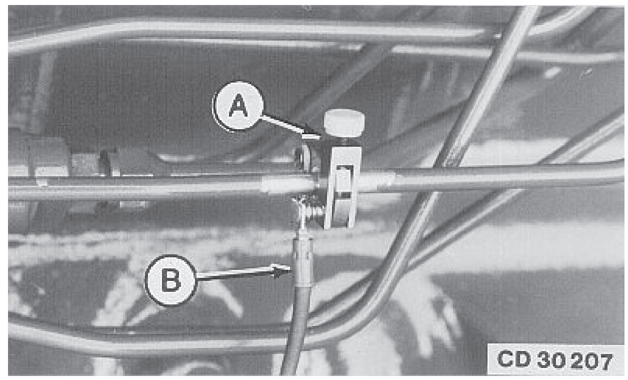
The STANADYNE “TIME-TRAC” meter can be used as a tachometer by using clamp-on transducer FKM10429-5 (A) on any high-pressure line.

Operating Instructions

1. Remove paint and thoroughly clean the area of the high-pressure line to which the clamp-on transducer is to be attached.
2. Install transducer (A) and connect cable FKM10429-3 (B) between transducer and socket meter (C). Also connect ground wire.
3. Switch on the meter by pressing the “ON/CLEAR” key and start the engine.



CD30206 —UN—07MAR95



CD30207 —UN—07MAR95

A—Clamp-on transducer FKM10429-5
B—Cable FKM10429-3
C—Timing meter FKM10429-1

CD,3274,G210,10 -19-10FEB09-1/1

Using JDG10534 TACH-N-TIME as Tachometer

NOTE: JDG10534 TACH-N-TIME Dynamic Timing Tool is no longer available. Now, order JDG11411 TACH-N-TIME kit.

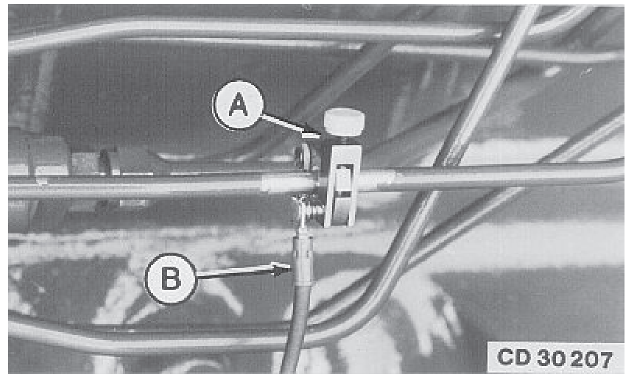
The TACH-N-TIME™ (JDG10534) meter can be used as a tachometer by using clamp-on transducer (A) on any high-pressure fuel injection line.

1. Remove paint and thoroughly clean the area of the high-pressure line to which the clamp-on transducer is to be attached.
2. Install transducer (A) on high-pressure fuel injection line.
3. Connect electrical cable (B) between transducer and meter port marked SENSOR SIGNAL (C). Set injection monitoring method switch to the CLAMP-ON PICK-UP position (D).
4. Connect the spring clip to a solid ground.

CAUTION: Do not connect TACH-N-TIME™ meter to 24 volt systems. Connect directly to the positive and negative terminals of the injection pump itself or other 12 volt system source.

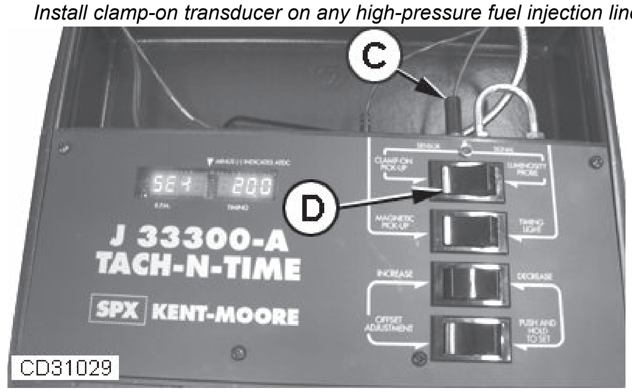
5. Connect the TACH-N-TIME™ battery leads to a 12 volt power source. Red to positive (+) and black to negative (-).
6. Start the engine to measure and record engine speed.

TACH-N-TIME is a trademark of SPX Corp.



CD30207 —UN—07MAR95

Install clamp-on transducer on any high-pressure fuel injection line



CD31029 —UN—10FEB09

Connect transducer cable to meter

A—Clamp-on transducer
B—Transducer cable
C—SENSOR SIGNAL port
D—CLAMP-ON PICK-UP position

CD03523,00001CC -19-16AUG12-1/1

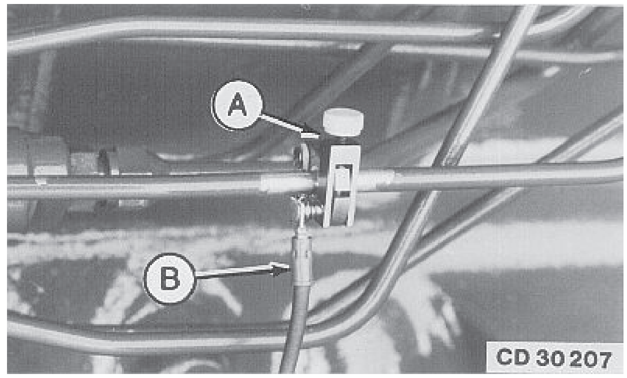
Using JDG11411 TACH-N-TIME as Tachometer

The TACH-N-TIME™ (JDG11411) meter can be used as a tachometer by using clamp-on transducer (A) on any high-pressure fuel injection line.

1. Remove paint and thoroughly clean the area of the high-pressure line to which the clamp-on transducer is to be attached.
2. Select proper transducer (A) according to the fuel line diameter, then install it.
3. Connect electrical cable (B) between transducer and meter port marked SENSOR SIGNAL (C).
4. Connect the spring clip to a solid ground.

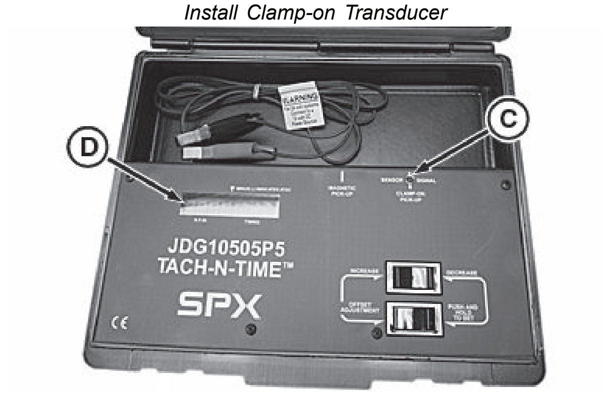
CAUTION: Do not connect TACH-N-TIME™ meter to 24 volt systems. Connect directly to the positive and negative terminals of the injection pump itself or other 12 volt system source.

5. Connect the TACH-N-TIME™ battery leads to a 12 volt power source. Red to positive (+) and black to negative (-).
6. Start the engine to measure and record engine speed from the digital display panel (D).



CD30207 —UN—07MAR95

Install Clamp-on Transducer



RG21818 —UN—14AUG12

Connect Transducer Cable to Meter

A—Clamp-on Transducer
B—Transducer Cable
C—SENSOR SIGNAL Port
D—Digital Display Panel

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CD03523,0000383 -19-23AUG12-1/1

Inspect Thermostat and Test Opening Temperature

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

Test thermostat as follows:

1. Remove thermostat.

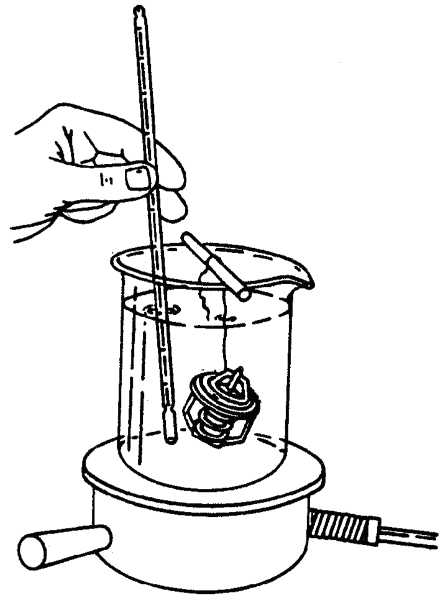
CAUTION: DO NOT allow thermostat or thermometer to rest against the side or bottom of container when heating water. Either may rupture if overheated.

2. 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)

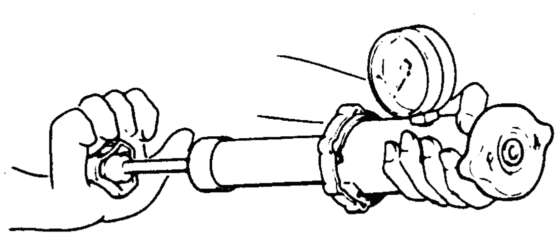


RG5971 —UN—23NOV97

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.

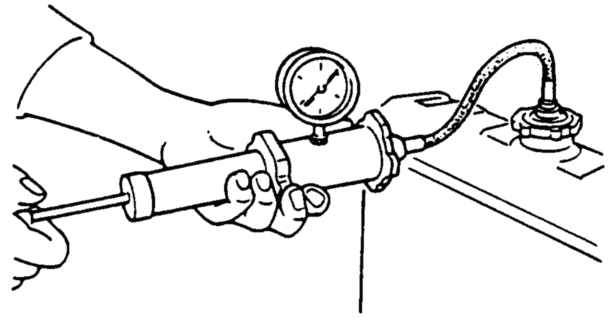
CD,CTM125,229 -19-01DEC97-1/1

Pressure Test Cooling System and Radiator Cap



RG6557 —UN—20JAN93

Pressure Testing Radiator Cap



RG6558 —UN—20JAN93

Pressure Testing Radiator

CAUTION: Explosive released fluids from pressurized cooling system can cause serious burns.

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

Test Radiator Cap:

1. Remove radiator cap and attach to D05104ST Pressure Pump as shown.
2. Pressurize cap to the following specification.[1]

Specification

Cooling System	
Test—Pressure	70 kPa (0.7 bar) (10 psi)

Gauge should hold pressure for 10 seconds within the normal range. If gauge does not hold pressure, replace radiator cap.

Test Cooling System:

NOTE: Engine should be warmed up to test overall cooling system.

[1]Test pressures recommended are for all Deere OEM cooling systems. On specific vehicle applications, test cooling system and pressure cap according to the recommended pressure for that vehicle.

1. Allow engine to cool, then carefully remove radiator cap.
2. Fill radiator with coolant to the normal operating level.

IMPORTANT: DO NOT apply excessive pressure to cooling system. Doing so may damage radiator and hoses.

3. Connect gauge and adapter to radiator filler neck. Pressurize cooling system as specified, using D05104ST Pressure Pump.
4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

   If leakage is detected, correct as necessary and pressure test system again.

   If no leakage is detected, but the gauge indicated a drop in pressure, coolant may be leaking internally within the system or at the block-to-head gasket.

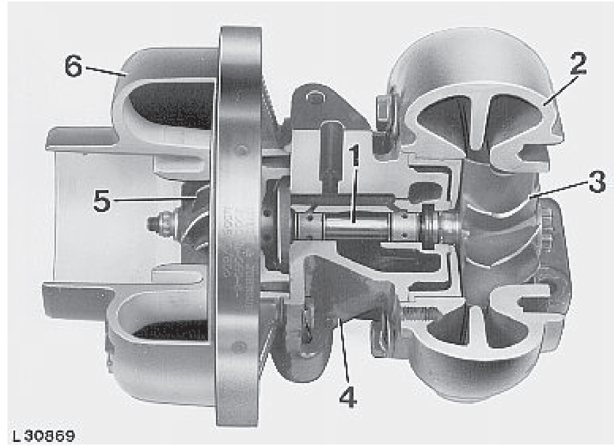
CD03523,0000119 -19-21JUN12-1/1

Turbocharger Operation

The turbine wheel (3) is driven by the hot engine exhaust gases. These gases flowing through the turbine housing (2) act on the turbine wheel causing shaft (1) to turn.

Compressor wheel (5) sucks in filtered air and discharges the compressed air into the intake manifold where it is then delivered to engine cylinders.

Engine oil under pressure from the engine lubrication system is forced through passages in center housing (4) to the bearings.

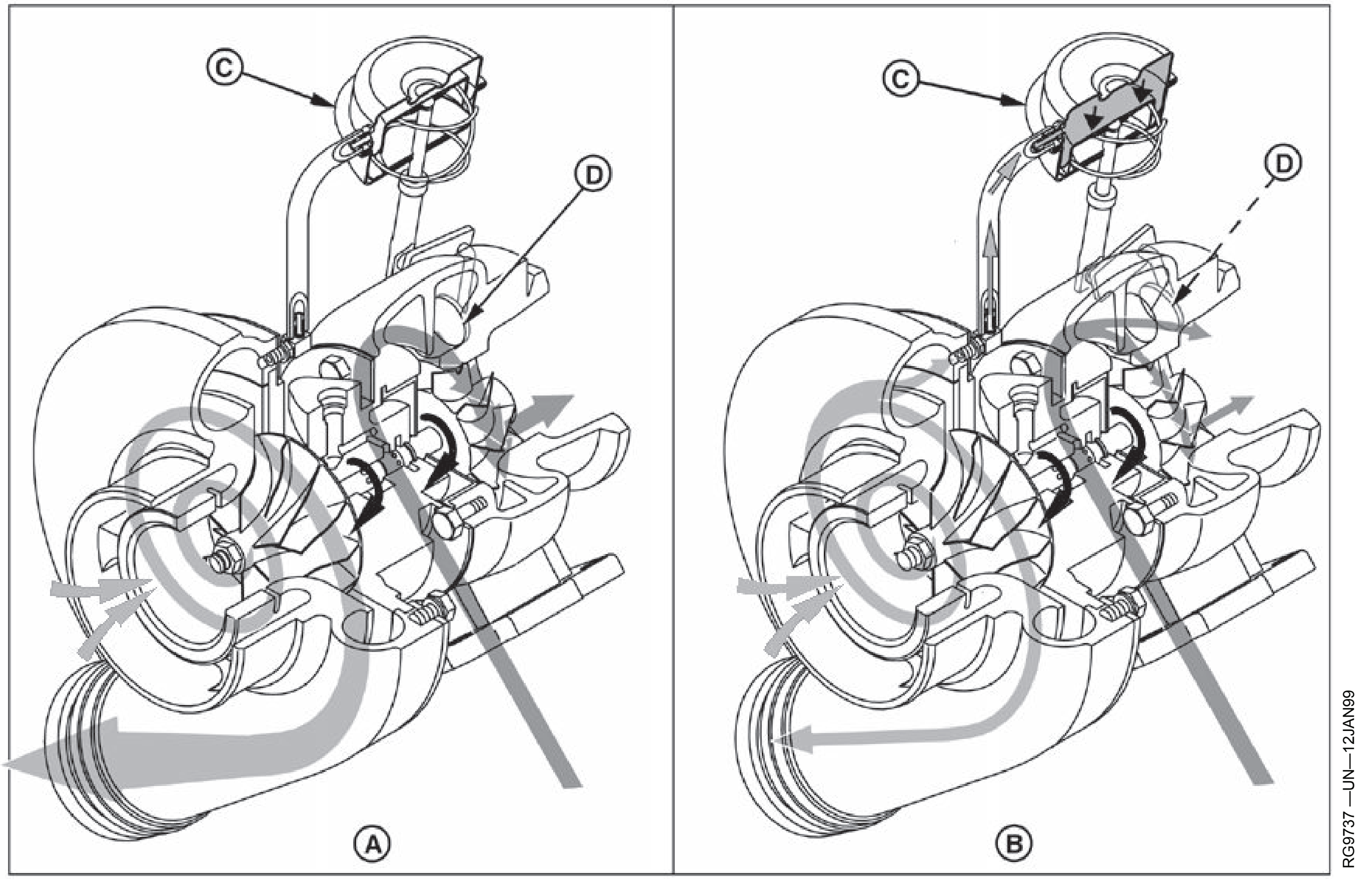


L30869 —UN—23MAY95

1— Shaft
2— Turbine housing
3— Turbine wheel
4— Center housing
5— Compressor wheel
6— Compressor housing

CD,3274,G215,2 -19-16MAY92-1/1

Wastegate Operation



A—Wastegate closed **B—Wastegate open** **C—Diaphragm** **D—Valve**

Some applications have a wastegate actuator (bypass) valve (D) to help control turbine speed and boost at high engine rpm operation. This device is integral to the turbine housing and is diaphragm (C) activated.

The wastegate actuator is precisely calibrated and opens a valve to direct some (excess) exhaust gas flow around the turbine wheel to be released from the turbine housing. This limits shaft speed which in turn controls boost pressure.

The valve allows the system to develop peak charge-air pressures for maximum engine boost response while eliminating the chance of excessive manifold pressure (over-boost) at high speeds or loads.

CD03523,0000140 -19-09SEP04-1/1

Test Turbocharger Wastegate

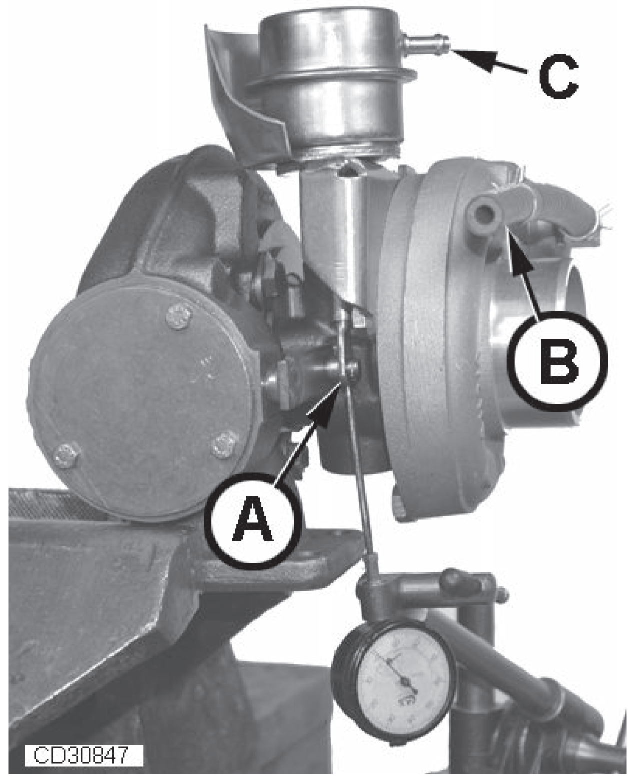
NOTE: Depending on application, it may be necessary to remove the turbocharger from the engine to get access to the push rod end of wastegate actuator (A).

1. Check hose (B) to wastegate actuator for kinks or cracks. Replace if damaged.
2. Disconnect hose from wastegate actuator.
3. Install a dial indicator as shown to measure the push rod travel.
4. Connect a regulated air source to actuator fitting (C).
5. Pressurize actuator to 114 kPa (1.14 bar; 16.5 psi) and compare push rod travel with specifications.

Specification

Wastegate push rod travel at 114 kPa (1.14 bar; 16.5 psi)—Distance................. 0.13 to 0.63 mm (0.005 to 0.025 in.)

If push rod travel in not within specifications, have turbocharger checked by a specialized repair shop or replace turbocharger.



CD30847 —UN—16NOV04

CD03523,000014A -19-17NOV04-1/1

Check Turbocharger Boost Pressure

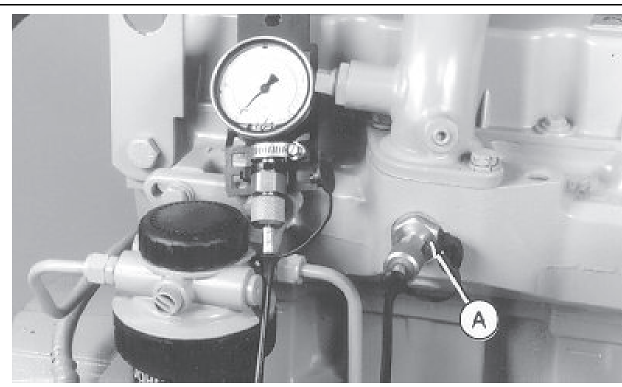
Attach pressure gauge (A) from FKM10002 (or JT05470) Universal Pressure Test kit, to any air inlet port.

Before checking boost pressure, warm up engine to allow the lubricating oil to reach operating temperature.

When engine is developing rated horse power at full load speed, observe pressure reading on gauge and compare with specification.

If the reading is low, check the following:

- Restriction in the air cleaner
- Leak in air intake system between turbocharger and cylinder head
- Defective turbocharger



CD30687 —UN—04MAY98

CD,CTM125,220 -19-19FEB01-1/1

Diagnosing Turbocharger Malfunctions

Lack of Engine Power

- Clogged manifold system
- Foreign material lodged in compressor, impeller or turbine
- Excessive dirt build-up in compressor
- Leak in engine intake or exhaust manifold
- Rotating assembly bearing failure

Engine Emits Black or Grey Smoke

- Excessive build-up in compressor or turbine
- Turbine housing cracked or attaching screws loose
- Exhaust manifold gaskets blowing

Oil on Compressor Wheel or in Compressor Housing (Oil Being Forced Through Center Housing)

- Excessive crankcase pressure
- Air intake restriction

Oil Dripping from Housing in Intake or Exhaust Manifold

- Damaged or worn journal bearings
- Rotating assembly unbalanced
- Damage to turbine or compressor wheel or blade
- Dirt or carbon build-up on wheel or wheels
- Bearing wear
- Oil starvation or insufficient lubrication
- Shaft seals worn
- Excessive crankcase pressure

Noise or Vibration

(Do not confuse the whine heard during rundown with noise which indicates a bearing failure).

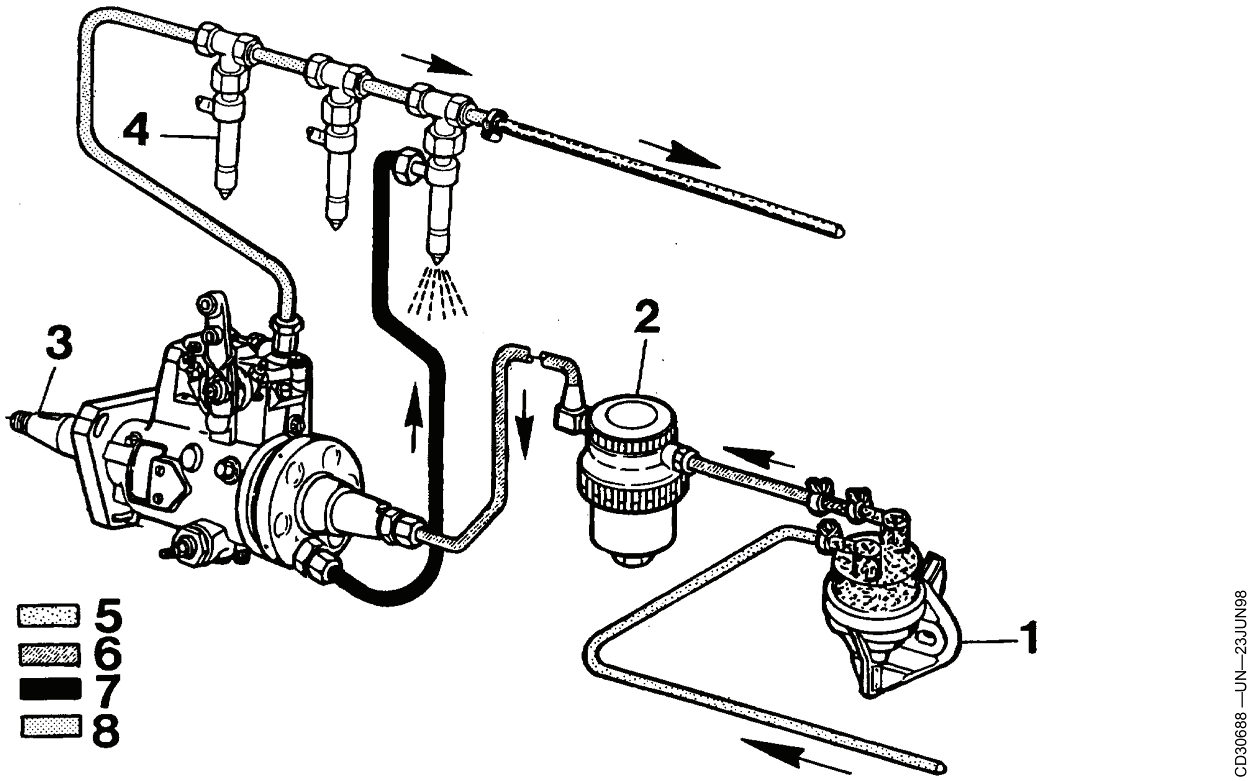
- Bearings not lubricated (insufficient oil pressure)
- Air leak in engine intake or exhaust manifold
- Improper clearance between turbine wheel and turbine housing
- Broken blades (or other wheel failures)

Drag in Turbine Wheel

- Carbon build-up behind turbine wheel caused by coked oil or combustion deposits
- Dirt build-up behind compressor wheel caused by air intake leaks
- Bearing seizure or dirty or worn bearings caused by excessive temperatures, unbalanced wheel, dirty oil, oil starvation, or insufficient lubrication.

CD,3274,G215,4 -19-15MAY92-1/1

General Operation (Rotary Fuel Injection Pump)



1— Fuel transfer pump (when equipped)
2— Fuel filter
3— Fuel injection pump
4— Fuel injection nozzle
5— Gravity pressure
6— Fuel transfer pump pressure
7— Fuel injection pump pressure
8— Return fuel pressure

The fuel transfer pump (1), when equipped, draws fuel from the tank and pressurizes it. This pressure permits the fuel to flow through the filter (2) and charge the transfer pump of the injection pump (3).

With the fuel injection pump charged with fuel by the fuel transfer pump, the injection pump plungers pressurize the fuel to approximately 50000 kPa (500 bar; 7255 psi). Delivery (pressure) lines are used to route this high pressure fuel to the fuel injection nozzles (4).

Fuel enters the injection nozzle at a pressure which easily overcomes the pressure required to open the nozzle valve. When the nozzle valve opens, fuel is forced out through the orifices in the nozzle tip and atomizes as it enters the combustion chamber.

Incorporated into the fuel system is a means of returning excess (or unused) fuel back to the fuel tank. Excess fuel comes from two sources:

1. Fuel injection pump: A quantity of fuel greater than that required by the engine is supplied to the fuel injection pump.
2. Fuel injection nozzles: A small amount of fuel seeps past the nozzle valve for lubrication purposes.

To get the excess fuel back to the tank, a return line from the injection pump is connected to the middle of the nozzle leak-off line. Fuel from both sources is then returned to the tank by a return pipe connected to the front end of the leak-off pipe.

CD,CTM125,222 -19-23JUL13-1/1

Fuel Supply Pump Operation (Rotary Fuel Injection Pump)

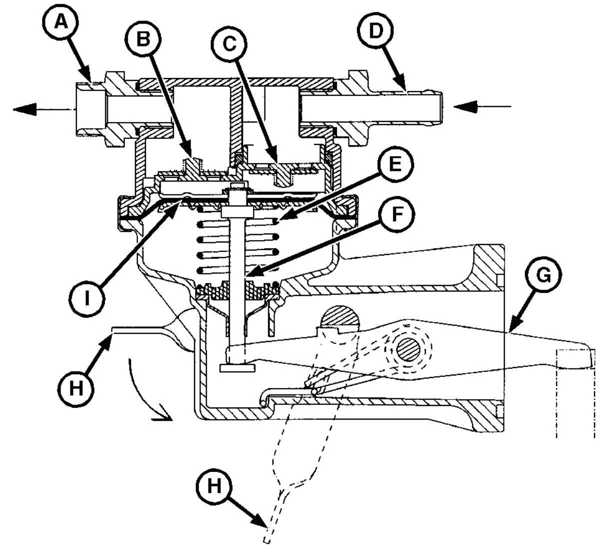
The fuel supply pump used with Delphi/Lucas and Stanadyne rotary fuel injection pumps uses an eccentric lobe on the engine camshaft to operate lever (G) on supply pump to pressurize fuel system.

Fuel flows from the fuel tank at gravity pressure to the inlet side (D) of the diaphragm-type pump.

As lever (G) rides on the high side of the camshaft lobe, rod (F) pulls diaphragm (I) down. Suction pressure opens the inlet check valve (C) and fuel is drawn into the pump.

As the camshaft lobe rotates to the low side, return spring (E) forces diaphragm (I) upward. The resulting fuel pressure closes inlet check valve (C) and opens outlet check valve (B), delivering fuel through outlet (A) to the injection pump.

Hand primer lever (H) is provided for manually forcing fuel through the system to bleed air from the fuel filter, lines... etc.



RG9119 —UN—17APR98

A—Fuel outlet
B—Outlet check valve
C—Inlet check valve
D—Fuel inlet
E—Return spring
F—Rod
G—Lever
H—Hand primer lever
I— Diaphragm

CD03523,0000141 -19-09SEP04-1/1

Measure Fuel Supply Pump Pressure (Rotary Fuel Injection Pump)

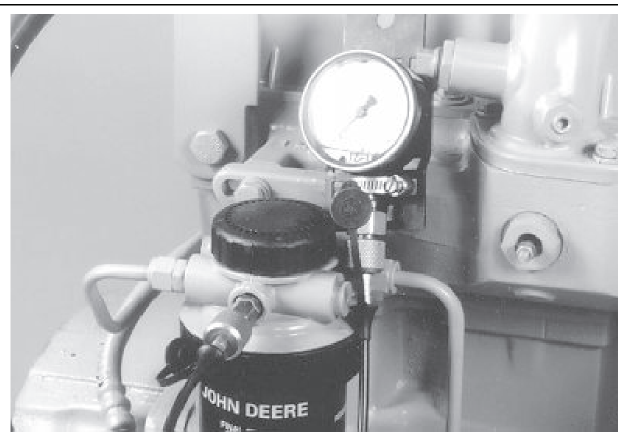
1. Remove plug on fuel filter base.
2. Install test equipment as shown.
3. Start engine. Fuel pump should maintain a positive minimum pressure as specified.

Specification

Fuel supply pump (Rotary fuel injection pump)—Pressure.................... 15—30 kPa (0.15—0.30 bar; 2—4.5 psi)

A low pressure can be due to a clogged filter element or a defective supply pump. Replace first the filter element then recheck pressure.

NOTE: The fuel supply pump is not repairable and therefore should be replaced when defective.



CD30690 —UN—19MAY98

CD,CTM125,225 -19-10SEP04-1/1

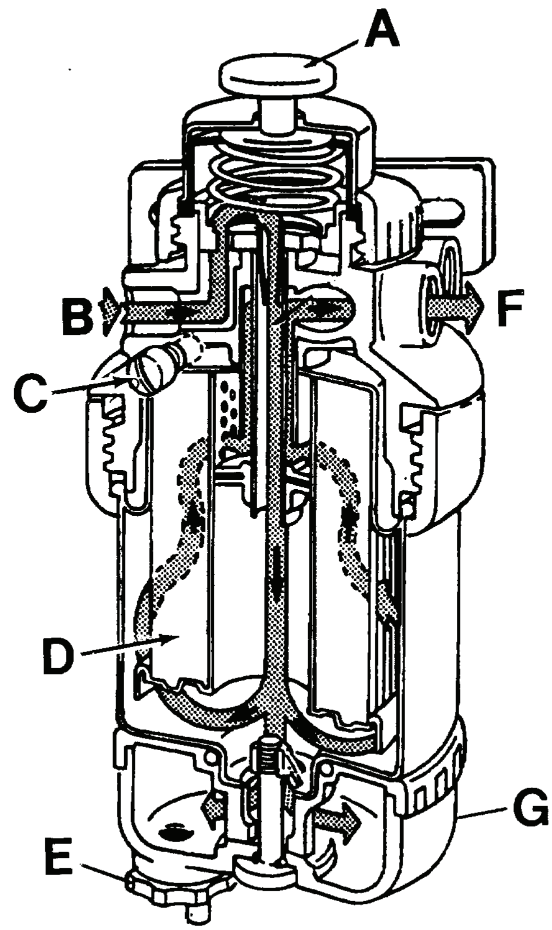
Fuel Filter Operation (Rotary Fuel Injection Pump)

Fuel enters the filter at (B) and flows through a filter media (D) before flowing through outlet (F) to the fuel injection pump. The filter media is housed in a metal sediment bowl and are glued to the bowl as one assembly.

Since water and other contaminants may settle at the bottom of the sediment bowl, a drain plug (E) is provided to permit their removal.

A bleed screw (C) enables air in the system to be expelled to the outside through the filters when the bleed plug is removed.

When equipped, the priming pump (A) supplies fuel from filter to injection pump to bleed the fuel system.

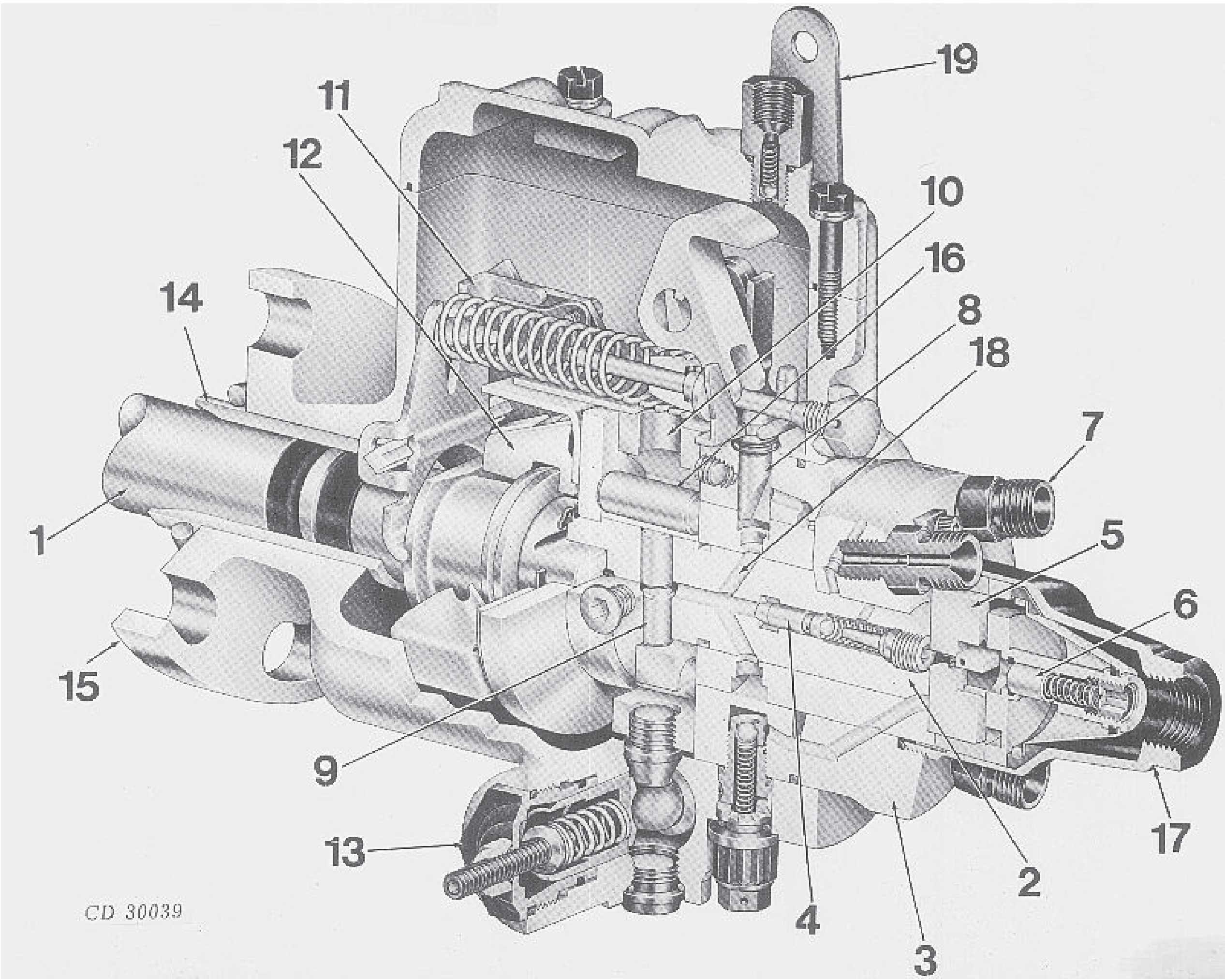


CD30689 —UN—16JUN98

A—Priming pump
B—Fuel inlet
C—Bleed screw
D—Filter media
E—Drain plug
F—Fuel outlet
G—Sediment glass bowl (optional)

CD,3274,G220,9 -19-09SEP04-1/1

STANADYNE Fuel Injection Pump (DB2/DB4) - Operation



CD30039 —UN—08MAR95

Stanadyne Fuel Injection Pump (DB2/DB4)

1— Drive shaft
2— Distributor rotor
3— Hydraulic head
4— Delivery valve
5— Transfer pump
6— Pressure regulator
7— Discharge fitting
8— Metering valve
9— Pumping plungers
10— Internal cam ring
11— Governor
12— Governor weights
13— Automatic advance
14— Drive shaft bushing
15— Housing
16— Rollers
17— Transfer pump inlet
18— Inlet passages
19— Throttle lever

The main rotating components are the drive shaft (1), distributor rotor (2), transfer pump (5) and governor (11).

The drive shaft engages the distributor rotor in the hydraulic head (3). The drive end of the rotor incorporates the transfer pump.

The plungers (9) are actuated towards each other simultaneously by an internal cam ring (10) via rollers (16) and shoes which are carried in slots at the drive end of rotor. The number of cam lobes normally equals the number of engine cylinders.

The transfer pump at the rear of the rotor is of a positive displacement vane type and is enclosed in the end caps. These end caps also house transfer pump inlet (17), fuel strainer and pressure regulator (6). Transfer pump pressure is automatically compensated for changes in viscosity due to temperature and variations in fuel grade.

The distributor rotor incorporates two inlet passages (18) and a single axial bore with one delivery valve (4) to serve all discharge fittings (7) to the injection lines. The hydraulic head contains the bore in which the rotor revolves, the metering valve (8) bore, the charging ports and head discharge fittings.

This pump contains its own all-speed mechanical governor (11). The centrifugal force of weights (12) in their retainer is transmitted through a sleeve to a governor arm and through a positive linkage hook to the metering valve. The metering valve can be closed to shut off fuel through a solid linkage by an independently operated shut-off lever.

Continued on next page

CD,CTM125,227 -19-20FEB01-1/2

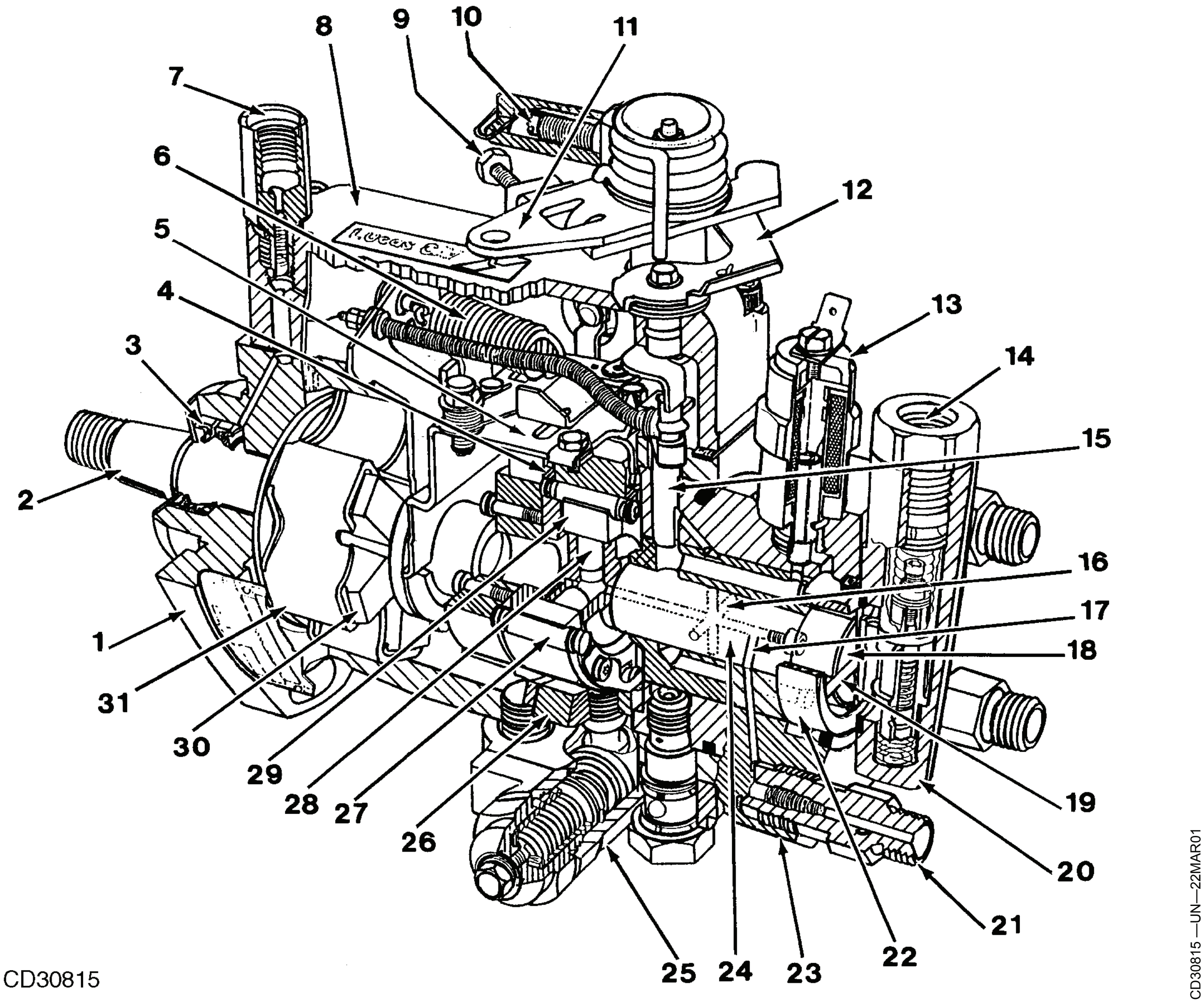
The automatic speed advance (13) either advances or retards hydraulically the beginning of fuel delivery from the pump. This can respond either to speed alone or to a combination of speed and load changes. The pump has also a light load advance system which provides additional advance in light load conditions. This system gives to the injection pump about the same beginning of injection as in the full-load conditions.

A cold advance switch is optional and aids in cold start-up operation.

IMPORTANT: Remember that all adjustments to the injection pump - except for slow idle - must be carried out on a test bench by a specialist injection pump repair station only. Internal adjustments in the field are not permitted, as this pump is a sealed unit.

CD,CTM125,227 -19-20FEB01-2/2

DELPHI/LUCAS Fuel Injection Pump (DP200 shown) - Operation



DELPHI/LUCAS Fuel Injection Pump (DP200)

1— Pump housing
2— Drive shaft
3— Seal ring
4— Scroll plate
5— Delivery adjusting device
6— Governor spring
7— Leak-off adapter
8— Governor housing
9— Slow idle adjusting screw
10— Fast idle adjusting screw
11— Speed control lever
12— Shut-off lever
13— Electric shut-off
14— Fuel inlet
15— Metering valve
16— Inlet passage
17— Discharge port
18— Rotor of transfer pump
19— Rotor blades of transfer pump
20— End plate
21— High pressure outlet
22— Eccentric sleeve of transfer pump
23— Pump head
24— Pump and distributor rotor
25— Automatic advance
26— Cam ring
27— Cam roller
28— Plunger
29— Roller shoe
30— Flyweights
31— Governor cage

IMPORTANT: Remember that all adjustments to the injection pump - except for slow idle - must be carried out on a test bench by a specialist injection pump repair station only. Internal adjustments in the field are not permitted, as this pump is a sealed unit.

The Lucas CAV fuel injection pump is a horizontally mounted distributor pump with mechanical governor and automatic hydraulic speed advance. The moving parts of the pump are simultaneously lubricated and cooled by the diesel fuel flowing through the pump; no additional lubricant is required.

Diesel fuel for injection is fed to the cylinders by a single unit. The pumping plungers (28) and distributor rotor (24) are fitted with two or four opposed plungers controlled by an internal cam ring (26).

Continued on next page

CD03523,000011A -19-20FEB01-1/2

On the other end of the rotor, there is a transfer pump (18) which delivers the fuel, drawn from the fuel filter, through the metering valve into the inlet bore in the pump hydraulic head (23), at a pressure which varies with engine speed.

As the rotor rotates, the inlet bore in pump head aligns with inlet bore in the rotor. Fuel coming from the transfer pump reaches the pump plunger chamber's through bore, regulated by the metering valve and forces the plungers apart.

During further rotation of the distributor rotor, inlet bore in the pump head is closed and distributor channel in the rotor eventually aligns with one of the outlet bores in the pump head. Meanwhile the pump plungers have reached the cam so that they move towards each other. The trapped, metered fuel is forced, under high pressure, through a channel in the rotor and outlet opening in the pump head. Then, through pressurizing valve and pressure line, to the fuel injection nozzle and into the appropriate cylinder.

A pressurizing valve is located at each outlet in the pump head where the pressure line leading to the fuel injection nozzle is connected. After injection the pressure valve closes again and with its small relief piston, draws in a quantity of fuel from the pressure line. The resulting relief in the pressure line causes a quick and firm closing of the nozzle valve. This prevents fuel from leaking into the combustion chamber.

The quantity of fuel which is needed at any given moment for each cylinder and combustion cycle is regulated by a metering valve. The metering valve is controlled by the speed control rod and control lever (11), and by the governor inside the governor housing (8). In the “NO-FUEL” (“OFF”) position, the metering valve completely cuts off the supply of fuel from transfer pump to the rotor.

At slow idle speed or under full load, the transfer pump feeds more fuel to the metering valve than is needed for injection. The excessive fuel flows through the pressure regulating valve back to the suction side of the transfer pump. A very small amount of this surplus fuel escapes through the top of the governor housing.

To obtain the best possible performance over the entire speed range, the fuel injection pump is fitted with an automatic, hydraulically operated speed advance (25). This speed advance is preset at the factory. The speed advance adjusts timing of the fuel injection pump in relation to engine speed and load.

The pump has also a light load advance system which provides additional advance in light load conditions. This system gives to the injection pump about the same beginning of injection as in the full-load conditions. The light load advance is standard on Model DP203 and optional on DP201 pumps.

A cold advance switch is optional and aids in cold start-up operation.

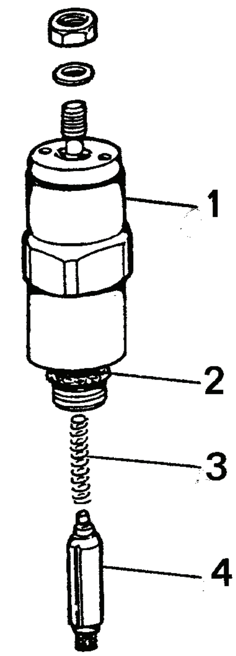
CD03523,000011A -19-20FEB01-2/2

Test Shut-Off Solenoid on DELPHI/LUCAS Injection Pump

1. With the pump installed on engine, check for an audible “click” when the ignition is switched on.
2. If a “click” cannot be heard, check for operating voltage from the terminal.
3. If no voltage, check corresponding electrical circuit (fuse, switch, wire...).
4. If voltage is correct, remove the solenoid carefully, ensuring that the plunger (4) and spring (3) do not fall out. Cover the exposed threaded bore in the pump to prevent dirt ingress.
5. Check that the plunger moves freely in the solenoid body.
6. Check the condition of the spring and the rubber valve seat.
7. Connect the assembled solenoid to ground and apply the appropriate voltage (12 V or 24 V) in order to check if the solenoid operates correctly. Replace solenoid if test is not satisfactory.
8. Refit the solenoid assembly in the hydraulic head and tighten to specification.

Specification

Shut-off solenoid (DELPHI/LUCAS)—Torque..15 N·m (11 lb-ft)



1— Solenoid body
2— O-ring seal
3— Spring
4— Plunger

9. Reconnect the electrical supply and check for satisfactory operation.

CD03523,000011B -19-10SEP04-1/1

Cold Start Advance System Operation

To comply with the exhaust emissions regulation, the timing of injection pump should be around 6—9 degrees before TDC. This timing values do not allow proper start-up operations when engine is cold. To ease engine start-up, a cold advance system gives to the injection pump a temporary over-timing.

STANADYNE Cold Start Advance

The cold advance system is a solenoid assembly (A) in relation with the advance piston (E), and connected through the wires (B) to a thermo-switch (F) located in thermostat cover.

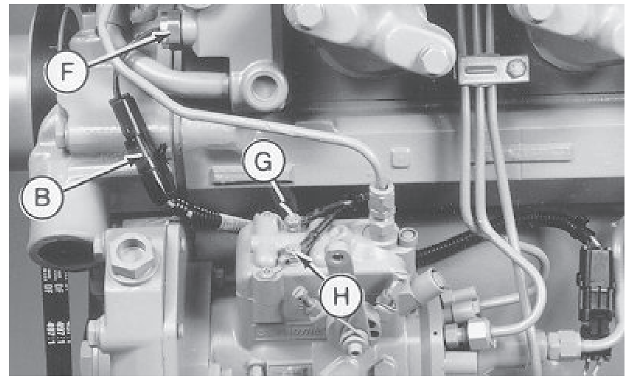
When coolant temperature is below 50°C (122°F), the solenoid valve (C) is activated and opens the cold advance circuit. This directs transfer pump pressure to the cold advance piston (D), forcing the advance piston to the fully advanced position.

When coolant temperature reaches 50°C (122°F), the solenoid valve (C) is no more activated and due to the spring action, closes the cold advance circuit.

The normal advance is now running and is controlled by the speed and load advance mechanism.

The cold advance system is connected to the fuel shut-off terminals as follows:

- Red wire to positive terminal (G)
- Black wire to negative (ground) terminal (H)



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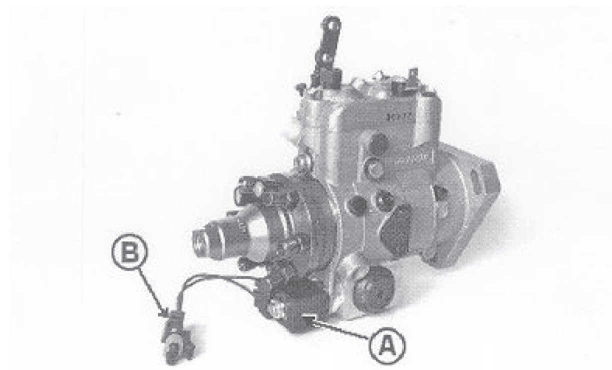
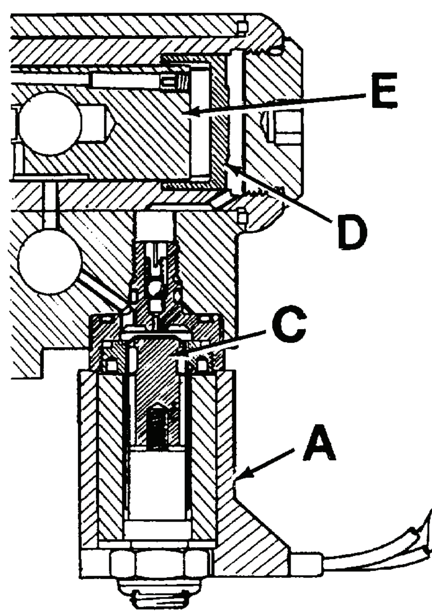


CD30696 —UN—20MAY98



CD30692 —UN—16JUN98

A—Cold start advance solenoid assembly
B—Electrical wires for thermo-switch connection
C—Solenoid valve
D—Cold advance piston
E—Advance piston
F—Thermo-switch
G—Fuel shut-off positive terminal
H—Fuel shut-off negative terminal

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CD,3274,G220,11 -19-20FEB01-1/2

DELPHI/LUCAS Cold Start Advance

The cold start advance system is a wax motor (A) in relation with the advance piston, and connected through the wire (B) to a thermo-switch (C) located in thermostat cover.

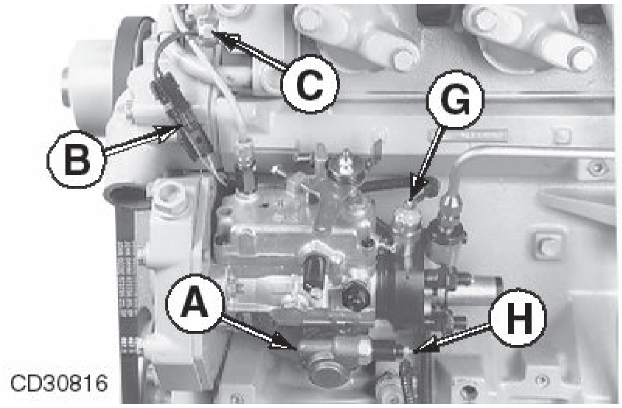
The switch is normally open at coolant temperature below 50°C (122°F). At cold start-up, there is no current flow to the wax motor and therefore the transfer pump pressure is applied to the cold advance piston toward the fully advanced position.

When coolant temperature reaches 50°C (122°F), the thermo-switch (C) closes and current flows to the wax motor. A heating element in the wax motor heats the wax (D), causing it to expand. As the wax expands, the wax motor plunger (E) extends, opening a ball valve (F) which allows fuel to escape. As fuel escapes, the pressure on the cold advance piston decreases until normal advance is obtained.

The cold start advance system harness is connected as follows:

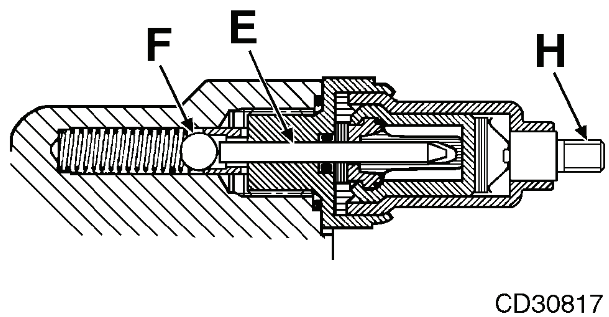
- Red wire to fuel shut-off solenoid terminal (G)
- Orange wire to wax motor terminal (H)

A—Wax motor
B—Electrical wire for thermo-switch connection
C—Thermo-switch
D—Heated wax
E—Wax motor plunger
F—Ball valve
G—Fuel shut-off solenoid terminal
H—Wax motor terminal



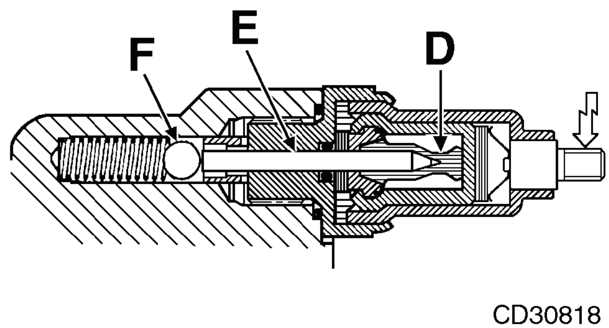
CD30816 —UN—17APR01

Cold Start advance system (Delphi/Lucas)



CD30817 —UN—22MAR01

Delpi/Lucas cold start advance operation (UNENERGIZED)



CD30818 —UN—22MAR01

Delphi/Lucas cold start advance operation (ENERGIZED)

CD,3274,G220,11 -19-20FEB01-2/2

Check Cold Start Advance System Operation

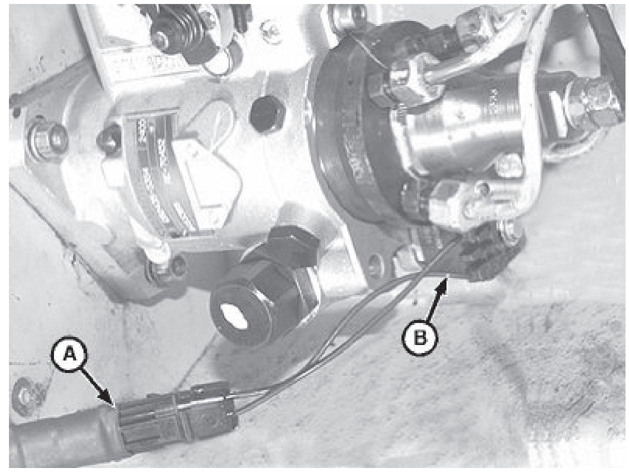
NOTE: To check operation of the cold start advance system, the engine will be operating in an advanced timing mode. After checks are completed, ensure that cold start circuits are returned to their original configuration to ensure proper injection pump timing and conformance to emission control standards.

Use FKM10429A (JT07158) TIME-TRAC Kit to check injection pump timing when performing operational checks on the cold start advance system. (See Dynamic Timing procedure).

STANADYNE Cold Start Advance

NOTE: Checks must be performed on a cold engine.

1. Install FKM10429A (JT07158) TIME TRAC Kit .
2. Insure that cold start switch is working by verifying a voltage potential (12 or 24 volts, depending on application) to the cold start solenoid.
3. Disconnect wiring connector (A) from the cold start advance solenoid (B).
4. Start cold engine and run at 1200 rpm. Check and record injection pump timing.
5. Connect wiring connector (A) to cold start advance solenoid. After approximately 30 seconds, check injection pump timing. There should be a 7—10° increase in timing, indicating proper operation of the cold start advance system. If no increase in timing was noted, have the injection pump serviced/repaired by an authorized Diesel Repair Station.



RG9144 —UN—18MAY98

Cold Start Advance System (Stanadyne)

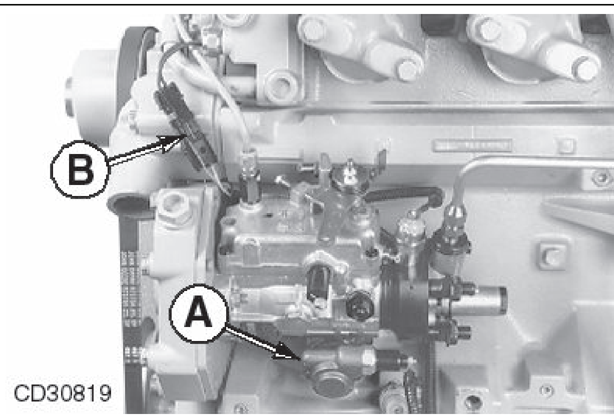
A—Connector **B—Cold start advance solenoid**

CD03523,000011C -19-20FEB01-1/2

DELPHI/LUCAS Cold Start Advance

NOTE: Checks must be performed on a cold engine. The cold start advance wax motor (A) is located on the bottom, outboard side of the injection pump. There is a single terminal input lead to the wax motor.

1. Install FKM10429A (JT07158) TIME TRAC Kit .
2. Disconnect wiring connector (B) from the cold start switch to wax motor harness. Verify that there is a voltage potential (12 or 24 volts, depending on application) at the wax motor connector.
3. Start cold engine and run at 1200 rpm. Check and record injection pump timing.
4. Connect a jumper wire across the wax motor connector terminals. After approximately 30 seconds, check injection pump timing. There should be a 7—10° decrease in timing indicating proper operation of the cold start advance system. If no decrease in timing was noted, have the injection pump serviced/repaired by an authorized Diesel Repair Station.



CD30819 —UN—17APR01

Cold Start Advance System (Delphi/Lucas)

A—Cold start advance wax motor **B—Connector**

CD03523,000011C -19-20FEB01-2/2

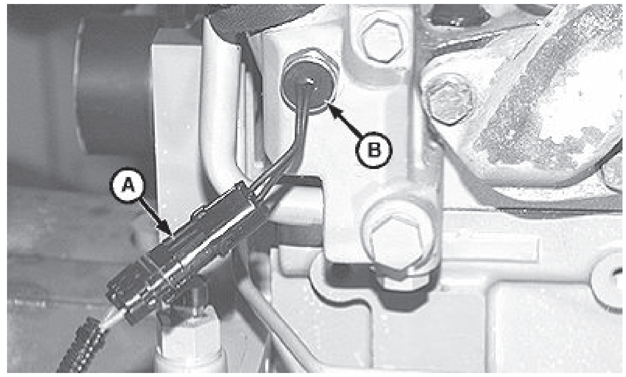
Check Cold Start Switch Operation

The cold start switch (B) is connected to the cold start advance device on injection pump.

1. Disconnect cold start switch connector (A) from pump wiring harness.
2. Remove cold start switch from thermostat cover.
3. Submerge switch in water at 50° C (122° F) for a few minutes.
4. Check for open or closed switch. On DELPHI/LUCAS pumps, the switch should be closed. On STANADYNE pumps, the switch should be open.
5. Replace switch if defective.
6. Install switch in thermostat cover and tighten to specification.

Specification

Cold start switch-to-thermostat cover—Torque .... 5 N·m (3.5 lb-ft) (42 lb-in.)



Cold Start Switch

A—Connector **B—Cold start switch**

7. Connect cold start switch connector to pump wiring harness.

CD03523,000011D -19-20FEB01-1/1

Light Load Advance Operation

Light load advance is used on engines with rotary injection pumps to maintain injection pump timing and engine speed as load decreases. Under full and/or consistent loads, transfer pressure in the injection pump is stable, acting on the advance piston to maintain pump timing and rated engine speed.

As the load begins to decrease, a corresponding decrease in transfer pressure occurs which tends to retard timing and drop engine rpm under the remaining load. To compensate, the governor begins to close a metering valve in the light load advance circuit. As flow through the metering valve drops, transfer pressure begins to rise again and acts on the advance piston to advance pump timing and maintain engine rpm.

CD03523,000011E -19-20FEB01-1/1

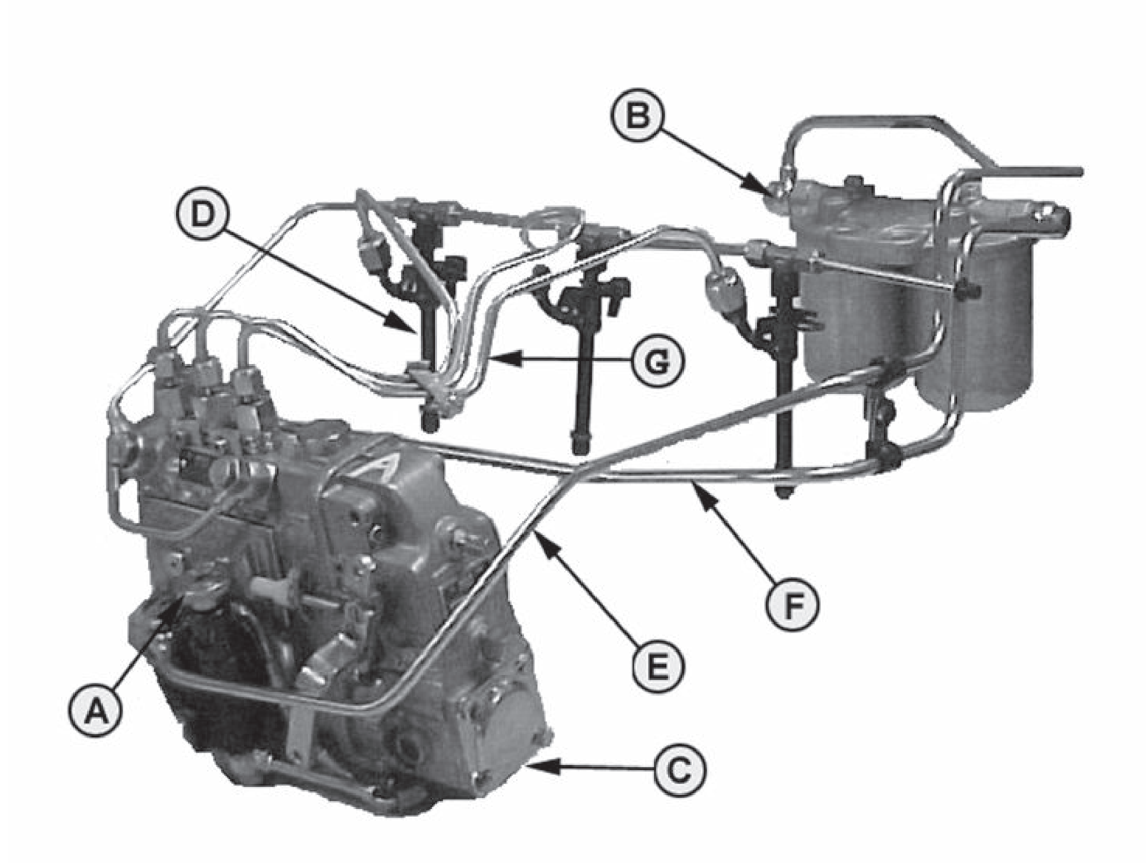
Check Light Load Advance Operation

Use FKM10429A (JT07158) TIME TRAC Kit to check injection pump timing when performing operational checks on the light load advance system (See Dynamic Timing procedure).

1. Install FKM10429A (JT07158) TIME TRAC Kit .
2. Operate engine at full load and rated speed. Note injection pump timing on TIME TRAC.
3. Gradually decrease load to the engine. Timing should continue to retard as the load is removed, but should start to advance again as the light load advance begins to operate at about 50 percent load.
4. If timing does not advance, the light load advance is not operating properly. Have the injection pump serviced/repaired by an authorized Diesel Repair Station.

CD03523,000011F -19-20FEB01-1/1

General Operation (MICO - BOSCH in-Line Fuel Injection Pump)



PY2222 —UN—13MAR04

A—Fuel supply pump
B—Fuel filter
C—Fuel injection pump
D—Fuel injection nozzle
E—Supply pump to filter line
F—Filter to fuel injection pump
G—High pressure line

The fuel supply pump (A), draws fuel from the tank and pressurizes it. This pressure permits the fuel to flow through the filter (B) and finally to fuel injection pump (C).

With the fuel injection pump charged with fuel by the supply pump, the injection pump pressurize the fuel to approximately 45000 kPa (450 bar). Delivery (pressure) lines are used to route this high pressure fuel to the fuel injection nozzles (D).

Fuel enters the injection nozzle at a pressure which easily overcomes the pressure required to open the nozzle valve. When the nozzle valve opens, fuel is forced out through the orifices in the nozzle tip and atomizes as it enters the combustion chamber.

Incorporated into the fuel system is a means of returning excess (or unused) fuel back to the fuel tank. Excess fuel comes from two sources:

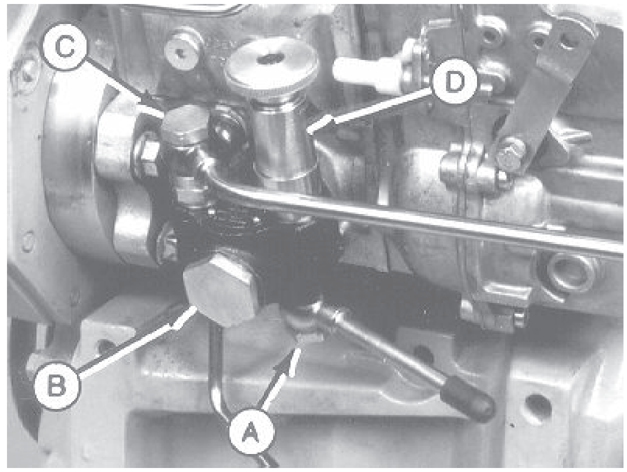
1. Fuel injection pump: A quantity of fuel greater than that required by the engine is supplied to the fuel injection pump.
2. Fuel injection nozzles: A small amount of fuel seeps past the nozzle valve for lubrication purposes.

To get the excess fuel back to the tank, a return line from the injection pump is connected to the middle of the nozzle leak-off line. Fuel from both sources is then returned to the tank by a return pipe connected to the front end of the leak-off pipe.

CD03523,0000142 -19-20SEP04-1/1

Fuel Supply Pump Operation (MICO - BOSCH in-Line Fuel Injection Pump)

The plunger-type MICO - BOSCH fuel supply pump is mounted on the side of the injection pump housing and is driven by the injection pump camshaft. Fuel enters the supply pump at (A), is pressurized by the plunger (B) to 350 kPa (3.5 bar; 50 psi), and discharged through outlet (C). The hand primer (D) provides manual pump operation for bleeding the fuel system.



CD30740 —UN—23FEB99

A—Fuel inlet
B—Plunger
C—Fuel outlet
D—Hand primer

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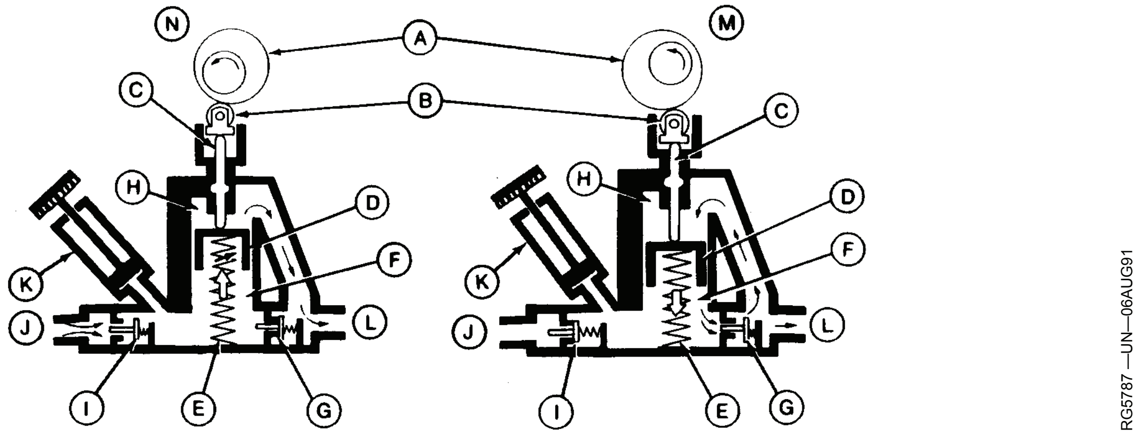
CD03523,0000143 -19-20SEP04-1/2

Fuel supply pump operation (MICO - BOSCH in-line fuel injection pump) - Cont'd



A—Camshaft
B—Roller tappet
C—Pressure spindle
D—Plunger
E—Plunger spring
F—Suction chamber
G—Pressure valve
H—Pressure chamber
I— Suction valve
J— Fuel inlet
K—Hand primer pump
L—Fuel outlet
M—Intermediate stroke position
N—Suction and discharge stroke position

As the pump camshaft (A) rotates toward the “high cam” intermediate stroke position (M), the roller tappet (B) and pressure spindle (C) cause the plunger (D) to compress the plunger spring (E).

Plunger movement forces the fuel out of the suction chamber (F), through the pressure valve (G) and into the pressure chamber (H). The amount of fuel discharged from the suction chamber is equal to the amount of fuel delivered for each stroke of the plunger. Towards the end of the intermediate stroke, the spring-loaded pressure valve closes again. suction chamber charged with fuel, the pumping cycle begins again.

As the camshaft rotates toward the “low cam” or suction and discharge position (N), plunger spring pressure causes the plunger, pressure spindle and roller tappet to follow the camshaft.

Movement of the plunger pushes the fuel from the pressure chamber and delivers it to the fuel filters and injection pump. At the same time, plunger suction pressure is permitting fuel to enter the suction chamber through the suction valve (I). With the suction chamber charged with fuel, the pumping cycle begins again.

Fuel is allowed to flow in around the pressure spindle to lubricate the spindle as it moves back and forth in housing. To prevent the fuel from entering the pump camshaft case, a rubber seal is positioned in the spindle bore of housing at the roller tappet end.

Unscrewing the knurled knob on the hand primer pump (K) and pulling upward causes the suction valve to open and fuel to flow into the suction chamber. When the hand plunger is pushed downward, the suction valve closes and fuel is forced out of the pressure valve.

CD03523,0000143 -19-20SEP04-2/2

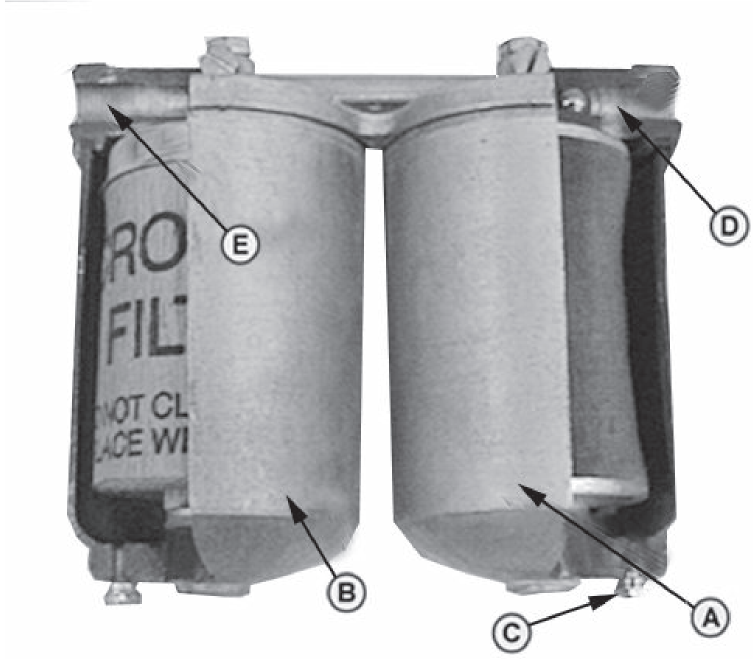
Diagnose Fuel Supply Pump Malfunctions (MICO - BOSCH in-Line Fuel Injection Pump)

IMPORTANT: Visually inspect the fuel inlet fitting and pump filter for possible plugging before disassembling to determine cause of malfunction.

Symptom	Problem	Solution
Low Supply Pump Output Pressure or Pump Not Functioning Correctly	Restriction at fuel inlet fitting.	Thoroughly clean fuel tank, lines, filters, and inlet fitting.
	Hand primer not screwed down tight, allowing dirt to enter hand primer plunger chamber.	Advise customer to tighten hand primer after use.
	Worn or pitted valves caused by foreign material lodging in valve.	Replace valves or complete pump depending on service part availability.
	Missing or broken spring(s).	Replace spring(s) or complete pump depending on service part availability.
	Broken spindle.	Replace pump.
	Out of fuel.	Add fuel to fuel tank.
	Fuel shut off at tank.	Open fuel shut off valve.
	Restricted fuel line.	Clean as required.
	Air leak in fuel line between pump and tank.	Repair as required.
	Loose or damaged fuel line connetions.	Repair.
	Hand primer left in upward position.	Bleed fuel system, gently push hand primer down and tighten securely.
	Worn or damaged valve assemblies.	Repair or replace.
	Broken valve spring(s)	Repair or replace.
Diesel Fuel Leaking Into Injection Pump Camshaft Case	Worn spindle and/or pump housing.	Replace pump.
	Defective seal.	Replace seal.

CD03523,0000144 -19-13SEP04-1/1

Fuel Filter Operation (MICO - BOSCH in-Line Fuel Injection Pump)



A—Primary filter
B—Secondary filter
C—Drain plug
D—Fuel inlet
E—Fuel outlet

FUNCTION:

Fuel filter provides clean, moisture free fuel for the injection process. The priming pump aids in the removal of excess air from the filter and lines so the injection pump can then draw fuel from the tank.

MAJOR COMPONENTS:

- Primary Filter
- Secondary Filter
- Drain Plug

THEORY OF OPERATION:

Fuel enters the filter at inlet (D) and flows through a first stage filter (A) and a second stage filter (B) before flowing through outlet (E) to the fuel injection pump. Primary and secondary filter elements are replaceable. Since water and contaminants settle at the bottom of the sediment bowl, a drain plug (C) is provided.

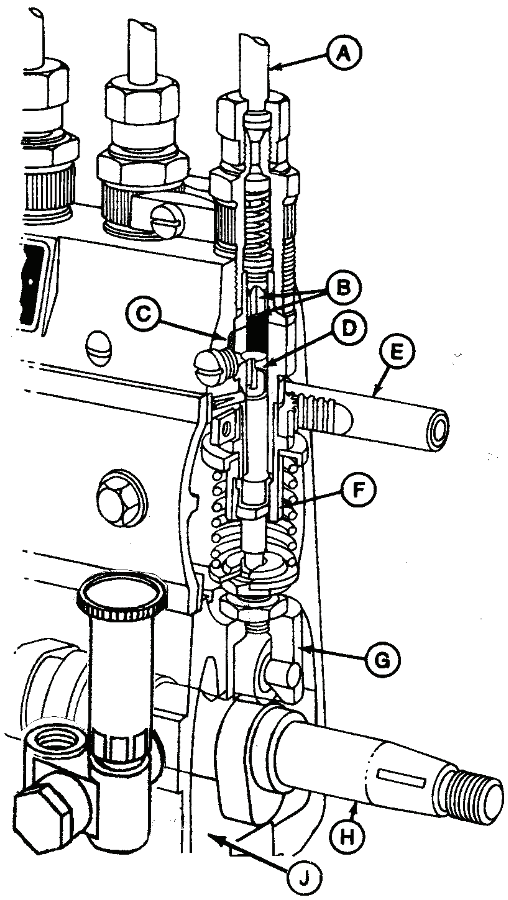
CD03523,0000145 -19-10SEP04-1/1

MICO - BOSCH in-Line Fuel Injection Pump Operation

Filtered fuel under pressure by the supply pump fills the injection pump fuel gallery (C). As the camshaft rotates, roller tappets (G) riding on the camshaft (H) lobes operate the plungers (D) to supply high pressure fuel through the delivery valves (B) to the injection nozzles.

A governor-operated control rack (E) is connected to the control sleeves (F) and plungers to regulate the quantity of fuel delivered to the engine.

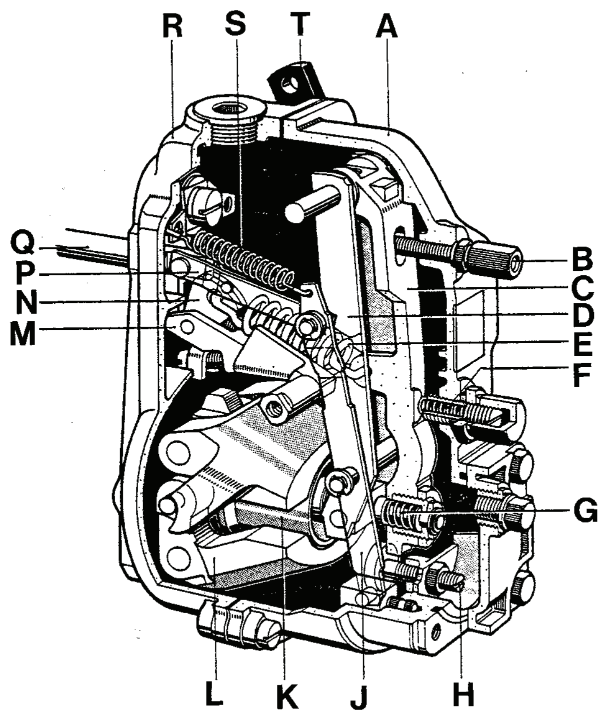
Engine lubricating oil is piped to the injection pump camshaft case (J) to provide splash lubrication of the working parts. Drain hole at the front end of the pump determines the level of oil maintained in the camshaft case. Excess oil drains out of this hole and returns back to the engine through the timing gear cover.



A—Fuel delivery pipe
B—Delivery valve
C—Fuel gallery
D—Barrel and plunger
E—Control rack
F—Control sleeve
G—Roller tappet
H—Camshaft
J—Camshaft case

CD03523,0000146 -19-13SEP04-1/1

Governor Operation (MICO - BOSCH in-Line Fuel Injection Pump)



CD30742 —UN—22FEB99

Governor maintains a set engine speed under varying loads.

The injection pump governor is a mechanical centrifugal flyweight type contained in a housing assembled to the injection pump and serviced with the pump.

The flyweights (L) are mounted on the injection pump camshaft. The flyweights move the thrust sleeve (k) in and out with changes in engine rpm. The thrust sleeve works against the tensioning lever (C). The tensioning lever is connected to the injection pump control rack (Q) by the link (P). The governor spring (E) connects the tensioning lever assembly to the throttle lever (T).

A—Governor cover
B—Slow idle speed screw
C—Tensioning lever
D—Guide lever
E—Main governor spring
F—Slow idle spring screw
G—Torque control spring
H—Full load adjusting screw
J—Fulcrum lever
K—Thrust sleeve
L—Flyweight
M—Swivel lever
N—Rocker
P—Link
Q—Control rack
R—Governor housing
S—Starting spring
T—Throttle lever

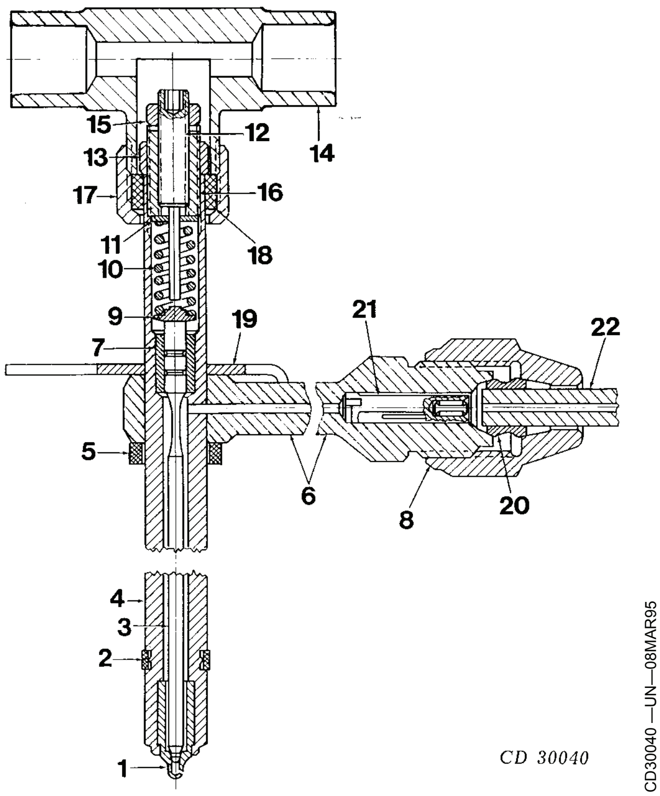
CD03523,0000147 -19-10SEP04-1/1

Diagnose MICO - BOSCH in-Line Fuel Injection Pump Malfunctions

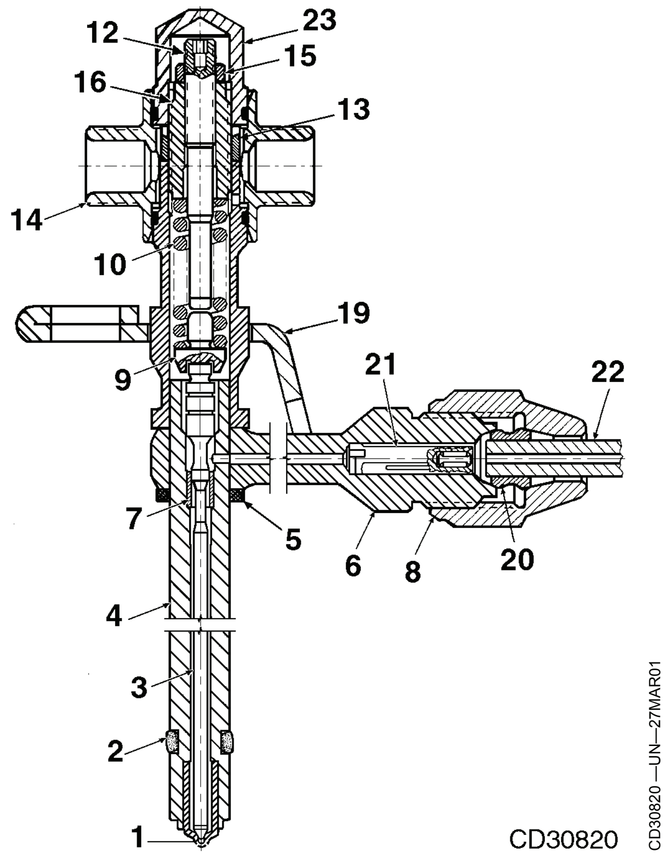
Symptom	Problem	Solution
Engine Starts Hard or Won't Start	Incorrect fuel shut-off lever position (pump control rack not moving all the way forward)	Adjust shut-off cable as required.
	Defective injection pump	Remove pump from engine and repair (see Group 40)
	Injection pump not correctly timed	Check pump timing
Slow Idle Speed Irregular	Slow idle stop screw improperly adjusted	Recheck stop screw adjustment
	Supplementary idling spring improperly adjusted	Recheck adjustment
	Defective injection pump	Remove pump from engine and repair (See Group 40)
Engine Horsepower Low	Pump not properly timed	Check timing
	Defective injection pump	Remove pump from engine and repair (See Group 40)

CD03523,0000148 -19-10SEP04-1/1

Fuel Injection Nozzles Operation (9.5 mm)



Conventional nozzle



"RSN" Nozzle

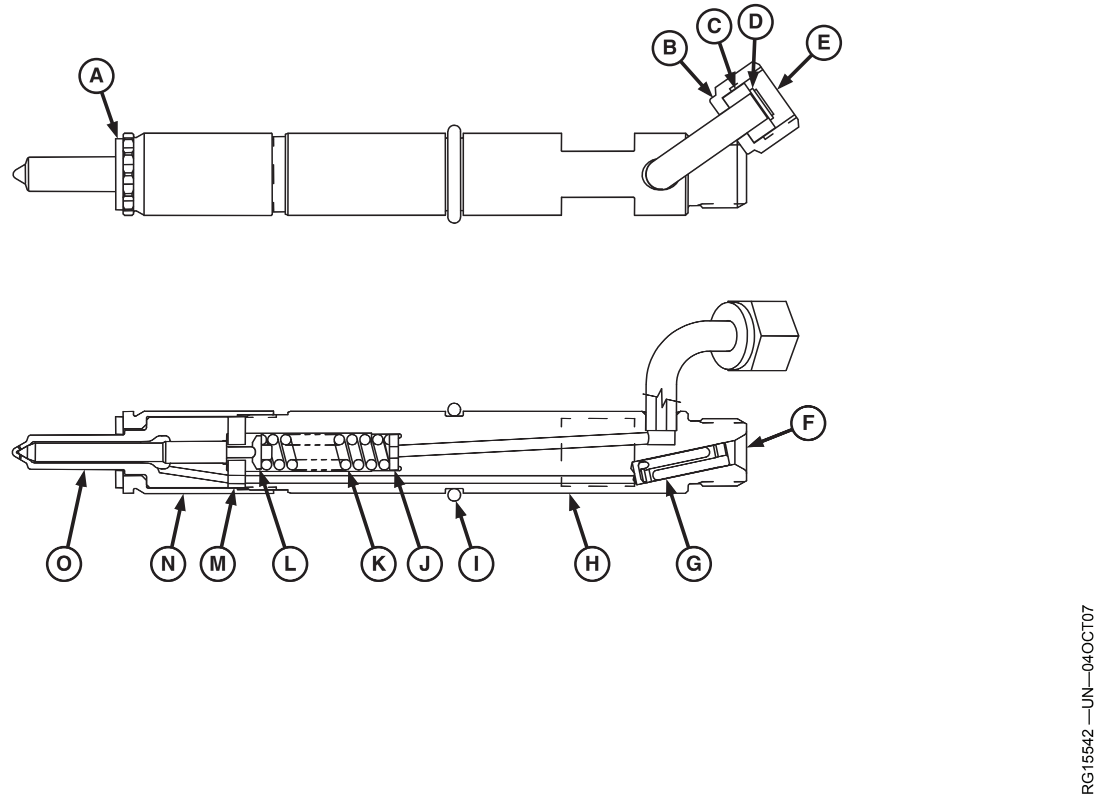
1— Spray tip
2— Carbon stop seal
3— Nozzle valve
4— Nozzle body
5— Seal washer
6— Connection for injection line
7— Nozzle valve guide
8— Union nut
9— Spring seat
10— Adjustable pressure spring
11— Spacer washer (conventional nozzle only)
12— Lift adjusting screw
13— Lock nut for pressure adjusting screw
14— T-fitting
15— Lock nut for lift adjusting screw
16— Pressure adjusting screw
17— Hex. nut (conventional nozzle only)
18— Grommet (conventional nozzle only)
19— Location clamp
20— Nipple
21— Filter screen
22— Fuel pressure line
23— Cap ("RSN" Nozzle only)

The nozzle spray tip (1) forms an integral unit with nozzle body (4) from which it cannot be separated. The injection nozzle is secured in the cylinder head by a location clamp (19), spring clamps and a cap screw. The nozzle is sealed in the cylinder head at its lower end with a carbon stop seal (2) which prevents carbon from collecting around nozzle in cylinder head. The top end is sealed with seal washer (5). The leak-off line is connected by T-fitting (14), which is fitted on the nozzle body and secured with grommet (18) and hex. nut (17) for conventional nozzles and by a cap with O-ring seal (23) for "RSN" nozzles.

The fuel injection nozzle has four spray orifices. Its opening pressure is adjusted by the pressure adjusting screw (16). The lift of nozzle valve (3) is adjusted by screw (12) located in pressure adjusting screw (16).

DPSG,OUOE003,35 -19-18APR12-1/1

Fuel Injection Nozzles Operation (17 mm)



Fuel Injection Nozzles (17 mm)—Operation

A—Sealing Washer
B—Flex Tube Nut
C—Flex Tube Sleeve
D—Square Retaining Ring
E—Fuel Leak-Off
F—Fuel Inlet
G—Edge-Type Filter
H—Nozzle Holder Body Assembly
I—O-Ring Seal
J—Pressure Adjusting Shim(s)
K—Pressure Adjusting Spring
L—Spring Seat
M—Adapter Plate Assembly
N—Nozzle Retaining Nut
O—Multihole Nozzle Assembly

The injectors are located in the engine cylinder head and are of the spring-loaded valve type, hydraulically actuated by metered high pressure fuel delivered from the injection pump.

A locating clamp positions and retains the injector in the cylinder head. The injector is sealed at the head bore entrance by an O-ring (I) to prevent fluids and debris from entering the space between the injector and the bore. A copper sealing washer (A) at the bottom prevents combustion gas leakage and carbon buildup around the injector in the head.

The injector is composed of two main assemblies, the nozzle holder body assembly (H) and the multihole nozzle assembly (O) . Enclosed in the holder assembly fuel inlet (F) is an edge filter (G), which filters the fuel before it enters the nozzle assembly to prevent debris damage or spray hole plugging. Also in the holder body is the spring chamber, which contains the spring seat (L), spring (K), and shim(s) (J). The shim thickness adjusts the spring preload on the valve to set the injector opening pressure. The spray pattern is aligned to the clamp flats on the holder body by dowel pins in the plate assembly (M). Precision surfaces between the two bodies and the plate provide a high-pressure metal-to metal seal. The retaining nut (N) holds all the injector components together.

The nozzle assembly (O) is composed of a needle valve that is matched to the nozzle body. During injection, the inlet fuel pressure working on the valve differential area generates a force that overcomes the spring preload, causing the valve to lift up to its stop against the adapter plate. The lift is a preset feature of the nozzle. The unrestricted fuel then passes through the small spray holes, causing fuel atomization into the combustion chamber. The valve covers the spray holes to minimize any unatomized fuel and resulting hydrocarbon emissions.

Continued on next page

CD03523,000037C -19-17AUG12-1/2

After the fuel has been injected, the spring closes the valve against its seat. In actual operation, the valve opens and closes very rapidly, providing a distinct audible chatter.

A small amount of fuel leaks past the tight guide clearance between the nozzle valve and body, out through the spring chamber, to provide lubrication for the injector moving parts. This excess fuel is then removed from the injector through the fuel leak-off (E) back to the fuel source.

CD03523,000037C -19-17AUG12-2/2

Diagnosing Fuel System Malfunctions

Fuel Not Reaching Fuel Injection Nozzles

- Fuel filter clogged
- Fuel line clogged or restricted
- Fuel transfer pump pressure too low
- Air in fuel system
- Fuel return line restricted
- Loss of fuel through leakage

Engine Hard to Start or Won't Start

- Water, dirt or air in fuel system
- Fuel filter clogged
- Shut-off knob stuck
- Fuel lines clogged or restricted
- Fuel injection nozzles dirty or faulty
- Fuel injection pump faulty
- Fuel transfer pump faulty
- Incorrect timing
- Fuel injection pump metering valve stuck in closed position (check speed-control linkage)

Engine Starts and Stops

- Water in fuel
- Filter clogged
- Air in fuel system
- Fuel lines clogged or restricted
- Fuel injection pump return line damaged

Engine Runs Irregularly or Stalls Frequently

- Filter clogged
- Air in fuel system
- Fuel injection nozzles faulty or dirty
- Fuel lines clogged or restricted
- Incorrect timing
- Water in fuel
- Fuel injection pump return line restricted
- Fuel injection nozzle leak-off line clogged

Poor Engine Idling

- Air in fuel system
- Fuel injection nozzles dirty or faulty
- Incorrect timing
- Automatic advance of fuel injection pump faulty or not operating
- Fuel lines clogged or restricted
- Water in fuel
- Fuel injection pump return line restricted
- Fuel injection nozzle leak-off line clogged

Lack of Engine Power

- Air cleaner restricted
- Incorrect timing
- Automatic advance of fuel injection pump faulty or not operating
- Fuel filter clogged
- Fuel injection nozzle leak-off line clogged
- Fuel injection nozzles faulty or nozzle valve sticking
- Fuel injection pump return line restricted
- Fuel injection pump housing is not full of fuel
- Water in fuel
- Speed control linkage incorrectly adjusted

Engine Emits Black or Grey Smoke

- Fuel injection nozzles faulty or nozzle valves sticking
- Incorrect timing
- Automatic advance of fuel injection pump faulty or not operating
- Air cleaner element clogged or dirty

Engine Emits Blue or White Smoke

- Cranking speed too low
- Incorrect timing
- Automatic advance of injection pump faulty or not operating
- Injection nozzles faulty or nozzle valves sticking
- Excessive wear in liners and/or stuck piston rings
- Engine does not get hot
- Excessive wear in valve guides

CD,3274,G220,12 -19-15MAY92-1/1

Testing Fuel Injection Nozzles on a Running Engine

Run engine at intermediate speed under no load. Slowly loosen fuel pressure line at one of the injection nozzles so that the fuel escapes at the line connection and is not forced through the nozzle (nozzle not opening). If there is a change in engine speed, this indicates that the nozzle is in order. If there is no change in engine speed, nozzle is faulty.

Repeat test consecutively at each of the remaining nozzles.

When a faulty fuel injection nozzle is found, remove it and check thoroughly as described in Group 40.

CD,3274,G220,16 -19-15MAY92-1/1

Section 05
Special Tools

Contents

Essential Tools

NOTE: Order tools according to information given in the SERVICEGARD™ Website.

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CD03523,00000F2 -19-29JAN13-1/41

TIME-TRAC Diesel Engine Timing Tester (Replaced by JDG10534 TACH-N-TIME) .... FKM10429A (or JT07158)

To perform the dynamic timing of engines.

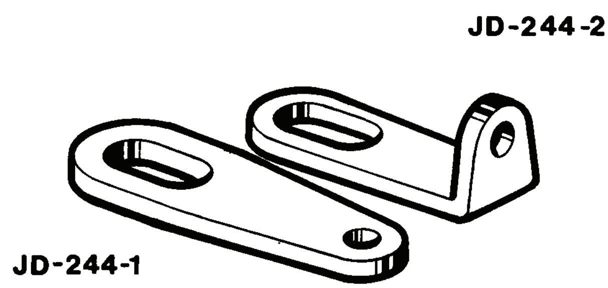
CD30441A —UN—12FEB09

FKM10429A TIME TRAC

CD03523,00000F2 -19-29JAN13-2/41

Engine Lifting Straps JD244

Use to lift engine or to remove cylinder head from engine.



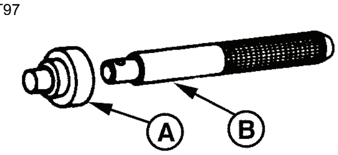
JD244 —UN—10MAY95

CD03523,00000F2 -19-29JAN13-3/41

Bushing Driver (A) JD248A

Use with JDG536 Handle (B) to install oil pressure regulating valve bushing.

RG5183 —UN—31OCT97



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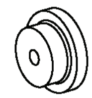
CD03523,00000F2 -19-29JAN13-4/41

Idler gear bushing driver.. JD252

Use with JDG537 Handle to remove and install idler gear bushings.



RG10566

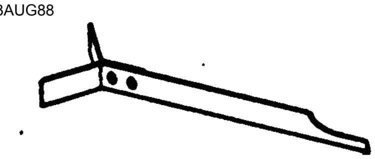
RG10566 —UN—28JAN00

CD03523,00000F2 -19-29JAN13-5/41

Gear timing tool JD254A

Time camshaft gear, injection pump gear, and balancer shafts.

RG5118 —UN—23AUG88

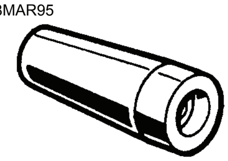


CD03523,00000F2 -19-29JAN13-6/41

Seal installing tool.. JD258

To install carbon stop seal on nozzle.

CD30304 —UN—08MAR95



CD 030304

CD03523,00000F2 -19-29JAN13-7/41

Bearing driver JD262A

To install water pump bearing.

CD30285 —UN—08MAR95

CD 030285

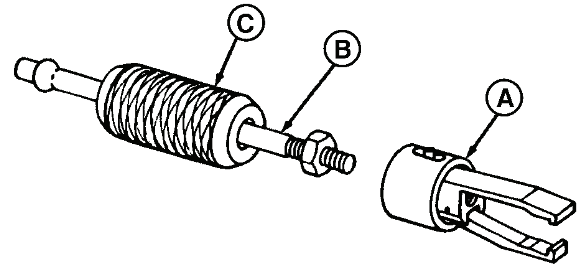
Continued on next page

CD03523,00000F2 -19-29JAN13-8/41

Fuel Injection Nozzle Puller JDE38B

Remove Stanadyne 9.5 mm injection nozzles.

A—JDG716 Adapter[1]
B—JDE38-2 Shank
C—JDE38-3 Hammer



RG6436 —UN—03NOV97

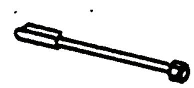
[1]If JDE38 or JDE38A Nozzle Puller is available, order JDG716 Adapter only.

CD03523,00000F2 -19-29JAN13-9/41

RG5084 —UN—23AUG88

Nozzle Bore Cleaning Tool JDE39

Clean injection nozzle bores in cylinder head.

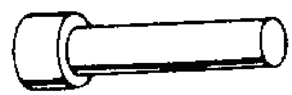


CD03523,00000F2 -19-29JAN13-10/41

RG5068 —UN—05DEC97

Timing Pin.. JDE81-4[1]

Lock engine at TDC when timing valve train. Use with JDG820 or JDE83 Flywheel Turning Tool.



RG5068

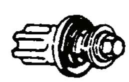
[1]JDE81-4 is no longer available. Order JDG1571.

CD03523,00000F2 -19-29JAN13-11/41

RG4950 —UN—23AUG88

Flywheel Turning Tool...JDE83

Rotate engine flywheel on engines with a 142 tooth flywheel ring gear and a flywheel housing tool guide bore of 26.5 mm (1.04 in.) diameter. Use with JDE81-4 or JDG1571 Timing Pin.

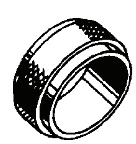


CD03523,00000F2 -19-29JAN13-12/41

RG5031 —UN—05DEC97

Piston Ring Compressor...JDE84

Compress rings while installing pistons.



RG5031

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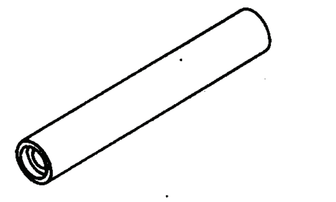
CD03523,00000F2 -19-29JAN13-13/41

Driver JDF15

Used to install tappet seals in fuel supply pumps (in-line fuel injection pump).



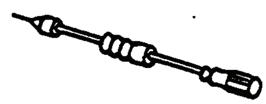
RG2017 —UN—30NOV88

CD03523,00000F2 -19-29JAN13-14/41

RG5109 —UN—23AUG88

Slide hammer seal puller JDG22

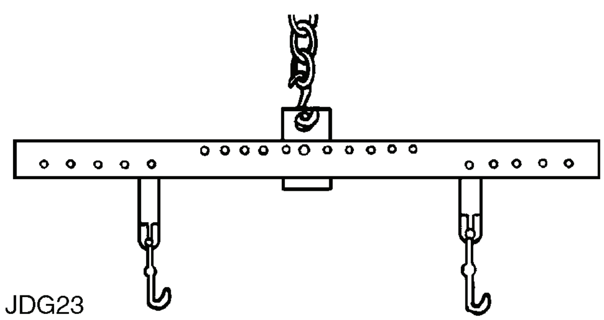
Used to remove seal.



CD03523,00000F2 -19-29JAN13-15/41

Engine Lifting Sling JDG23

Use to lift engine or to remove cylinder head from engine.



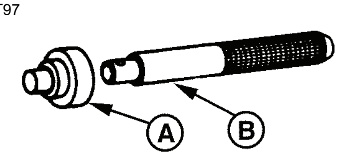
JDG23 —UN—02MAY01

CD03523,00000F2 -19-29JAN13-16/41

RG5183 —UN—31OCT97

Handle (B) JDG536 (OTC813)

Use with JD248A Bushing Driver (A) to install oil pressure regulating valve bushing.



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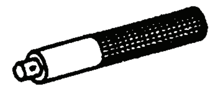
CD03523,00000F2 -19-29JAN13-17/41

Handle JDG537

Use with JD252 Idler Gear Bushing Driver to remove and install idler gear bushings.



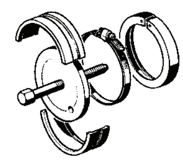
RG10567 —UN—28JAN00

CD03523,00000F2 -19-29JAN13-18/41

Rear crankshaft wear sleeve puller .... JDG645 (or JDG645E)[1] (or JDG698A)

Remove wear sleeve from rear crankshaft flange.

CD30241 —UN—08MAR95



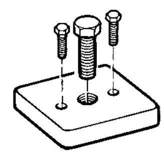
[1]Order JDG645E when tool is ordered from European Parts Distribution Center (EPDC).

CD03523,00000F2 -19-29JAN13-19/41

Injection pump removal tool..............................JDG670A[1]

To remove drive gear from injection pump shaft.

CD30306 —UN—08MAR95

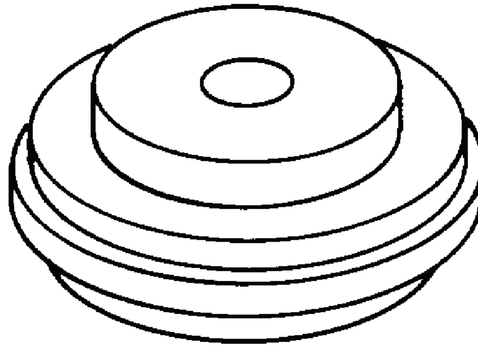


[1]JDG670A is no longer available. Order JDG1560.

CD03523,00000F2 -19-29JAN13-20/41

Valve Seat Insert Installing Adapter..................... JDG675

Use with JDG676 Pilot Driver to install intake and exhaust valve seat inserts.



RG5240 —UN—05DEC97

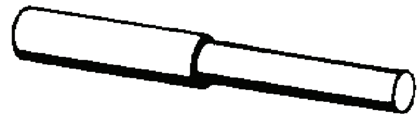
Continued on next page

CD03523,00000F2 -19-29JAN13-21/41

Valve Seat Driver.. JDG676

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

RG5065 —UN—05DEC97



RG5065

CD03523,00000F2 -19-29JAN13-22/41

Valve Stem Seal Installer...................................... JDG678

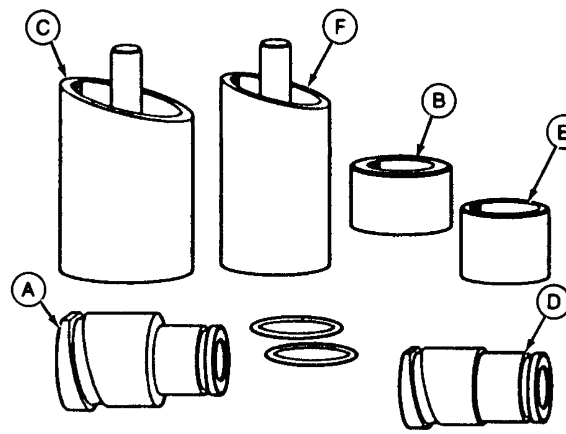
Use to install valve stem seals.

RG5612 —UN—12APR90

CD03523,00000F2 -19-29JAN13-23/41

Connecting Rod Bushing Remover and Installer.. JDG738

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

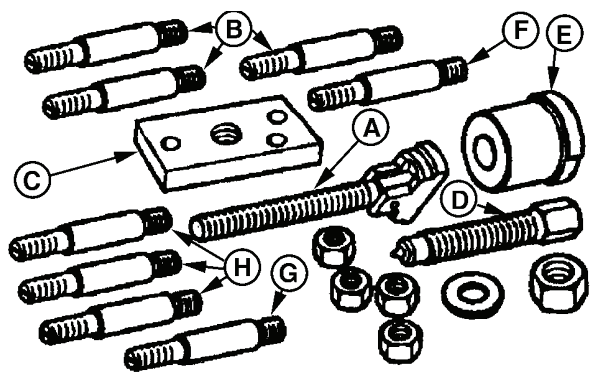


RG7028 —UN—26OCT94

CD03523,00000F2 -19-29JAN13-24/41

Camshaft bushing service set ....JDG739B (formerly JDG739 or JDG739A)

Used to replace camshaft bushing.



RG7651 —UN—07NOV97

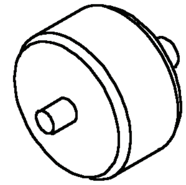
Continued on next page

CD03523,00000F2 -19-29JAN13-25/41

RG7939 —UN—05JAN98

Idler Gear Installer Pilot...... JDG791A (Formerly JDG791)

Guide idler gear onto idler shaft, on engines with camshaft-gear-driven auxiliary drive and 70 mm (2.75 in.) upper idler gear bushing.

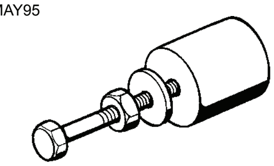


CD03523,00000F2 -19-29JAN13-26/41

JDG794 —UN—10MAY95

Crankshaft gear driver..JDG794A (Formerly JDH7 or JDG794)[1]

Install gear on crankshaft.



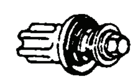
[1]JDG794A consists of JDG794 and JDG794A-1 longer screw.

CD03523,00000F2 -19-29JAN13-27/41

RG4950 —UN—23AUG88

Flywheel Turning Tool............JDG820 (formerly JDE81-1)

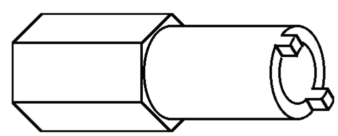
Rotate engine flywheel on engines with a 129 tooth flywheel ring gear and a flywheel housing tool guide bore of 29.9 mm (1.18 in.) diameter. Use with JDE81-4 or JDG1571 Timing Pin.



CD03523,00000F2 -19-29JAN13-28/41

Injection Nozzle Wrench....................................... JDG949

Used to adjust opening pressure on conventional injection nozzles.



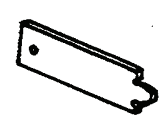
RG7644 —UN—23NOV97

CD03523,00000F2 -19-29JAN13-29/41

RG5076 —UN—23AUG88

Ring groove wear gauge JDG957

Used to check top groove of pistons on engine with 6° angle ring.



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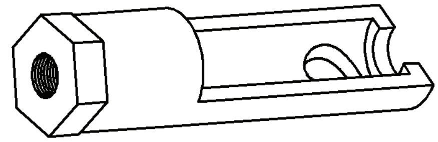
CD03523,00000F2 -19-29JAN13-30/41

RG11741 —UN—24MAY01

RSN Nozzle Puller Adapter ....JDG1515-1[1]

Use with JDE38-2 and JDE38-3 (from JDE38B) to pull Stanadyne 9.5 mm RSN injection nozzles.



JDG1515-1 RSN Nozzle Puller Adapter

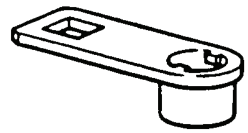
[1]JDG1515-1 is part of JDG1515 Tool Set.

CD03523,00000F2 -19-29JAN13-31/41

JDG15152 —UN—13JUN01

Pressure Adjusting Screw Locknut Wrench ...JDG1515-2[1]

Used to loosen or tighten lock nut of pressure adjusting screws on injection RSN nozzles.



JDG1515-2

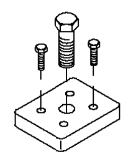
[1]JDG1515-2 is part of JDG1515 Tool Set.

CD03523,00000F2 -19-29JAN13-32/41

RG12017 —UN—16NOV01

Injection Pump drive Gear Puller........................ JDG1560

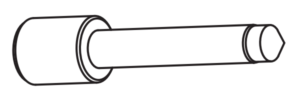
Remove drive gear from tapered shaft of injection pump (replaces JDG670A).



CD03523,00000F2 -19-29JAN13-33/41

Timing Pin.. JDG1571

Used to lock flywheel at No. 1 Top Dead Center for injection pump timing.



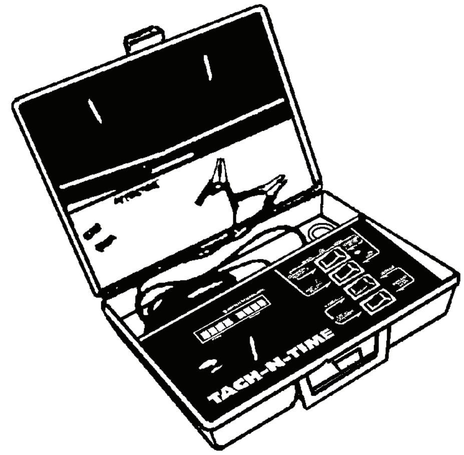
RG12031 —UN—20DEC01

Continued on next page

CD03523,00000F2 -19-29JAN13-34/41

TACH-N-TIME™[1] Kit (Replaced by JDG11411).. JDG10534

Used to perform the dynamic timing of engines. **JDG10534 TACH-N-TIME Kit** consists of the following: JDG10505P1 TACH-N-TIME Base Unit, JDG10505P2 Magnetic Crankshaft Probe, JDG10505P3 6 mm Red Clamp-On Transducer, JDG10505P4 1/4 in. Black Clamp-On Transducer, JDG1571 Timing Pin, JDG793 Threaded Magnetic Pickup Adapter and JDG281 Tapered Adapter for Flywheel Housing without tapped hole.



RG15531 —UN—14SEP07

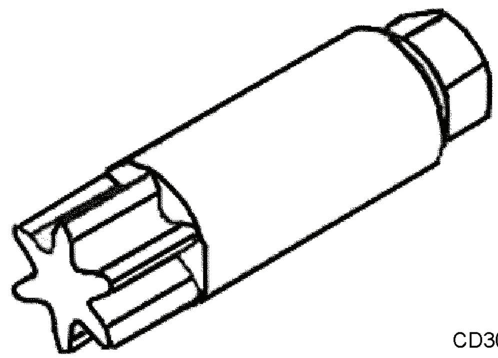
JDG10534

[1]*TACH-N-TIME is a trademark of SPX Corp.*

CD03523,00000F2 -19-29JAN13-35/41

Flywheel Turning Tool...................................... JDG10576

Used to rotate flywheel on engines with 147-tooth flywheel ring gear and a 26.5 mm (1.04 in.) flywheel housing guide bore diameter.



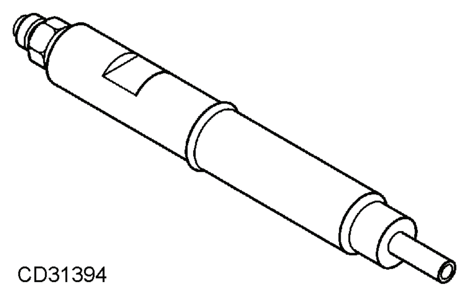
CD30998 —UN—24SEP07

CD30998

CD03523,00000F2 -19-29JAN13-36/41

Compression Test Adapter JDG11064

Used with JT01674A for compression testing through the nozzle hole in engine with 17 mm injector



CD31394 —UN—20APR12

CD31394

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CD03523,00000F2 -19-29JAN13-37/41

TACH-N-TIME™ Kit JDG11411

Used to perform the dynamic timing of engines. **JDG11411 TACH-N-TIME™ Kit** consists of the following: JDG10505P5 TACH-N-TIME™ Base Unit, JDG10505P2 Magnetic Crankshaft Probe, JDG10505P3 6 mm Red Clamp-On Transducer, JDG10505P4 1/4 in. Black Clamp-On Transducer, JDG1571 Timing Pin, JDG793 Threaded Magnetic Pickup Adapter and JDG281 Tapered Adapter for Flywheel Housing with smooth hole.

RG15531 —UN—14SEP07

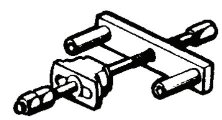
JDG11411 Tach-N-Time Kit

CD03523,00000F2 -19-29JAN13-38/41

CD30234 —UN—08MAR95

Cylinder liner puller... KCD10001

Used to remove and install cylinder liners.



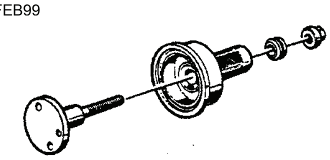
CD 030234

CD03523,00000F2 -19-29JAN13-39/41

CD30709 —UN—22FEB99

Oil seal/Wear sleeve installer set .... KCD10002A (Formerly KCD10002) or JT30040B

Install rear crankshaft oil seal/wear sleeve assembly.

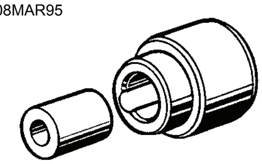


CD03523,00000F2 -19-29JAN13-40/41

CD30252 —UN—08MAR95

Front crankshaft oil seal driver KJD10164

Install front crankshaft oil seal.



CD 030252

CD03523,00000F2 -19-29JAN13-41/41

Service Equipment & Recommended Tools

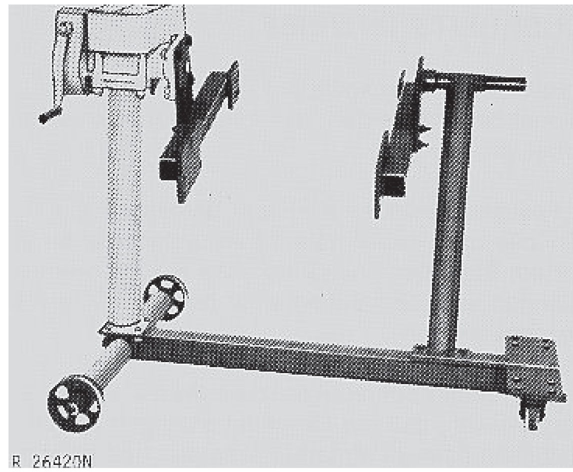
NOTE: Order tools according to information given in the SERVICEGARD™ Website. Some tools may be available from a local supplier.

SERVICEGARD is a trademark of Deere & Company

CD03523,00000F3 -19-20APR12-1/34

Engine Repair Stand (900 kg—-2000 lb.)......... D01003AA

To support engine during repair



R26420N —UN—22MAY95

CD03523,00000F3 -19-20APR12-2/34

Bushing, Bearing and Seal Driver Set D01045AA

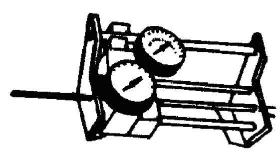
Install pilot bearing in flywheel.

CD03523,00000F3 -19-20APR12-3/34

Spring Compression Tester D01168AA

Test valve spring compression.

RG5061 —UN—05DEC97



RG5061

CD03523,00000F3 -19-20APR12-4/34

Push Puller D01200AA

Use with D01218AA to remove crankshaft gear.

CD03523,00000F3 -19-20APR12-5/34

Pulling Attachment... D01218AA

Use with D01200AA Push Puller to remove crankshaft gear.

CD03523,00000F3 -19-20APR12-6/34

Precision Straightedge D05012ST

Check cylinder head flatness.

Continued on next page

CD03523,00000F3 -19-20APR12-7/34

Cooling System Pressure Pump D05104ST

Used to pressure test radiator cap and cooling system.

R26406N —UN—29NOV88

D05104ST

CD03523,00000F3 -19-20APR12-8/34

Engine Repair Stand (2700 kg—-6000 lb.)....... D05223ST

To support engine during repair

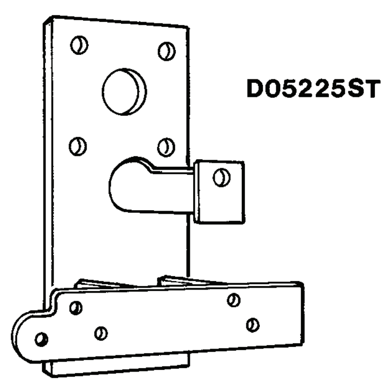
CD31030 —UN—11FEB09

D05223ST Engine Repair Stand

CD03523,00000F3 -19-20APR12-9/34

Engine Repair Stand Adapter........................... D05225ST

To allow installation of engine onto D01003AA Engine Repair Stand



D05225ST —UN—22MAY95

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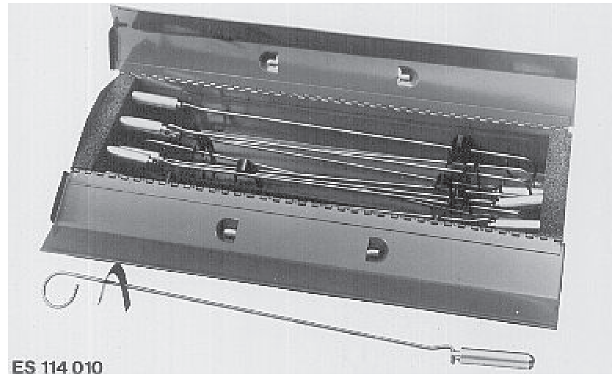
CD03523,00000F3 -19-20APR12-10/34

Magnetic follower holder kit D15001NU

Hold cam followers when removing and installing camshaft.



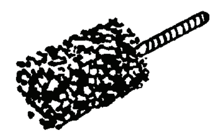
ES114010 —UN—07MAR95

CD03523,00000F3 -19-20APR12-11/34

Flexible Cylinder Hone D17004BR

Hone cylinder liners.

RG5074 —UN—07NOV97

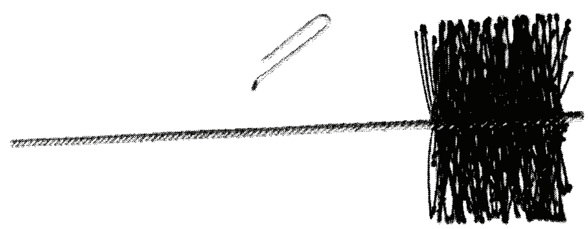


RG5074

CD03523,00000F3 -19-20APR12-12/34

O-Ring Groove Cleaning Brush........................ D17015BR

Clean cylinder liner O-ring groove in block.



RG5075

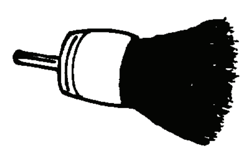
RG5075 —UN—07NOV97

CD03523,00000F3 -19-20APR12-13/34

End Brush... D17024BR

Clean valve seat and bores.

RG5063 —UN—05DEC97



RG5063

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CD03523,00000F3 -19-20APR12-14/34

Dial indicator....................................... D17527CI[1] (Metric)

Used with JDG451, KJD10123 or magnetic base to measure piston and liner height. Also used to measure valve recess in cylinder head.

[1]*D17527CI is also available under tool number FKM10103 which is part of KJD10123 Piston/Liner height gauge. This dial indicator is also available in English units under tool number D17526CI*

ES107506 —UN—07MAR95

CD03523,00000F3 -19-20APR12-15/34

Universal pressure test kit ....FKM10002 or JT05470

To measure engine oil or intake manifold pressure.

FKM10002 —UN—13MAY96

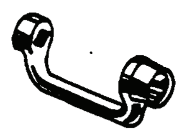
CD03523,00000F3 -19-20APR12-16/34

Torque Wrench Adapter.......................JD307 (or JD-307)[1]

Use with standard torque wrench to tighten head bolts under rocker arm assembly.

[1]*Order JD-307 when tool is ordered from European Parts Distribution Center (EPDC).*

RG5085 —UN—23AUG88

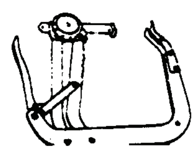


CD03523,00000F3 -19-20APR12-17/34

Valve Spring Compressor......................................JDE138

Use to compress valve springs when removing and installing valves.

RG5070 —UN—23AUG88



CD03523,00000F3 -19-20APR12-18/34

3/4 in. Special Crowsfoot Wrench JDF22

Tighten injection lines at pump and nozzles.

RG5154 —UN—23AUG88

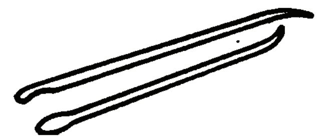
Continued on next page

CD03523,00000F3 -19-20APR12-19/34

O-Ring Seal Tool Set JDG127

Use to remove and install O-Ring seals.

RG5133 —UN—23AUG88

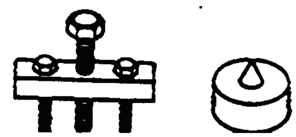


CD03523,00000F3 -19-20APR12-20/34

Vibration Damper Puller Set JDG410

Remove vibration damper and pulley.

RG5112 —UN—06APR89

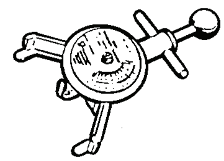


CD03523,00000F3 -19-20APR12-21/34

Tension gauge JDG529

Measure V-Belt tension.

JDG529 —UN—10MAY95

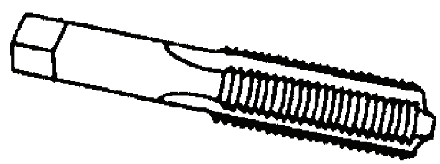


CD03523,00000F3 -19-20APR12-22/34

Tap... JDG680

Used to restore threaded holes in cylinder block for cylinder head cap screws.

RG5100 —UN—05DEC97



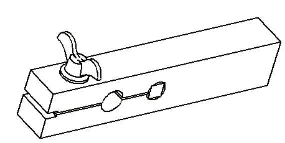
RG5100

CD03523,00000F3 -19-20APR12-23/34

Spring Chamber Cap Wrench JDG1521

Used to remove the spring chamber cap on RSN nozzles.

RG11742 —UN—24MAY01



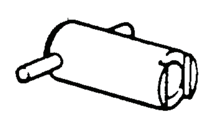
JDG1521 Spring Chamber Cap Wrench (RSN)

CD03523,00000F3 -19-20APR12-24/34

Pressure Adjusting Screw Tool.......................... JDG1522

Used to adjust opening pressure on RSN nozzles.

JDG1522 —UN—13JUN01



JDG1522

JDG1522 Pressure Adjusting Screw Tool (RSN)

Continued on next page

CD03523,00000F3 -19-20APR12-25/34

Adapter for 9.5 mm pencil nozzle JT01679

To check engine compression. To be used with JT02017 holding clamp.

CD03523,00000F3 -19-20APR12-26/34

Holding clamp...JT02017

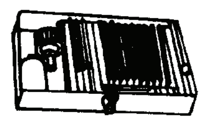
To hold JT01679 compression test adapter.

CD03523,00000F3 -19-20APR12-27/34

Valve Guide Knurler Kit JT05949

Knurl valve guides.

RG5064 —UN—05DEC97



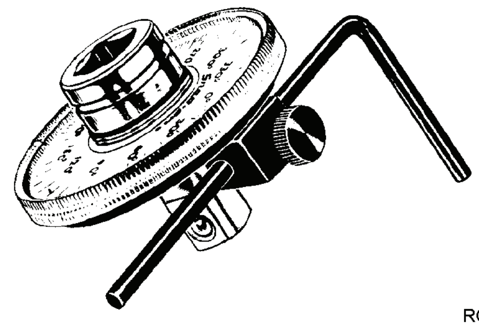
RG5064

JT05949

CD03523,00000F3 -19-20APR12-28/34

Torque Angle Gauge..JT05993

To accurately torque-turn cap screws in cylinder head and connecting rods.



RG5698

RG5698 —UN—05DEC97

JT05993

CD03523,00000F3 -19-20APR12-29/34

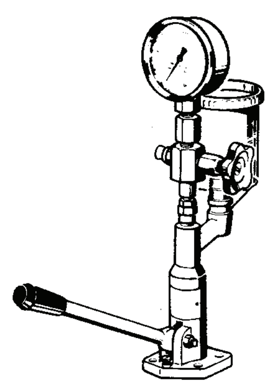
Pressure gauge (40 bar—-600 psi) JT07042

To check engine compression.

CD03523,00000F3 -19-20APR12-30/34

Injection nozzle tester (R. BOSCH)......................JT25510

Check nozzle opening pressure.



CD 030307

CD30307 —UN—07MAR95

Continued on next page

CD03523,00000F3 -19-20APR12-31/34

Fuel pressure line..KJD10109

To connect injection nozzle to BOSCH tester.

CD30308 —UN—08MAR95

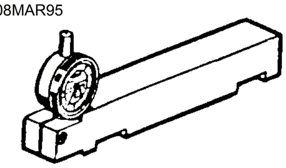
CD 030308

CD03523,00000F3 -19-20APR12-32/34

Piston/Liner height gauge............... KJD10123 or JDG451

Used with a dial indicator to measure piston and liner height. Also used to measure valve recess in cylinder head.

CD30235 —UN—08MAR95



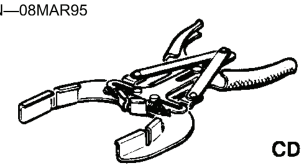
CD 030235

CD03523,00000F3 -19-20APR12-33/34

Piston ring expander..KJD10140

Used to replace piston rings.

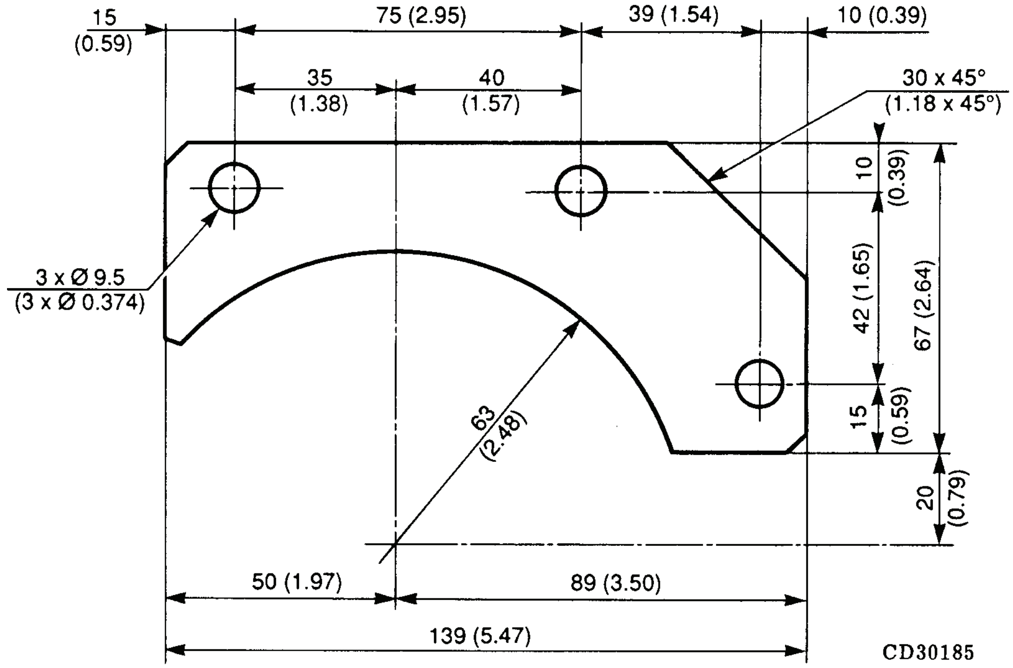
CD30236 —UN—08MAR95



CD 030236

CD03523,00000F3 -19-20APR12-34/34

Template for front plate replacement



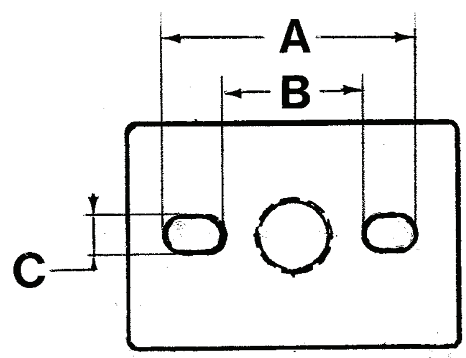
CD30185 —UN—08MAR95

CD03523,000010D -19-05FEB01-1/1

Modification of JDG670A

JDG670A[1] special tool can be used to remove the MICO - BOSCH in-line injection pump when modified as indicated.

NOTE: JDG1560 Puller can be used without modification.



CD30732 —UN—22FEB99

A—40 mm (1.57 in.)
B—23 mm (0.90 in.)
C—7 mm (0.27 in.)

[1] *JDG670A is no longer available. Order JDG1560.*

CD03523,000013B -19-24SEP04-1/1

Section 06
Specifications

Contents

Cylinder Head and Valves Specifications

Item	Measurement	Specification
Valve lift		
Intake valve	Valve lift at 0.00 mm (in.) clearance	11.56—12.37 mm (0.455—0.487 in.)
	Wear Tolerance	11.13 mm (0.438 in.)
Exhaust valve	Valve lift at 0.00 mm (in.) clearance	11.28—12.12 mm (0.444—0.477 in.)
	Wear Tolerance	10.85 mm (0.427 in.)
Combustion face	Flatness	0.08 mm (0.003 in.) Maxi
New cylinder head	Thickness	104.87—105.13 mm (4.129—4.139 in.)
Refaced cylinder head	Minimum thickness	104.11 mm (4.099 in.)
Cylinder head combustion face	Surface finish	2.5 micron (0.0001 in.) C.L.A.
Valve guide		
Cylinder head bore	Diameter	7.912—7.938 mm (0.312—0.313in.)
Guide-to-valve stem	Clearance	0.05—0.10 mm (0.002—0.004 in.)
	Wear tolerance	0.15 mm (0.006 in.)
Oversized valve stem		
1st size	Diameter	+ 0.38 mm (0.015 in.)
2nd size	Diameter	+ 0.76 mm (0.015 in.)
Valve seat	Width	1.50—2.00 mm (0.059—0.079 in.)
	Maximum runout	0.08 mm (0.003 in.)
	Angle	30°
Intake Valve	Recess	0.61—1.11 mm (0.024—0.044 in.)
	Wear tolerance	1.63 mm (0.064 in.)
Exhaust Valve	Recess	1.22—1.72 mm (0.048—0.068 in.)
	Wear tolerance	2.26 mm (0.089 in.)
Exhaust valve seat		
Bore	Diameter	42.987—43.013 mm (1.6924—1.6934 in.)
	Chamfer height	3.82 mm (0.150 in.) Reference
	Depth	9.936—10.064 mm (0.3912—0.3962 in.)
	Chamfer angle	38—42°
	Radius	0.5 mm (0.019 in.) Maxi
Intake valve seat		
Bore	Diameter	47.104—47.130 mm (1.8545—1.8555 in.)
	Chamfer height	3.45 mm (0.136 in.) Reference
	Depth	9.936—10.064 mm (0.3912—0.3962 in.)
	Chamfer angle	38—42°
	Radius	0.5 mm (0.019 in.) Maxi
Intake valve insert	Outside diameter	47.205—47.231 mm (1.858—1.859 in.)
Exhaust valve insert	Outside diameter	43.087—43.113 mm (1.696—1.697 in.)
Intake valve head	Diameter	46.47—46.73 mm (1.830—1.840 in.)

Continued on next page CD03523,00000E8 -19-10MAR09-1/2

Item	Measurement	Specification
Exhaust valve head	Diameter	42.37—42.63 mm (1.668—1.678 in.)
Intake Valve Stem	Diameter	7.864—7.884 mm (0.3096—0.3104 in.)
Exhaust Valve Stem	Diameter	7.848—7.874 mm (0.3090—0.3100 in.)
Valve Face	Maximum permissible runout	0.038 mm (0.0015 in.)
Valve face	Angle	29.25° ± 0.25°
Valve Spring Compression	Free length	approx. 54 mm (2.125 in.)
	Load with spring compressed to 46 mm (1.81 in.)	240—280 N (54—62 lb.)
	Load with spring compressed to 34.5 mm (1.36 in.)	590—680 N (133—153 lb.)
Rocker arm		
Shaft	Diameter	19.99—20.02 mm (0.787—0.788 in.)
	Wear tolerance	19.94 mm (0.785 in.)
Bore	Diameter	20.07—20.12 mm (0.790—0.792 in.)
	Wear tolerance	20.17 mm (0.784 in.)
Spring	Load at 46 mm (1.81 in.) compressed length	18—27 N (4—6 lb.)
Intake Valve	Clearance	0.35 mm (0.014 in.)
Exhaust Valve	Clearance	0.45 mm (0.018 in.)
3-cylinder engine	Firing order	1-2-3
Rocker arm adjustment screw jam nut (Later design)	Torque	30 N·m (25 lb-ft)
Cylinder head bolts		
1st step	Torque	100 N·m (75 lb-ft)
2nd step	Torque	150 N·m (110 lb-ft)
Recheck after 5 minutes	Torque	150 N·m (110 lb-ft)
Final step	Torque Turn	60° ± 10°
Rocker arm support cap screw	Torque	50 N·m (35 lb-ft)
Rocker arm cover cap screw	Torque	10 N·m (7 lb-ft)

CD03523,00000E8 -19-10MAR09-2/2

Cylinder Block, Liners, Pistons and Rods Specifications

Item	Measurement	Specification
Cylinder Liner Bore	Diameter	106.49—106.52 mm (4.1925—4.1937 in.)
	Maximum wear	0.25 mm (0.01 in.)
	Maximum taper	0.05 mm (0.002 in.)
	Maximum out-of-round	0.05 mm (0.002 in.)
Piston-to-cylinder liner	Clearance, measured at bottom of skirt	0.09—0.14 mm (0.0035—0.0055 in.)
Piston cooling jet	Torque	10 N·m (7.5 lb-ft)
	Flow Rate (each)	1.5 L/min (1/4 qt/min)
Cam Follower Bore	Diameter	31.70—31.75 mm (1.248—1.250 in.)
	Maximum clearance	0.13 mm (0.005 in.)
Camshaft bore		
Without bushing	Diameter	55.98—56.01 mm (2.204—2.205 in.)
For bushing installation (No.1 only)	Diameter	59.96—59.99 mm (2.361—2.362 in.)
With bushing installed (No.1 only)	Diameter	55.96—55.99 mm (2.203—2.204 in.)
Crankshaft Bore	Diameter	84.46—84.48 mm (3.325—3.326 in.)
Crankshaft main bearing bores	Diameter	84.45—84.48 mm (3.325—3.326 in.)
	Distance with block top face (A)	301.98—302.11 mm (11.889—11.894 in.)
Top Desk	Out-of Flat for every 150 mm (5.90 in.) length or width	0.025 mm (0.001 in.)
	Surface finish (CLA)	0.8—3.2 micron (32—128 micro-in)
	Maximum wave deep	8 micron (320 micro-in)
Crankshaft bore centerline-to-top desk	Distance	301.98—302.11 mm (11.889—11.894 in.)
Liner counterbore	Depth (A)	5.95—5.99 mm (0.234—0.236 in.)
Liner	Protrusion	0.01—0.10 mm (0.0004—0.004 in.)
	Maximum permissible difference between adjacent cylinders	0.03 mm (0.001 in.)
CD15466 Liner shim	Thickness	0.05 mm (0.002 in.)
R65833 Liner shim	Thickness	0.10 mm (0.004 in.)
Liner packing	Minimum dimension for proper compression	0.13 mm (0.005 in.)
Connecting rod bearing (assembled)	Diameter	69.848—69.898 mm (2.7499—2.7519 in.)
Crankshaft journal	Diameter	69.799—69.825 mm (2.748—2.749 in.)
	Maximum permissible clearance	0.16 mm (0.006 in.)
Undersized connecting rod bearing	1st Size	0.25 mm (0.01 in.)
Connecting rod bushing		
Straight pin-end	Bore diameter	32.010—32.036 mm (1.2602—1.2612 in.)

Continued on next page

CD03523,00000F1 -19-12JUN12-1/2

Item	Measurement	Specification
	Pin to bushing oil clearance	0.010—0.042 mm (0.0004—0.0016 in.)
	Wear tolerance	0.10 mm (0.004 in.)
Tapered pin-end	Bore diameter	41.300—41.326 mm (1.626—1.627 in.)
	Pin to bushing oil clearance	0.007—0.043 mm (0.0003—0.0017 in.)
	Wear tolerance	0.10 mm (0.004 in.)
Bore-to-bore distance	Distance	180.975—181.025 mm (7.125—7.127 in.)
Piston pin		
Straight pin-end connecting rod	Diameter	31.994—32.000 mm (1.2596—1.2598 in.)
	Pin to bushing oil clearance	0.010—0.042 mm (0.0004—0.0016 in.)
	Wear tolerance	0.10 mm (0.004 in.)
Tapered pin-end connecting rod	Diameter	41.27—41.28 mm (1.6248—1.6252 in.)
	Pin to bushing oil clearance	0.007—0.043 mm (0.0003—0.0017 in.)
	Wear tolerance	0.10 mm (0.004 in.)
Piston pin bore		
Straight pin-end connecting rod	Diameter	32.003—32.013 mm (1.2600—1.2603 in.)
Tapered pin-end connecting rod	Diameter	41.285—41.295 mm (1.6254—1.6258 in.)
2nd and 3rd Piston ring groove	Clearance	0.20 mm (0.008 in.) maxi
Piston skirt	Diameter at 11 mm (0.43 in.) from bottom	106.381—106.399 mm (4.1882—4.1890 in.)
Piston-to-cylinder liner	Clearance	0.09—0.14 mm (0.0035—0.0055 in.)
Piston	Protrusion above block	0.08—0.35 mm (0.003—0.014 in.)
Connecting rod bolts	Torque	56 N·m (40 lb-ft)
	Torque Turn	90—100 °
Cylinder block plugs and fittings		
A—Coolant drain (1/4“)	Torque	17 N·m (13 lb-ft)
B—Turbocharger oil return (1/2”)	Torque	45 N·m (33 lb-ft)
C—1/2“ cyl. for dipstick tube	Torque	67 N·m (50 lb-ft)
D—Oil galleries (1/8”)	Torque	17 N·m (13 lb-ft)
E—1/4“ Coolant gallery (side)	Torque	17 N·m (13 lb-ft)
F—Rear Coolant gallery (1”)	Torque	45 N·m (33 lb-ft)
G—Oil gallery (3/8“)	Torque	45 N·m (33 lb-ft)
H—Piston cooling jet	Torque	10 N·m (7.5 lb-ft)

CD03523,00000F1 -19-12JUN12-2/2

Crankshaft, Main Bearings and Flywheel Specifications

Item	Measurement	Specification
Crankshaft pulley	Max. wobble	0.5 mm (0.02 in.)
Crankshaft		
2-piece thrust bearing	End Play	0.13—0.40 mm (0.005—0.016 in.)
	Wear tolerance	0.50 mm (0.02 in.)
5/6-piece thrust bearing	End Play	0.03—0.35 mm (0.001—0.014 in.)
	Wear tolerance	0.50 mm (0.02 in.)
Oversized crankshaft thrust washer	Thickness	+ 0.18 mm (0.007 in.)
Crankshaft main journal	Diameter (Standard)	79.324—79.350 mm (3.123—3.124 in.)
Crankshaft rod journal	Diameter (Standard)	69.799—69.825 mm (2.748—2.749 in.)
Crankshaft main or rod Journal	Maximum taper	0.03 mm (0.0012 in.)
	Maximum out-of-roundness	0.075 mm (0.003 in.)
Crankshaft main bearings assembled	Diameter	79.396—79.440 mm (3.126—3.127 in.)
Crankshaft main bearing-to-journal	Oil clearance	0.046—0.116 mm (0.0018—0.0046 in.)
	Maximum wear	0.15 mm (0.006 in.)
Undersized crankshaft main bearing	1st Size	0.25 mm (0.01 in.)
	2nd Size	0.50 mm (0.02 in.)
	3rd Size	0.76 mm (0.03 in.)
Crankshaft Micro-Finishing specifications	Center Line Average (C.L.A.)	0.2 micron (8 micro-in.) or better
	Skewness parameter (Sk)	Negative
	Bearing ratio (Tp) with 1% Tp reference line at a depth of 0.22 micron (8.8 micro-in.)	Tp more than 20%
	Bearing ratio (Tp) with 1% Tp reference line at a depth of 0.38 micron (15.2 micro-in.)	Tp more than 80%
	Bearing ratio (Tp) with 1% Tp reference line at a depth of 0.64 micron (25.6 micro-in.)	Tp more than 90%
Pulley-to-crankshaft	Torque	150 N·m (110 lb-ft)
Crankshaft main bearing - Cap screws + washer	Initial torque	20 N·m (15 lb-ft)
	Final Torque	135 N·m (100 lb-ft)
Crankshaft main bearing - Flanged cap screws	Initial torque	20 N·m (15 lb-ft)
	Final Torque	40 N·m (30 lb-ft) + additional 60° turn
Crankshaft pulley-to-Collet bolt	Torque	35 N·m (25 lb-ft)
Flywheel bolt	Torque	160 N·m (120 lb-ft)
Flywheel housing		
3/8 in. cap screw	Torque (1st stage)	30 N·m (23 lb-ft)
	Torque (2nd stage)	50 N·m (35 lb-ft)

Continued on next page

CD03523,00000F6 -19-12JUN12-1/2

Repair Specifications

Item	Measurement	Specification
5/8 in. cap screw	Torque	230 N·m (170 lb-ft)

CD03523,00000F6 -19-12JUN12-2/2

Camshaft and Timing Gear Train Specifications

Item	Measurement	Specification
Helical timing gear		
Upper idler/crankshaft gear	Backlash	0.07—0.30 mm (0.003—0.012 in.)
	Wear tolerance	0.40 mm (0.016 in.)
Upper idler/camshaft gear	Backlash	0.07—0.35 mm (0.003—0.014 in.)
	Wear tolerance	0.51 mm (0.020 in.)
Upper idler/injection pump gear	Backlash	0.07—0.35 mm (0.003—0.014 in.)
	Wear tolerance	0.51 mm (0.020 in.)
Lower idler/crankshaft gear	Backlash	0.07—0.35 mm (0.003—0.014 in.)
	Wear tolerance	0.51 mm (0.020 in.)
Lower idler/oil pump gear	Backlash	0.04—0.38 mm (0.0016—0.015 in.)
	Wear tolerance	0.40 mm (0.016 in.)
Spur timing gear Engines for 5300/5300N Tractors (-242551CD) All other Engines (-270818CD)		
Upper idler/crankshaft gear	Backlash	0.04—0.35 mm (0.0016—0.014 in.)
	Wear tolerance	0.60 mm (0.024 in.)
Upper idler/camshaft gear	Backlash	0.08—0.45 mm (0.003—0.018 in.)
	Wear tolerance	0.85 mm (0.033 in.)
Upper idler/injection pump gear	Backlash	0.08—0.45 mm (0.003—0.018 in.)
	Wear tolerance	0.85 mm (0.033 in.)
Lower idler/crankshaft gear	Backlash	0.04—0.35 mm (0.0016—0.014 in.)
	Wear tolerance	0.65 mm (0.025 in.)
Lower idler/oil pump gear	Backlash	0.08—0.40 mm (0.003—0.016 in.)
	Wear tolerance	0.75 mm (0.030 in.)
Camshaft/aux. drive gear	Backlash	0.09—1.24 mm (0.0035—0.049 in.)
	Wear tolerance	1.34 mm (0.053 in.)
Spur timing gear Engines for 5300/5300N Tractors (242552CD-) All other Engines (270819CD-)		
Upper idler/crankshaft gear	Backlash	0.01—0.49 mm (0.0004—0.019 in.)
Upper idler/camshaft gear	Backlash	0.01—0.52 mm (0.0004—0.020 in.)
Upper idler/injection pump gear	Backlash	0.01—0.52 mm (0.0004—0.020 in.)
Lower idler/crankshaft gear	Backlash	0.01—0.46 mm (0.0004—0.018 in.)
Lower idler/oil pump gear	Backlash	0.01—0.49 mm (0.0004—0.019 in.)
Camshaft/aux. drive gear	Backlash	0.01—0.54 mm (0.0004—0.021 in.)
Camshaft	End play	0.08—0.23 mm (0.003—0.009 in.)
	Maximum wear	0.38 mm (0.015 in.)
Thrust Plate	Thickness	3.935—3.985 mm (0.155—0.157 in.)

Continued on next page

CD03523,00000FC -19-10MAR09-1/3

Item	Measurement	Specification
	Maximum wear	3.8 mm (0.15 in.)
Camshaft Journal	Diameter	55.872—55.898 mm (2.1997—2.2007 in.)
	Maximum wear	55.85 mm (2.199 in.)
Camshaft Journal-to-bore	Max. clearance	0.18 mm (0.007 in.)
Camshaft Intake Lobe	Height	6.93—7.42 mm (0.273—0.292 in.)
	Maximum wear	6.68 mm (0.263 in.)
Camshaft Exhaust Lobe	Height	6.76—7.26 mm (0.266—0.286 in.)
	Maximum wear	6.50 mm (0.256 in.)
Cam Follower	diameter	31.62—31.64 mm (1.124—1.246 in.)
Cam Follower-to-Bore	Clearance	0.06—0.13 mm (0.002—0.005 in.)
Upper and lower idler gear	End play	0.14—0.29 mm (0.006—0.012 in.)
	Maximum wear	0.40 mm (0.016 in.)
Upper idler gear shaft (helical gear)	Diameter	44.437—44.463 mm (1.7495—1.7505 in.)
Lower idler gear shaft (helical and spur gear)	Diameter	44.437—44.463 mm (1.7495—1.7505 in.)
Upper idler gear shaft (spur gear)	Diameter	69.759—69.775 mm (2.7464—2.747 in.)
Upper idler gear bushing (helical gear)	Diameter	44.501—44.527 mm (1.752—1.753 in.)
Lower idler gear bushing (helical and spur gear)	Diameter	44.501—44.527 mm (1.752—1.753 in.)
Upper idler gear bushing (spur gear)	Diameter	69.827—69.857 mm (2.7491—2.7503 in.)
Upper idler gear bushing-to-shaft (helical gear)	Clearance	0.038—0.09 mm (0.0015—0.0035 in.)
	Maximum wear	0.15 mm (0.006 in.)
Lower idler gear bushing-to-shaft (helical and spur gear)	Clearance	0.038—0.09 mm (0.0015—0.0035 in.)
	Maximum wear	0.15 mm (0.006 in.)
Upper idler gear bushing-to-shaft (spur gear)	Clearance	0.052—0.098 mm (0.002—0.0038 in.)
	Maximum wear	0.15 mm (0.006 in.)
Upper shaft spring pin (spur gear)	Protrusion (C)	7.5—8.5 mm (0.295—0.335 in.)
Camshaft thrust plate cap screws	Torque	50 N·m (35 lb-ft)
Front plate countersunk screws	Torque	35 N·m (25 lb-ft)
Upper idler gear cap screw	Torque	110 N·m (80 lb-ft).
Lower idler gear nut	Torque	110 N·m (80 lb-ft).
Oil pump drive gear nut	Torque	75 N·m (55 lb-ft)
Aluminum timing gear cover		
Magnetic pick-up	Torque	15 N·m (11 lb-ft)

Continued on next page CD03523,00000FC -19-10MAR09-2/3

Item	Measurement	Specification
Injection pump drive gear nut access plug (Composite)	Torque	30 N·m (22 lb-ft)
Injection pump drive gear nut access plug (Steel)	Torque	70 N·m (52 lb-ft)
Oil pan to timing gear cover, cap screws (18—23)	Torque	50 N·m (35 lb-ft)
Timing gear cover to front plate, cap screws (1—17)	Torque	50 N·m (35 lb-ft)
Oil pressure regulating valve plug	Torque	95 N·m (70 lb-ft)
Aluminium oil filler neck	Torque	50 N·m (35 lb-ft)
Composite oil filler neck	Torque	30 N·m (22 lb-ft)
Obturation plate for oil filler orifice	Torque	50 N·m (35 lb-ft)
Auxiliary Equipment driven by camshaft gear		
Accessory gear-to-shaft	Torque	55 N·m (41 lb-ft)
Auxiliary equipment-to-engine (cap screw or nut)	Torque	50 N·m (35 lb-ft)

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Lubrication System Specifications

Item	Measurement	Specification
Oil pressure regulating valve spring	Load at a length of 42.5 mm (1.68 in.)	60 to 75 N (13.5 to 16.5 lb.)
Oil by-pass valve spring	Load at a length of 29 mm (1.14 in.)	79 to 96.5 N (18 to 22 lb.)
Oil pump		
Standard flow gear	Thickness	41.15 to 41.20 mm (1.62 to 1.622 in.)
	Axial clearance	0.05 to 0.17 mm (0.002 to 0.007 in.)
	Wear tolerance	0.22 mm (0.0085 in.)
Reduced flow gear	Thickness	28.80 to 28.85 mm (1.1339 to 1.1358 in.)
	Axial clearance	0.05 to 0.17 mm (0.002 to 0.007 in.)
	Wear tolerance	0.22 mm (0.0085 in.)
All types	Radial clearance between gear and pump housing	0.10 to 0.16 mm (0.004 to 0.006 in.)
	Wear tolerance	0.20 mm (0.008 in.)
Drive shaft bore	Diameter	16.05 to 16.08 mm (0.632 to 0.633 in.)
	Wear tolerance	0.08 mm (0.003 in.)
Drive shaft	Diameter	16.02 to 16.03 mm (0.630 to 0.631in.)
	Wear tolerance	0.025 mm (0.001 in.)
Idler shaft	Diameter	12.32 to 12.34 mm (0.485 to 0.486 in.)
	Wear tolerance	0.013 mm (0.0005 in.)
Oil cooler nipple	Torque	35 N·m (25 lb-ft)
Standard oil cooler/Oil filter bracket on Engine with camshaft-gear-driven auxiliary drive		
Oil cooler/filter bracket holding screw	Torque	35 N·m (25 lb-ft)
Oil filter fitting	Torque	45 N·m (33 lb-ft)
Oil cooler nipple	Torque	35 N·m (25 lb-ft)
Oil filter adapter/oil cooler holding screw (remote oil filter)	Torque	35 N·m (25 lb-ft)
Oil pressure regulating valve plug	Torque	95 N·m (70 lb-ft)
Oil pump strainer screws	Torque	50 N·m (35 lb-ft)
Oil pump-to-front plate, screws	Torque	50 N·m (35 lb-ft)
Oil pump drive gear nut	Torque	75 N·m (55 lb-ft)
Oil pan (all types)-to-timing gear cover	Torque	50 N·m (35 lb-ft)
Sheet metal oil pan-to-block and flywheel housing	Torque	50 N·m (35 lb-ft)
Aluminium oil pan-to-block and flywheel housing	Torque	50 N·m (35 lb-ft)
Cast iron pan-to-block and flywheel housing: SAE 5 screws (3 dashes)	Torque	50 N·m (35 lb-ft)

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Item	Measurement	Specification
Cast iron pan-to-block and flywheel housing: SAE 8 screws (6 dashes)	Torque	70 N·m (50 lb-ft)
Oil pan drain plug		
Cylindrical plug with copper seal	Torque	70 N·m (50 lb-ft)
Cylindrical plug with O-ring seal	Torque	50 N·m (35 lb-ft)
Conical plug	Torque	55 N·m (40 lb-ft)

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Oil Dipstick Guide Height Specifications

JOHN DEERE AGRICULTURAL EQUIPMENT		
Machine Model	**Engine Model**	**Dipstick guide height**
Tractor		
5003E (India built)	PY3029DPY03 (Trem 3)	149 mm (5.86 in.)
5036C (india built)	PY3029DPY21	149 mm (5.86 in.)
5038C MFWD (India built)	PY3029DPY29	149 mm (5.86 in.)
5038 (India built)	PY3029DPY17 (Trem 3)	149 mm (5.86 in.)
5038D (India built)	PY3029DPY23)	149 mm (5.86 in.)
5041C (India built)	PY3029DPY22	149 mm (5.86 in.)
5041C MFWD (India built)	PY3029DPY210)	149 mm (5.86 in.)
5042D (India built)	PY3029DPY24	149 mm (5.86 in.)
5042D MFWD (India built)	PY3029DPY211	149 mm (5.86 in.)
5045D (India built)	PY3029DPY25	149 mm (5.86 in.)
5045D (Export-US, India built)	PY3029TPY30 (IT4)	149 mm (5.86 in.)
5045E (Export-US, India built)	PY3029TPY25 (IT4)	149 mm (5.86 in.)
5050D (India built)	PY3029DPY26	149 mm (5.86 in.)
5050E (Export-EU, India built)	PY3029TPY33	149 mm (5.86 in.)
5055D (Export-US, India built)	PY3029TPY29 (Tier 2)	149 mm (5.86 in.)
5055E (Export-US, India built)	PY3029TPY21 (Tier 2)	149 mm (5.86 in.)
5055E (India built)	PY3029HPY36	149 mm (5.86 in.)
5055E (Export-EU, India built)	PY3029HPY32	149 mm (5.86 in.)
5055E Cab (Export-EU, India built)	PY3029HPY42	149 mm (5.86 in.)
5055 Cab (Export-US, India built)	PY3029TPY50	149 mm (5.86 in.)
5056G/GV/GF (Agritalia built)	CD3029TAT70 (Tier 2)	156 mm (6.14 in.)
5060E (India built)	PY3029HPY37	149 mm (5.86 in.)
5065E (Export-US, India built)	PY3029TPY22 (Tier 2)	149 mm (5.86 in.)
5065E (India built)	PY3029HPY38	149 mm (5.86 in.)
5065E (Export-EU, India built)	PY3029HPY33	149 mm (5.86 in.)
5065E Cab (Export-EU, India built)	PY3029HPY41	149 mm (5.86 in.)
5065E Cab (Export-US, India built)	PY3029TPY49	149 mm (5.86 in.)
5067G/GV/GF (Agritalia built)	CD3029TAT71 (Tier 2)	156 mm (6.14 in.)
5075E (Export-US, India built)	PY3029TPY24 (Tier 2)	149 mm (5.86 in.)
5075E (India built)	PY3029HPY39	149 mm (5.86 in.)
5075E (Export-EU, India built)	PY3029HPY34	149 mm (5.86 in.)
5075E Cab (Export-EU, India built)	PY3029HPY40	149 mm (5.86 in.)
5075E Cab (Export-US, India built)	PY3029TPY48	149 mm (5.86 in.)
5103 (India built)	PY3029DPY03 (Trem 3)	149 mm (5.86 in.)
5103 Super (India built)	PY3029DPY04 (Trem 3)	149 mm (5.86 in.)
5103 (Export-U.S., India built))	PE3029DPY06 (Tier 1)	156 mm (6.14 in.)
5103 (Export-U.S., India built)	PY3029DPY12 (Tier 1)	149 mm (5.86 in.)
5103 (Export-U.S., India built)	PY3029TPY23 (Tier 2)	149 mm (5.86 in.)
5103 (Export-Australia, India built)	PY3029DPY12 (Tier 1)	149 mm (5.86 in.)
5103 (Export-Australia, India built)	PY3029TPY25 (IT4)	149 mm (5.86 in.)
5104 (India built)	PY3029DPY14 (Trem 3)	149 mm (5.86 in.)
5105 (Advantage, Augusta built)	PE3029DLV51	156 mm (6.14 in.)
5105 (Advantage, Augusta built)	PE3029DLV56 (Tier 2)	156 mm (6.14 in.)
5203 (India built)	PY3029DPY02 (Trem 3)	149 mm (5.86 in.)
5203 Super (India built)	PY3029DPY08 (Trem 3)	149 mm (5.86 in.)
5203 (Export-U.S., India built)	PE3029DPY05 (Tier 1)	156 mm (6.14 in.)
5203 (Export-U.S., India built)	PY3029DPY13 (Tier 1)	149 mm (5.86 in.)
5203 (Export-U.S., India built)	PY3029TPY21 (Tier 2)	149 mm (5.86 in.)

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JOHN DEERE AGRICULTURAL EQUIPMENT		
Machine Model	**Engine Model**	**Dipstick guide height**
5204 (India built)	PY3029DPY15 (Trem 3)	149 mm (5.86 in.)
5204 (Export-Mexico, India built)	PY3029DPY18 (Trem 3)	149 mm (5.86 in.)
5205 (Advantage, Augusta built)	PE3029DLV52	156 mm (6.14 in.)
5205 (Advantage, Augusta built)	PE3029DLV57 (Tier 2)	156 mm (6.14 in.)
5210 (Augusta built)	PE3029DLV53 (Tier 1)	156 mm (6.14 in.)
5210 (Augusta built)	PE3029DLV54 (Tier 1)	156 mm (6.14 in.)
5215/5215N (Agritalia built)	CD3029TAT70 (Tier 2)	156 mm (6.14 in.)
5220 (Augusta built)	PE3029DLV53 (Tier 1)	156 mm (6.14 in.)
5220 (Augusta built)	PE3029DLV55 (Tier 1)	156 mm (6.14 in.)
5300/5300N (Augusta built)	CD3029DAT01	136 mm (5.35 in.)
5303 (Export-Mexico, India built)	PY3029DPY07 (Trem 3)	149 mm (5.86 in.)
5303 (Export-Turkey, India built)	PY3029DPY05 (Tier 1)	149 mm (5.86 in.)
5303 (Export-Turkey, India built)	PY3029TPY26 (Tier 2)	149 mm (5.86 in.)
5303 (Export-U.S., India built))	PY3029TPY11 (Tier 1)	149 mm (5.86 in.)
5303 (Export-U.S. India built))	PE3029TLV52 (Tier 1)	156 mm (6.14 in.)
5303 (Export-U.S., India built)	PY3029TPY22 (Tier 2)	149 mm (5.86 in.)
5303 (Export-North Africa, India built)	PY3029DPY07 (Trem 3)	149 mm (5.86 in.)
5303 (Export-South Africa, India built)	PY3029DPY07 (Trem3)	149 mm (5.86 in.)
5310/5310N (Agritalia built)	CD3029DAT50 (Tier 1)	156 mm (6.14 in.)
5310 (India built)	PY3029DPY01 (Trem 3)	149 mm (5.86 in.)
5310R (India built)	PY3029DPY09	149 mm (5.86 in.)
5310S (India built)	PY3029TPY03 (Tier 1)	149 mm (5.86 in.)
5310/5310N (Augusta built)	PE3029TLV50 (Tier 1)	156 mm (6.14 in.)
5310/5310N (Augusta built)	PE3029TLV52 (Tier 1)	156 mm (6.14 in.)
5315/5315N (Agritalia built)	CD3029TAT71 (Tier 2)	156 mm (6.14 in.)
5320/5320N (Augusta built)	PE3029TLV52 (Tier 1)	156 mm (6.14 in.)
5400/5400N (Agritalia built)	CD3029TAT02	156 mm (6.14 in.)
5403 (Export-Turkey, India built)	PY3029TPY02 (Tier 1)	149 mm (5.86 in.)
5403 (Export-Turkey, India built)	PY3029TPY27 (Tier 2)	149 mm (5.86 in.)
5403 (Export-U.S. India built)	PY3029TPY24 (Tier 2)	149 mm (5.86 in.)
5403 (Export-South Africa, India built).)	PY3029TPY04 (Trem 3)	149 mm (5.86 in.)
5410 (India built)	PY3029TPY03 (Trem 3)	149 mm (5.86 in.)
5410 (Export-China, India built)	PY3029TPY01 (Trem 3)	149 mm (5.86 in.)
5410/5410N (Agritalia built)	CD3029TAT50 (Tier 1)	156 mm (6.14 in.)
5503 (Export-Turkey, India built)	PY3029TPY28 (Tier 2)	149 mm (5.86 in.)
5610 (India built)	PY3029TPY11 (Trem 3)	149 mm (5.86 in.)
R40 (Export - China, India built)	PY3029TPY211	149 mm (5.86 in.)

JOHN DEERE CONSTRUCTION AND FORESTRY EQUIPMENT		
Machine Model	**Engine Model**	**Dipstick guide height**
Skid Steer Loader		
240 (Non-Auxiliary Drive)	PE3029DKV50	131 mm (5.16 in.)
240 (Auxiliary Drive)	PE3029DKV51	131 mm (5.16 in.)
240 (Tier 1, Non-Auxiliary Drive)	PE3029DKV54	131 mm (5.16 in.)
240 (Tier 1, Auxiliary Drive)	PE3029DKV55	131 mm (5.16 in.)
250 (Tier 1, Auxiliary Drive)	PE3029TKV50	131 mm (5.16 in.)
250 (Tier 1, Non-Auxiliary Drive)	PE3029TKV51	131 mm (5.16 in.)
260 (Tier 1, Auxiliary Drive)	PE3029TKV52	131 mm (5.16 in.)
260 (Tier 1, Non-Auxiliary Drive)	PE3029TKV53	131 mm (5.16 in.)

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)		
Engine Model	**Oil dipstick option code**	**Dipstick guide height**
3029DF120	4001, 4002	189 mm (7.44 in.)
	4003	387 mm (15.24 in.)
	4004	187 mm (7.36 in.)
	4005	390 mm (15.35 in.)
	4006	205 mm (8.07 in.)
	4022	196 mm (7.72 in.)
	4024	136 mm (5.35 in.)
3029DF121	4004	187 mm (7.36 in.)
	4005	390 mm (15.35 in.)
3029DF122	4001, 4004	189 mm (7.44 in.)
3029DF123	4004	187 mm (7.36 in.)
3029DF124	4004	187 mm (7.36 in.)
3029DF128	4004	187 mm (7.36 in.)
3029DF150	4004	187 mm (7.36 in.)
	4005	390 mm (15.35 in.)
	4006	205 mm (8.07 in.)
	4022	196 mm (7.72 in.)
	4024	136 mm (5.35 in.)
3029DF151	4004	187 mm (7.36 in.)
3029DF152	4004	187 mm (7.36 in.)
3029DF160	4006	205 mm (8.07 in.)
	4022	196 mm (7.72 in.)
	4024	136 mm (5.35 in.)
	4033	155 mm (6.10 in.)
3029DF161	4022	196 mm (7.72 in.)
	4024	136 mm (5.35 in.)
3029DF162	4006	205 mm (8.07 in.)
	4024	136 mm (5.35 in.)
	4027	208 mm (8.19 in.)
3029DF163	4024	136 mm (5.35 in.)
3029DF164	4024	136 mm (5.35 in.)
	4033	155 mm (6.10 in.)
3029DF165	4024	136 mm (5.35 in.)
3029DF166	4026	156 mm (6.14 in.)
3029DF180	4006	205 mm (8.07 in.)
	4022	196 mm (7.72 in.)
	4024	136 mm (5.35 in.)
	4033	155 mm (6.10 in.)
3029DF186	4026	156 mm (6.14 in.)
3029DFG21		187 mm (7.36 in.)
3029DFG22		187 mm (7.36 in.)
3029DFG50		187 mm (7.36 in.)
3029DFG51		187 mm (7.36 in.)
3029HF270	4006	205 mm (8.07 in.)
	4023	212 mm (8.35 in.)
	4024	136 mm (5.35 in.)
	4026	156 mm (6.14 in.)
3029HFG80	4006	205 mm (8.07 in.)
3029HFU70	4006	205 mm (8.07 in.)
3029HFU80	4006	205 mm (8.07 in.)

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)		
Engine Model	**Oil dipstick option code**	**Dipstick guide height**
3029TF120	4006	205 mm (8.07 in.)
	4023	212 mm (8.35 in.)
	4024	136 mm (5.35 in.)
	4025	408 mm (16.06 in.)
	4027	208 mm (8.19 in.)
3029TF121	4006	205 mm (8.07 in.)
	4025	408 mm (16.06 in.)
3029TF123	4006	205 mm (8.07 in.)
3029TF150	4006	205 mm (8.07 in.)
	4023	212 mm (8.35 in.)
	4024	136 mm (5.35 in.)
	4025	408 mm (16.06 in.)
3029TF151	4011	507 mm (19.96 in.)
3029TF152	4006	205 mm (8.07 in.)
3029TF158	4006	205 mm (8.07 in.)
3029TF160	4006	205 mm (8.07 in.)
	4021, 4026	156 mm (6.14 in.)
	4023	212 mm (8.35 in.)
	4024	136 mm (5.35 in.)
	4033	155 mm (6.10 in.)
3029TF161	4021	156 mm (6.14 in.)
	4022	141 mm (5.55 in.)
3029TF162	4006	205 mm (8.07 in.)
	4026	156 mm (6.14 in.)
	4027	208 mm (8.19 in.)
3029TF163	4006	205 mm (8.07 in.)
	4024	136 mm (5.35 in.)
	4027	208 mm (8.19 in.)
3029TF180	4006	205 mm (8.07 in.)
	4023	212 mm (8.35 in.)
	4024	136 mm (5.35 in.)
	4026	156 mm (6.14 in.)
	4033	155 mm (6.10 in.)
3029TF270	4006	205 mm (8.07 in.)
	4023	212 mm (8.35 in.)
	4024	136 mm (5.35 in.)
	4025	408 mm (16.06 in.)
	4026	156 mm (6.14 in.)
3029TFG21		187 mm (7.36 in.)
3029TFG50		187 mm (7.36 in.)
3029TFG51		187 mm (7.36 in.)
3029TFG71		212 mm (8.35 in.)
3029TFG80	4006	187 mm (7.36 in.)
3029TFU70	4006	205 mm (8.07 in.)
3029TFU80	4006	187 mm (7.36 in.)

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Cooling System Specifications

Item	Measurement	Specification
Impeller-to-water pump housing	Clearance	0 to -0.25 mm (0 to -0.01 in.)
Fan/Alternator belt		
Single belt (New belt)	Tension	578—622 N (130—140 lb-force)
Single belt (Used belt[1])	Tension	378—423 N (85—94 lb-force)
Dual belt (New belt)	Tension	423—467 N (95—104 lb-force)
Dual belt (Used belt[1])	Tension	378—423 N (85—94 lb-force)
Fan/Alternator belt	Tension	19 mm (0.75 in.) deflection with an 90 N (20 lb-force) halfway between pulleys
Water pump housing-to-cover, cap screws	Torque	45 N·m (33 lb-ft)
Water pump-to-engine, cap screws	Torque	50 N·m (35 lb-ft)
Water pump-to-engine, nut	Torque	40 N·m (30 lb-ft)
Thermostat cover cap screws	Torque	50 N·m (35 lb-ft)
Cold Start Advance Switch	Torque	5 N·m (3.5 lb-ft)
Fan-to-pulley, 5/16 in. cap screws	Torque	30 N·m (22 lb-ft)
Fan-to-pulley, 3/8 in. cap screws	Torque	50 N·m (35 lb-ft)

[1] *Belts are considered used after 10 minutes of operation.*

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Distance from Pulley or Hub to Water Pump Housing Sealing Surface Specifications

JOHN DEERE AGRICULTURAL EQUIPMENT		
Machine Model	**Engine Model**	**Distance**
Tractor		
5003E (India built)	PY3029DPY03 (Trem 3)	136 mm (5.35 in.)
5036C (India built)	PY3029DPY21	136 mm (5.35 in.)
5038C MFWD (India built)	PY3029DPY29	136 mm (5.35 in.)
5038 (India built)	PY3029DPY17 (Trem 3)	136 mm (5.35 in.)
5038D (India built)	PY3029DPY23	136 mm (5.35 in.)
5041C (India built)	PY3029DPY22	136 mm (5.35 in.)
5041C MFWD (India built)	PY3029DPY210	136 mm (5.35 in.)
5042D (India built)	PY3029DPY24	136 mm (5.35 in.)
5042D MFWD (India built)	PY3029DPY211	136 mm (5.35 in.)
5045D (India built)	PY3029DPY25	136 mm (5.35 in.)
5045D (Export-US, India built)	PY3029TPY30 (IT4)	136 mm (5.35 in.)
5045E (Export-US, India built)	PY3029TPY25 (IT4)	136 mm (5.35 in.)
5050D (India built)	PY3029DPY26	136 mm (5.35 in.)
5050E (Export-EU, India built)	PY3029TPY33	136 mm (5.35 in.)
5055D (Export-US, India built)	PY3029TPY29 (Tier 2)	136 mm (5.35 in.)
5055E (Export-US, India built)	PY3029TPY21 (Tier 2)	136 mm (5.35 in.)
5055E (India built)	PY3029HPY36	136 mm (5.35 in.)
5055E (Export-EU, India built)	PY3029HPY32	136 mm (5.35 in.)
5055E Cab (Export-EU, India built)	PY3029HPY42	136 mm (5.35 in.)
5055E Cab (Export-US, India built)	PY3029TPY50	136 mm (5.35 in.)
5056G/GV/GF (Agritalia built)	CD3029TAT70 (Tier 2)	136 mm (5.35 in.)
5060E (India built)	PY3029HPY37	136 mm (5.35 in.)
5065E Export-US, (India built)	PY3029TPY22 (Tier 2)	136 mm (5.35 in.)
5065E (India built)	PY3029HPY38	136 mm (5.35 in.)
5065E (Export-EU, India built)	PY3029HPY33	136 mm (5.35 in.)
5065E Cab (Export-EU, India built)	PY3029HPY41	136 mm (5.35 in.)
5065E Cab (Export-US, India built)	PY3029TPY49	136 mm (5.35 in.)
5067G/GV/GF (Agritalia built)	CD3029TAT71 (Tier 2)	136 mm (5.35 in.)
5075E (Export-US, India built)	PY3029TPY24 (Tier 2)	136 mm (5.35 in.)
5075E (India built)	PY3029HPY39	136 mm (5.35 in.)
5075E (Export-EU, India built)	PY3029HPY34	136 mm (5.35 in.)
5075E Cab (Export-EU, India built)	PY3029HPY40	136 mm (5.35 in.)
5075E Cab (Export-US, India built)	PY3029TPY48	136 mm (5.35 in.)
5103 (India built)	PY3029DPY03 (Trem 3)	136 mm (5.35 in.)
5103 Super (India built)	PY3029DPY04 (Trem 3)	136 mm (5.35 in.)
5103 (Export-U.S., India built))	PE3029DPY06 (Tier 1)	136 mm (5.35 in.)
5103 (Export-U.S., India built)	PY3029DPY12 (Tier 1)	136 mm (5.35 in.)
5103 (Export-U.S., India built)	PY3029TPY23 (Tier 2)	136 mm (5.35 in.)
5103 (Export-Australia, India built)	PY3029DPY12 (Tier 1)	136 mm (5.35 in.)
5103 (Export-Australia, India built)	PY3029TPY25 (IT4)	136 mm (5.35 in.)
5104 (India built)	PY3029DPY14 (Trem 3)	136 mm (5.35 in.)
5105 (Advantage, Augusta built)	PE3029DLV51	136 mm (5.35 in.)
5105 (Advantage, Augusta built)	PE3029DLV56 (Tier 2)	136 mm (5.35 in.)
5203 (India built)	PY3029DPY02 (Trem 3)	136 mm (5.35 in.)
5203 Super (India built)	PY3029DPY08 (Trem 3)	136 mm (5.35 in.)
5203 (Export-U.S., India built)	PE3029DPY05 (Tier 1)	136 mm (5.35 in.)
5203 (Export-U.S., India built)	PY3029DPY13 (Tier 1)	136 mm (5.35 in.)

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JOHN DEERE AGRICULTURAL EQUIPMENT		
Machine Model	**Engine Model**	**Distance**
5203 (Export-U.S., India built)	PY3029TPY21 (Tier 2)	136 mm (5.35 in.)
5204 (India built)	PY3029DPY15 (Trem 3)	136 mm (5.35 in.)
5204 (Export-Mexico, India built)	PY3029DPY18 (Trem 3)	136 mm (5.35 in.)
5205 (Advantage, Augusta built)	PE3029DLV52	136 mm (5.35 in.)
5205 (Advantage, Augusta built)	PE3029DLV57 (Tier 2)	136 mm (5.35 in.)
5210 (Augusta built)	PE3029DLV53 (Tier 1)	136 mm (5.35 in.)
5210 (Augusta built)	PE3029DLV54 (Tier 1)	136 mm (5.35 in.)
5215/5215N (Agritalia built)	CD3029TAT70 (Tier 2)	136 mm (5.35 in.)
5220 (Augusta built)	PE3029DLV53 (Tier 1)	136 mm (5.35 in.)
5220 (Augusta built)	PE3029DLV55 (Tier 1)	136 mm (5.35 in.)
5300/5300N (Augusta built)	CD3029DAT01	136 mm (5.35 in.)
5303 (Export-Mexico, India built)	PY3029DPY07 (Trem 3)	136 mm (5.35 in.)
5303 (Export-Turkey, India built)	PY3029DPY05 (Tier 1)	136 mm (5.35 in.)
5303 (Export-Turkey, India built)	PY3029TPY26 (Tier 2)	136 mm (5.35 in.)
5303 (Export-U.S., India built))	PY3029TPY11 (Tier 1)	136 mm (5.35 in.)
5303 (Export-U.S. India built))	PE3029TLV52 (Tier 1)	136 mm (5.35 in.)
5303 (Export-U.S., India built)	PY3029TPY22 (Tier 2)	136 mm (5.35 in.)
5303 (Export-North Africa, India built)	PY3029DPY07 (Trem 3)	136 mm (5.35 in.)
5303 (Export-South Africa, India built)	PY3029DPY07 (Trem3)	136 mm (5.35 in.)
5310/5310N (Agritalia built)	CD3029DAT50 (Tier 1)	136 mm (5.35 in.)
5310 (India built)	PY3029DPY01 (Trem 3)	136 mm (5.35 in.)
5310R (India built)	PY3029DPY09	136 mm (5.35 in.)
5310S (India built)	PY3029TPY03 (Tier 1)	136 mm (5.35 in.)
5310/5310N (Augusta built)	PE3029TLV50 (Tier 1)	136 mm (5.35 in.)
5310/5310N (Augusta built)	PE3029TLV52 (Tier 1)	136 mm (5.35 in.)
5315/5315N (Agritalia built)	CD3029TAT71 (Tier 2)	136 mm (5.35 in.)
5320/5320N (Augusta built)	PE3029TLV52 (Tier 1)	136 mm (5.35 in.)
5400/5400N (Agritalia built)	CD3029TAT02	136 mm (5.35 in.)
5403 (Export-Turkey, India built)	PY3029TPY02 (Tier 1)	136 mm (5.35 in.)
5403 (Export-Turkey, India built)	PY3029TPY27 (Tier 2)	136 mm (5.35 in.)
5403 (Export-U.S. India built)	PY3029TPY24 (Tier 2)	136 mm (5.35 in.)
5403 (Export-South Africa, India built).)	PY3029TPY04 (Trem 3)	136 mm (5.35 in.)
5410 (India built)	PY3029TPY03 (Trem 3)	136 mm (5.35 in.)
5410 (Export-China, India built)	PY3029TPY01 (Trem 3)	136 mm (5.35 in.)
5410/5410N (Agritalia built)	CD3029TAT50 (Tier 1)	136 mm (5.35 in.)
5503 (Export-Turkey, India built)	PY3029TPY28 (Tier 2)	136 mm (5.35 in.)
5610 (India built)	PY3029TPY11 (Trem 3)	136 mm (5.35 in.)
R40 (Export - China, India built)	PY3029TPY211	136 mm (5.35 in.)

Distance from Pulley or Hub to Water Pump Housing Sealing Surface

JOHN DEERE CONSTRUCTION AND FORESTRY EQUIPMENT		
Machine Model	**Engine Model**	**Distance**
Skid Steer Loader		
240 (Non-Auxiliary Drive)	PE3029DKV50	137 mm (5.39 in.)
240 (Auxiliary Drive)	PE3029DKV51	137 mm (5.39 in.)
240 (Tier 1, Non-Auxiliary Drive)	PE3029DKV54	137 mm (5.39 in.)
240 (Tier 1, Auxiliary Drive)	PE3029DKV55	137 mm (5.39 in.)
250 (Tier 1, Auxiliary Drive)	PE3029TKV50	137 mm (5.39 in.)
250 (Tier 1, Non-Auxiliary Drive)	PE3029TKV51	137 mm (5.39 in.)
260 (Tier 1, Auxiliary Drive)	PE3029TKV52	137 mm (5.39 in.)
260 (Tier 1, Non-Auxiliary Drive)	PE3029TKV53	137 mm (5.39 in.)

Distance from Pulley or Hub to Water Pump Housing Sealing Surface

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)		
Engine Model	**Water pump option code**	**Distance**
3029DF120	2007, 2020, 2021	140 mm (5.51 in.)
	2010, 2022, 2044	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
3029DF121	2020	140 mm (5.51 in.)
	2023	165 mm (6.50 in.)
3029DF122	2034	140 mm (5.51 in.)
3029DF123	2020	140 mm (5.51 in.)
3029DF124	2034	140 mm (5.51 in.)
3029DF128	2034, 2042	140 mm (5.51 in.)
3029DF150	2010, 2022	137 mm (5.39 in.)
	2020, 2021	140 mm (5.51 in.)
	2023	165 mm (6.50 in.)
3029DF151	2020	140 mm (5.51 in.)
3029DF152	2020	140 mm (5.51 in.)
3029DF160	2020, 2021	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
3029DF161	2020	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
3029DF162	2022, 2024	137 mm (5.39 in.)
3029DF163	2020	140 mm (5.51 in.)
3029DF164	2020	140 mm (5.51 in.)
3029DF165	2024	137 mm (5.39 in.)
	2033	140 mm (5.51 in.)
3029DF166	2017	137 mm (5.39 in.)
3029DF180	2020, 2021	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
3029DF186	2017	137 mm (5.39 in.)
3029DFG21		137 mm (5.39 in.)
3029DFG22		137 mm (5.39 in.)
3029DFG50		137 mm (5.39 in.)
3029DFG51		137 mm (5.39 in.)
3029HF270	2020	140 mm (5.51 in.)
3029HFG80	2020	140 mm (5.51 in.)
3029HFU70	2020	140 mm (5.51 in.)
3029HFU80	2020	140 mm (5.51 in.)
3029TF120	2020, 2021	140 mm (5.51 in.)
	2020, 2028	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
3029TF121	2020	140 mm (5.51 in.)
	2023	165 mm (6.50 in.)
3029TF123	2020	140 mm (5.51 in.)
3029TF150	2020, 2021	140 mm (5.51 in.)
	2022, 2028	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
3029TF151	2022	137 mm (5.39 in.)
	2025	140 mm (5.51 in.)
3029TF152	2020	140 mm (5.51 in.)
3029TF158	2020	140 mm (5.51 in.)

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)		
Engine Model	**Water pump option code**	**Distance**
3029TF160	2020,2021	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
3029TF161	2020	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
3029TF162	2022, 2024	137 mm (5.39 in.)
3029TF163	2024	137 mm (5.39 in.)
	2033	140 mm (5.51 in.)
3029TF180	2020, 2021	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
3029TF270	2020, 2021, 2033	140 mm (5.51 in.)
3029TFG21		137 mm (5.39 in.)
3029TFG50		137 mm (5.39 in.)
3029TFG51		137 mm (5.39 in.)
3029TFG71		137 mm (5.39 in.)
3029TFG80	2020	140 mm (5.51 in.)
3029TFU70	2020	140 mm (5.51 in.)
3029TFU80	2020	140 mm (5.51 in.)

Distance from Pulley or Hub to Water Pump Housing Sealing Surface

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Air Intake and Exhaust System Specifications

Turbocharger Boost Pressure

JOHN DEERE AGRICULTURAL EQUIPMENT				
Tractor Model	**Engine Model**	**Turbocharger Model**	**Rated Speed rpm**	**Boost pressure at full rated speed kpa (bar) (psi) ± 10%**
Tractor				
5045D (Export-US, India built)	PY3029TPY30 (IT4)	Honeywell	2300	72 (0.72) (10.4)
5045E (Export-US, India built)	PY3029TPY25 (IT4)	Honeywell	2400	75 (0.75) (10.9)
5050E (Export-EU, India built)	PY3029TPY33	Honeywell	2400	70 (0.70) (10.1)
5055D (Export-US, India built)	PY3029TPY29 (Tier 2)	Honeywell	2300	82 (0.82) (11.9)
5055E (Export-US, India built)	PY3029TPY21 (Tier 2)	Honeywell	2400	85 (0.85) (12.3)
5055E (India built)	PY3029HPY36	Borg-Warner	2400	110 (1.10) (16.0)
5055E (Export-EU, India built)	PY3029HPY32	Borg-Warner	2400	115 (1.15) (16.7)
5055E Cab (Export -EU, India built)	PY3029HPY42	Borg-Warner	2400	115 (1.15) (16.7)
5055E (Export-US, India built)	PY3029TPY50	Honeywell	2400	85 (0.85) (12.3)
5056G/GV/GF (Agritalia built)	CD3029TAT70 (Tier 2)	Borg-Warner/Schwitzer S1B (with wastegate)	2300	74 (0.74) (10.7)
5060E (India built)	PY3029HPY37	Borg-Warner	2400	
5065E Export-US, (India built)	PY3029TPY22 (Tier 2)	Borg-Warner/Schwitzer S1B	2400	100 (1.00) (14.5)
5065E (India built)	PY3029HPY38	Borg-Warner	2400	
5065E (Export-EU, India built)	PY3029HPY33	Borg-Warner	2400	125 (1.25) (18.1)
5065E Cab (Export-EU, India built)	PY3029HPY41	Borg-Warner	2400	125 (1.25) (18.1)
5065E Cab (Export-US, India built)	PY3029TPY49	Borg-Warner	2400	100 (1.00) (14.5)
5067G/GV/GF (Agritalia built)	CD3029TAT71 (Tier 2)	Borg-Warner/Schwitzer S1B (with wastegate)	2300	81 (0.81) (11.7)
5075E (Export-US, India built)	PY3029TPY24 (Tier 2)	Borg-Warner/Schwitzer S1B	2400	117 (1.17) (17)
5075E (India built)	PY3029HPY39	Borg-Warner	2400	
5075E (Export-EU, India built)	PY3029HPY34	Borg-Warner	2400	140 (1.40) (20.3)
5075E Cab (Export-EU, India built)	PY3029HPY40	Borg-Warner	2400	140 (1.40) (20.3)
5075E Cab (Export-US, India built)	PY3029TPY48	Borg-Warner	2400	117 (1.17) (17)
5103 (Export-U.S., India built)	PY3029TPY23 (Tier 2)	Borg-Warner/Schwitzer S1B	2400	76 (0.76) (11)
5103 (Export-Australia, India built)	PY3029TPY25 (IT4)	Borg-Warner/Schwitzer S1B	2400	75 (0.75) (10.9)
5203 (Export-U.S., India built)	PY3029TPY21 (Tier 2)	Borg-Warner/Schwitzer S1B	2400	85 (0.85) (12.3)
5215/5215N (Agritalia built)	CD3029TAT70 (Tier 2)	Borg-Warner/Schwitzer S1B (with wastegate)	2300	74 (0.74) (10.7)
5303 (Export-Turkey, India built)	PY3029TPY26 (Tier 2)	Borg-Warner/Schwitzer S1B	2400	85 (0.85) (12.3)
5303 (Export-U.S., India built))	PY3029TPY11 (Tier 1)	Borg-Warner/Schwitzer S1B	2400	77 (0.77) (11.2)
5303 (Export-U.S. India built))	PE3029TLV52 (Tier 1)	Borg-Warner/Schwitzer S1B	2400	100 (1.00) (14.5)
5303 (Export-U.S., India built)	PY3029TPY22 (Tier 2)	Borg-Warner/Schwitzer S1B	2400	100 (1.00) (14.5)
5310S (India built)	PY3029TPY03 (Tier 1)	Borg-Warner/Schwitzer S1B	2400	77 (0.77) (11.2)
5310/5310N (Augusta built)	PE3029TLV50 (Tier 1)	Borg-Warner/Schwitzer S1B	2400	100 (1.00) (14.5)
5310/5310N (Augusta built)	PE3029TLV52 (Tier 1)	Borg-Warner/Schwitzer S1B	2400	100 (1.00) (14.5)
5315/5315N (Agritalia built)	CD3029TAT71 (Tier 2)	Borg-Warner/Schwitzer S1B (with wastegate)	2300	81 (0.81) (11.7)
5320/5320N (Augusta built)	PE3029TLV52 (Tier 1)	Borg-Warner/Schwitzer S1B	2400	100 (1.00) (14.5)
5400/5400N (Agritalia built)	CD3029TAT02	Garrett TA25	2400	77 (0.77) (11.2)
5403 (Export-Turkey, India built)	PY3029TPY02 (Tier 1)	Borg-Warner/Schwitzer S1B	2400	77 (0.77) (11.2)

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JOHN DEERE AGRICULTURAL EQUIPMENT				
Tractor Model	**Engine Model**	**Turbocharger Model**	**Rated Speed rpm**	**Boost pressure at full rated speed kpa (bar) (psi) ± 10%**
5403 (Export-Turkey, India built)	PY3029TPY27 (Tier 2)	Borg-Warner/Schwitzer S1B	2400	100 (1.00) (14.5)
5403 (Export-U.S. India built)	PY3029TPY24 (Tier 2)	Borg-Warner/Schwitzer S1B	2400	117 (1.17) (17)
5403 (Export-South Africa, India built).)	PY3029TPY04 (Trem 3)	Borg-Warner/Schwitzer S1B	2400	121 (1.21) (17.5)
5410 (India built)	PY3029TPY03 (Trem 3)	Borg-Warner/Schwitzer S1B	2400	77 (0.77) (11.2)
5410 (Export-China, India built)	PY3029TPY01 (Trem 3)	Borg-Warner/Schwitzer S1B	2400	121 (1.21) (17.5)
5410/5410N (Agritalia built)	CD3029TAT50 (Tier 1)	Borg-Warner/Schwitzer S1B	2300	99 (0.99) (14.4)
5503 (Export-Turkey, India built)	PY3029TPY28 (Tier 2)	Borg-Warner/Schwitzer S1B	2400	117 (1.17) (17)
5610 (India built)	PY3029TPY11 (Trem 3)	Borg-Warner/Schwitzer S1B	2400	77 (0.77) (11.2)
R40 (Export - China, India built)	PY3029TPY211	Honeywell	2400	100 (1.00) (14.5)

Turbocharger boost pressure

JOHN DEERE CONSTRUCTION AND FORESTRY EQUIPMENT				
Machine Model	**Engine Model**	**Turbocharger Model**	**Rated Speed rpm**	**Boost pressure at full rated speed kpa (bar) (psi) ± 10%**
Skid Steer Loader				
250 (Tier 1, Auxiliary Drive)	PE3029TKV50	Borg-Warner/Schwitzer S1B	2400	99 (0.99) (14.4)
250 (Tier 1, Non-Auxiliary Drive)	PE3029TKV51	Borg-Warner/Schwitzer S1B	2400	99 (0.99) (14.4)
260 (Tier 1, Auxiliary Drive)	PE3029TKV52	Borg-Warner/Schwitzer S1B	2400	105 (1.05) (15.2)
260 (Tier 1, Non-Auxiliary Drive)	PE3029TKV53	Borg-Warner/Schwitzer S1B	2400	105 (1.05) (15.2)

Turbocharger boost pressure

-JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)				
Engine Model	**Fuel injection pump option code**	**Turbocharger Model**	**Rated Speed rpm**	**Boost pressure at full rated speed kpa (bar) (psi) ± 10%**
3029HF270	16K7, 16K8	Borg-Warner/Schwitzer S1B	1500	80 (0.80) (11.6)
	16K9, 16L1	Borg-Warner/Schwitzer S1B	1500	N/A
3029HFU70	16K7, 16K8	Borg-Warner/Schwitzer S1B	1500	80 (0.80) (11.6)
3029TF120	1602, 1632, 1640	Garrett TA25 or Schwitzer S1B	2500	85 (0.85) (12.3)
	16TT, 16TU	Borg-Warner/Schwitzer S1B	1500	85 (0.85) (12.3)
3029TF121	1602, 1632	Garrett TA25	2500	85 (0.85) (12.3)
3029TF123	16BT	Garrett TA25	2500	85 (0.85) (12.3)
3029TF150	16DE, 16EJ	Borg-Warner/Schwitzer S1B	2500	135 (1.35) (19.6)
	16DF, 16EK	Borg-Warner/Schwitzer S1B	2500	114 (1.14) (17)
	16TR, 16TS	Borg-Warner/Schwitzer S1B	1800	77 (0.77) (11.2)
3029TF152	16EA	Borg-Warner/Schwitzer S1B	2500	135 (1.35) (19.6)
3029TF158	16TR, 16TS	Borg-Warner/Schwitzer S1B	1800	77 (0.77) (11.2)
	16TT, 16TU	Borg-Warner/Schwitzer S1B	1500	85 (0.85) (12.3)
3029TF160	1602, 1632, 1634, 1640	Garrett TA25 or Schwitzer S1B	2500	85 (0.85) (12.3)
	1633	Garrett TA25	2200	55 (0.55) (8)
3029TF161	16EV	Garrett TA25	2500	85 (0.85) (12.3)
3029TF162	1633	Garrett TA25	2200	55 (0.55) (8)
3029TF163	1602	Garrett TA25	2500	85 (0.85) (12.3)
3029TF180	16DG, 16EL	Borg-Warner/Schwitzer S1B	2500	135 (1.35) (19.6)
	16DH, 16EM	Borg-Warner/Schwitzer S1B	2500	114 (1.14) (17)
	16ZB	Borg-Warner/Schwitzer S1B	2500	114 (1.14) (17)

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-JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)				
Engine Model	**Fuel injection pump option code**	**Turbocharger Model**	**Rated Speed rpm**	**Boost pressure at full rated speed kpa (bar) (psi) ± 10%**
3029TF270	164D, 164E	Borg-Warner/Schwitzer S1B	2500	74 (0.74) (10.7)
	168W, 168X, 16ZE, 164F, 164G	Borg-Warner/Schwitzer S1B	2500	76 (0.76) (11)
	164H, 164I	Borg-Warner/Schwitzer S1B	1800	94 (0.94) (13.6)
	16K5, 16K6	Borg-Warner/Schwitzer S1B	1500	61 (0.61) (8.8)
3029TFG21		Garrett TA25	2300	70 (0.7) (10)
3029TFG50		Borg-Warner/Schwitzer S1B	2300	99 (0.99) (14.4)
3029TFG51		Borg-Warner/Schwitzer S1B	2500	114 (1.14) (16)
3029TFG71		Borg-Warner/Schwitzer S1B	2500	76 (0.76) (11)
3029TFG80	16BJ, 16BR	Borg-Warner/Schwitzer S1B	1500	54 (0.54) (7.8)
3029TFU70	16K5,16K6	Borg-Warner/Schwitzer S1B	1500	61 (0.61) (8.8)
3029TFU80	16BJ, 16BR	Borg-Warner/Schwitzer S1B	1500	54 (0.54) (7.8)

Turbocharger boost pressure

Item	Measurement	Specification
Intake manifold-to-cylinder head, cap screws	Torque	50 N·m (35 lb-ft)
Exhaust manifold-to-cylinder head, cap screws	Torque	50 N·m (35 lb-ft)
GARRETT Turbocharger		
TA25 model	Radial clearance	0.06—0.13 mm (0.0024—0.005 in.)
TA25 model	Axial clearance	0.025—0.09 mm (0.001—0.0035 in.)
Turbocharger-to-Exhaust manifold	Torque	30 N·m (20 lb-ft)
Center housing-to-Turbine housing	Torque	25 N·m (18 lb-ft)
Oil inlet line-to-Turbocharger	Torque	25 N·m (18 lb-ft)
Oil return line-to-Turbocharger	Torque	40 N·m (30 lb-ft)
Borg-Warner/Schwitzer Turbocharger		
S1B model	Radial clearance	0.51 mm (0.20 in.) Maxi
S1B model	Axial clearance	0.14 mm (0.0055 in.) Maxi
Turbocharger-to-Exhaust manifold	Torque	30 N·m (20 lb-ft)
Center housing-to-Turbine housing	Torque	25 N·m (18 lb-ft)
Oil inlet line-to-Turbocharger	Torque	25 N·m (18 lb-ft)
Oil return line-to-Turbocharger	Torque	40 N·m (30 lb-ft)
Air heater glow plug	Torque	35 N·m (25 lb-ft)

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Fuel System Specifications

Item	Measurement	Specification
Round fuel filter assembly		
Fuel filter head-to-engine bolts	Torque	50 N·m (37 lb-ft)
Plug-to-Fuel filter head	Torque	5 N·m (3.5 lb-ft)
Fuel lines to fuel filter	Torque	30 N·m (23 lb-ft)
Fuel pump-to-Cylinder block, cap screws	Torque	30 N·m (23 lb-ft)
Throttle lever (Stanadyne)		
Position screw	Torque	3—3.5 N·m (2.2—2.6 lb-ft)
Spring screw	Torque	4—4.5 N·m (3—3.3 lb-ft)
Aneroid bracket-to-Injection pump, screws (Stanadyne)	Torque	5 N·m (45 lb-in.)
Aneroid lever lift-off (Stanadyne)	Pressure	76—102 mm Hg (3—4 in. Hg) 10—14 kPa (1.5—2.0 psi)
Aneroid lever at full travel (Stanadyne)	Pressure	330—380 mm Hg (13—15 in. Hg) 44—51 kPa (6.4—7.4 psi)
STANADYNE DB2 or DB4 Fuel Injection Pump		
Lock shaft timing lock screw	Torque	8 N·m (71 lb-in.)
Drive gear nut (DB2)	Torque	125 N·m (92 lb-ft)
Drive gear nut (DB4)	Torque	200 N·m (145 lb-ft)
Fuel injection line-to-Injection pump	Torque	25 N·m (18 lb-ft)
Fuel injection pump-to-front plate, nut	Torque	25 N·m (18 lb-ft)
Fuel supply line-to-Injection pump	Torque	30 N·m (23 lb-ft)
Fuel return line-to-Injection pump	Torque	15 N·m (11 lb-ft)
Engine firing order	3 Cyl.	1-2-3
DELPHI/LUCAS Fuel Injection Pump		
Drive gear nut	Torque	80 N·m (60 lb-ft)
Fuel injection line-to-Injection pump	Torque	30 N·m (23 lb-ft)
Fuel injection pump-to-front plate, nut	Torque	25 N·m (18 lb-ft)
Fuel supply line-to-Injection pump	Torque	30 N·m (23 lb-ft)
Fuel return line-to-Injection pump	Torque	15 N·m (11 lb-ft)
Engine firing order	3 Cyl.	1-2-3
MICO - BOSCH in-line Fuel Injection Pump		
Supply pump-to-injection pump, nuts	Torque	5—7 N·m (4—5 lb-ft)
Dive gear nut	Torque	85 N·m (62 lb-ft)
Pump-to-front plate nut	Torque	50 N·m (35 lb-ft)

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Item	Measurement	Specification
Injection line	Torque	25 N·m (18 lb-ft)
Oil supply line	Torque	15 N·m (11 lb-ft)
Fuel supply line	Torque	25 N·m (18 lb-ft)
Fuel outlet line-to-supply pump	Torque	25 N·m (18 lb-ft)
Fuel inlet line-to-supply pump	Torque	25 N·m (18 lb-ft)
Fuel return line	Torque	25 N·m (18 lb-ft)
Governor housing	Oil quantity	300 ml (10.14 oz)
Fuel Injection Nozzle (9.5 mm)		
Nozzle (9.5 mm)	Return leakage at 10300 kPa (103bar; 1500 psi)	1 to 14 drops within 30 seconds
	Pressure adjusting screw lock nut-Torque	10 N·m (7 lb-ft)
	Lift adjusting screw lock nut-Torque	5 N·m (3.5 lb-ft)
	Injection line-to-nozzle-Torque	30 N·m (23 lb-ft)
	Fuel injection nozzle-to-Cylinder head, cap screws-Torque	37 N·m (27 lb-ft)
	Leak-off lines, nuts-Torque	5 N·m (3.5 lb-ft)
	Opening pressure difference between cylinders	700 kPa (7 bar; 100 psi) Maxi

Fuel Injection Nozzles Specifications (9.5 mm)						
Nozzle part number (See Fuel Injection Pump Specifications)	Supplier part number	Opening pressure bar (psi)	Needle lift	Washer thickness	Washer color	Nozzle type
RE36935	28480	223 (3240)	1/2 turn	2.92 mm (0.115 in.)	Green	Conventional
RE36939	28484	258 (3740)	3/4 turn	1.9 mm (0.075 in.)	Red	Conventional
RE48786	29278 or 29279	258 (3740)	3/4 turn	1.9 mm (0.075 in.)	Red	Conventional
RE50833	33234	258 (3740)	1/2 turn	1.9 mm (0.075 in.)	Red	Conventional
RE57469	RE32261	241 (3500)	3/4 turn	2.92 mm (0.115 in.)	Green	Conventional
RE60062	RE32262	241 (3500)	3/4 turn	2.92 mm (0.115 in.)	Green	Conventional
RE504353	34691 or 38413	241 (3500)	7/8 turn	1.9 mm (0.075 in.)	Red	“Rape Shaping Nozzle” (RSN)
RE509896	35541	258 (3740)	3/4 turn	2.92 mm (0.115 in.)	Green	Conventional
RE520785	36497	241 (3500)	3/4 turn	2.92 mm (0.115 in.)	Green	Conventional
RE531437	38414	241 (3500)	7/8 turn	1.9 mm (0.075 in.)	Red	“Rape Shaping Nozzle” (RSN)
RE538052	39543 or 39544	241 (3500)	1/2 turn	1.9 mm (0.075 in.)	Red	Conventional

Fuel Injection Nozzle (17 mm)

Fuel Injection Nozzles Specifications (17 mm)				
Nozzle part number (See Fuel Injection Pump Specifications)	Supplier part number	Supplier name	Opening pressure bar (psi)	Opening pressure difference between cylinders - bar (psi)
• RE537233 (Production) • RE537234 (Service)	• 39470 (Production) • 39471 (Service)	STANADYNE	210 (3046)	8 bar (116 psi)
RE537583	F002 C7Z 372	MICO-BOSCH	220 (3191)	8 bar (116 psi)
RE543122	F002 C7Z 370	MICO-BOSCH	212 (3075)	8 bar (116 psi)
RE543426	F002 C7Z 371	MICO-BOSCH	204 (2959)	8 bar (116 psi)

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Fuel Injection Pump Specifications

JOHN DEERE AGRICULTURAL EQUIPMENT								
TRACTOR MODEL	**ENGINE MODEL**	**INJECTION PUMP (type)**	**INJECTION NOZZLE (type)**	**SLOW IDLE rpm**	**FAST IDLE rpm**	**RATED SPEED rpm**	**POWER[a] kW (hp)**	**DYNAMIC TIMING [b] deg**
Tractor								
5003E (India built)	PY3029DPY03	RE527522 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2500	2300	28 (37)	6.5
5036C (India built)	PY3029DPY21	RE537223 (MICO-BOSCH)	RE543426 (17 mm /MICO-BOSCH)	850	2300	2100	26 (34)	12.5
5036C MFWD (India built)	PY3029DPY29	RE537223 (MICO-BOSCH)	RE543426 (17 mm /MICO-BOSCH)	850	2300	2100	26 (34)	12.5
5038 (India built)	PY3029DPY17	RE538900 (MICO-BOSCH)	RE538000 (9.5 mm Conv.)	850	2500	2300	28 (37)	5.5
5038D (India built)	PY3029DPY23	RE541560 (MICO-BOSCH)	RE543426 (17 mm /MICO-BOSCH)	850	2500	2300	28 (37)	12.5
5041C (India built)	PY3029DPY22	RE537225 (MICO-BOSCH)	RE543122 (17 mm /MICO-BOSCH)	850	2300	2100	30 (40)	11
5041C MFWD (India built)	PY3029DPY210	RE537225 (MICO-BOSCH)	RE543122 (17 mm /MICO-BOSCH)	850	2300	2100	30 (40)	11
5042D (India built)	PY3029DPY24	RE541561 (MICO-BOSCH)	RE543122 (17 mm /MICO-BOSCH)	850	2500	2300	30.5 (41)	12.5
5042D MFWD (India built)	PY3029DPY211	RE541562 (MICO-BOSCH)	RE543122 (17 mm /MICO-BOSCH)	850	2500	2300	33 (44)	13
5045D (India built)	PY3029DPY25	RE541562 (MICO-BOSCH)	RE543122 (17 mm /MICO-BOSCH)	850	2500	2300	33 (44)	13
5045D (Export-US, India built)	PY3029TPY30	RE538152 (DB4)	RE538000 (9.5 mm Conv.)	850	2500	2300	33 (44)	-1.0
5045E (Export-US, India built)	PY3029TPY25	RE533699 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	33 (44)	-1.0
5050D (India built)	PY3029DPY26	RE541563 (MICO-BOSCH)	RE537583 (17 mm /MICO-BOSCH)	850	2500	2300	36.5 (49)	11
5050E (Export - EU, India built)	PY3029TPY33	RE552303 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	36 (48)	8
5055D (Export-US, India built)	PY3029TPY29	RE538150 (DB4)	RE57469 (9.5 mm Conv.)	850	2500	2300	42 (56)	1.0
5055E (Export-US, India built)	PY3029TPY21	RE527148 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	42 (56)	1.0
5055E (India built)	PY3029HPY36	RE546579 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	42 (56)	8
5055E (Export - EU, India built)	PY3029HPY32	RE533845 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	41 (55)	6.5
5055E Cab (Export - EU, India built)	PY3029HPY42	RE533845 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	41 (55)	6.5
5055E Cab (Export - US, India built)	PY3029TPY50	RE527148 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	42 (56)	8

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JOHN DEERE AGRICULTURAL EQUIPMENT								
TRACTOR MODEL	ENGINE MODEL	INJECTION PUMP (type)	INJECTION NOZZLE (type)	SLOW IDLE rpm	FAST IDLE rpm	RATED SPEED rpm	POWER[a] kW (hp)	DYNAMIC TIMING [b] deg
5056G/GV/GF (Agritalia built)	CD3029TAT70	RE519327 (DB4)	RE48786 (9.5 mm Conv.)	850	2500	2300	41 (55)	-0.5
5060E (India built)	PY3029HPY37	RE546808 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	45 (60)	8
5065E Export-US, (India built)	PY3029TPY22	RE521065 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	48 (64)	0.5
5065E (India built)	PY3029HPY38	RE546809 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	48 (64)	
5065E (Export - EU, India built)	PY3029HPY33	RE533846 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	48 (64)	6.5
5065E Cab (Export - EU, India built)	PY3029HPY41	RE533846 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	48 (64)	6.5
5065E Cab (Export - US, India built)	PY3029TPY49	RE521065 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	48 (64)	8
5067G/GV/GF (Agritalia built)	CD3029TAT71	RE519328 (DB4)	RE48786 (9.5 mm Conv.)	850	2500	2300	49 (66)	1.0
5075E (Export-US, India built)	PY3029TPY24	RE531128 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	55 (74)	0.5
5075E (India built)	PY3029HPY39	RE546580 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	55 (74)	7
5075E (Export - Australia, India built)	PY3029HPY34	RE533847 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	55 (74)	7
5075E (Export - EU, India built)	PY3029HPY34	RE533847 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	55 (74)	7
5075E Cab (Export - EU, India built)	PY3029HPY40	RE533847 (DB4)	RE537233 (17 mm VCO)	850	2600	2400	55 (74)	7
5075E Cab (Export - US, India built)	PY3029TPY48	RE531128 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	55 (74)	8
5103 (India built)	PY3029DPY03	RE527522 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2500	2300	28 (37)	6.5
5103 Super (India built)	PY3029DPY04	RE527523 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2500	2300	31 (42)	7.0
5103 (Export-U.S., India built))	PE3029DPY06	RE518650 (DB2)	RE50833 (9.5 mm Conv.)	850	2600	2400	33 (44)	14.5
5103 (Export-U.S., India built)	PY3029DPY12	RE522909 (DB4)	RE50833 (9.5 mm Conv.)	850	2600	2400	37 (50)	6.5
5103 (Export-U.S., India built)	PY3029TPY23	RE528526 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	37 (50)	0.5
5103 (Export-Australia, India built)	PY3029DPY12	RE522909 (DB4)	RE50833 (9.5 mm Conv.)	850	2600	2400	37 (50)	6.5

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JOHN DEERE AGRICULTURAL EQUIPMENT								
TRACTOR MODEL	**ENGINE MODEL**	**INJECTION PUMP (type)**	**INJECTION NOZZLE (type)**	**SLOW IDLE rpm**	**FAST IDLE rpm**	**RATED SPEED rpm**	**POWER[a] kW (hp)**	**DYNAMIC TIMING [b] deg**
5103 (Export-Australia, India built)	PY3029TPY25	RE533699 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	34 (46)	-1.0
5104 (India built)	PY3029DPY14	RE533213 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2500	2300	33 (44)	7.5
5105 (Advantage, Augusta built)	PE3029DLV51	RE504059 (DB2)	RE504353 (9.5 mm RSN)	850	2500	2300	34 (46)	6.0
5105 (Advantage, Augusta built)	PE3029DLV56	RE522579 (DB4)	RE50833 (9.5 mm Conv.)	900	2500	2300	37 (50)	7.0
5203 (India built)	PY3029DPY02	RE527524 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2500	2300	35 (47)	6.5
5203 Super (India built)	PY3029DPY08	RE527525 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2500	2300	37 (50)	5.0
5203 (Export-U.S., India built)	PE3029DPY05	RE518649 (DB4)	RE50833 (9.5 mm Conv.)	850	2500	2300	40 (54)	5.5
5203 (Export-U.S., India built)	PY3029DPY13	RE522910 (DB4)	RE50833 (9.5 mm Conv.)	850	2600	2400	42 (56)	7.5
5203 (Export-U.S., India built)	PY3029TPY21	RE527148 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	42 (56)	1.0
5204 (India built)	PY3029DPY15	RE533215 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2500	2300	36 (48)	6.5
5204 (Export-Mexico, India built)	PY3029DPY18	RE533215 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2500	2300	36 (48)	6.5
5205 (Advantage, Augusta built)	PE3029DLV52	RE504060 (DB2)	RE504353 (9.5 mm RSN)	850	2500	2300	40 (54)	6.5
5205 (Advantage, Augusta built)	PE3029DLV57	RE522580 (DB4)	RE50833 (9.5 mm Conv.)	900	2500	2300	42 (56)	7.5
5210 (Augusta built)	PE3029DLV53	RE504951 (DB2)	RE504353 (9.5 mm RSN)	850	2600	2400	40 (54)	16.0
5210 (Augusta built)	PE3029DLV54	RE504951 (DB2)	RE504353 (9.5 mm RSN)	850	2600	2400	40 (54)	7.0
5215/5215N (Agritalia built)	CD3029TAT70	RE519327 (DB4)	RE48786 (9.5 mm Conv.)	850	2500	2300	41 (55)	-0.5
5220 (Augusta built)	PE3029DLV53	RE504951 (DB2)	RE504353 (9.5 mm RSN)	850	2600	2400	40 (54)	16.0
5220 (Augusta built)	PE3029DLV55	RE518649 (DB4)	RE48786 (9.5 mm Conv.)	850	2600	2400	40 (54)	7.0
5300/5300N (Agritalia built)	CD3029DAT01	RE57288 (DP200)	RE36935 (9.5 mm Conv.)	775	2600	2400	42 (57)	18.0

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JOHN DEERE AGRICULTURAL EQUIPMENT								
TRACTOR MODEL	**ENGINE MODEL**	**INJECTION PUMP (type)**	**INJECTION NOZZLE (type)**	**SLOW IDLE rpm**	**FAST IDLE rpm**	**RATED SPEED rpm**	**POWER[a] kW (hp)**	**DYNAMIC TIMING [b] deg**
5303 (Export-Mexico, India built)	PY3029DPY07	RE527526 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2600	2400	42 (57)	5.5
5303 (Export-Turkey, India built)	PY3029DPY05	RE518649 (DB4)	RE50833 (9.5 mm Conv.)	850	2600	2400	40 (54)	5.5
5303 (Export-Turkey, India built)	PY3029TPY26	RE527148 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	42 (57)	- 0.5
5303 (Export-U.S., India built)	PY3029TPY11	RE500442 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	48 (64)	7.0
5303 (Export-U.S. India built)	PE3029TLV52	RE500442 (DB4)	RE57469 (9.5 mm Conv.)	850	2600	2400	48 (64)	6.0
5303 (Export-U.S., India built)	PY3029TPY22	RE521065 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	48 (64)	0.5
5303 (Export-North Africa, India built)	PY3029DPY07	RE527526 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2600	2400	42 (57)	5.5
5303 (Export-South Africa, India built)	PY3029DPY07	RE527526 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2600	2400	42 (57)	5.5
5310/5310N (Agritalia built)	CD3029DAT50	RE508603 (DB4)	RE50833 (9.5 mm Conv.)	850	2500	2300	40 (54)	6.5
5310 (India built)	PY3029DPY01	RE527526 (MICO-BOSCH)	RE520785 (9.5 mm Conv.)	850	2600	2400	42 (56)	5.5
5310R (India built)	PY3029DPY09	RE544251 (DB4)	RE520785 (9.5 mm Conv.)	850	2600	2400	42 (56)	13.5
5310S (India built)	PY3029TPY03	RE522713 (DB4)	RE48786 (9.5 mm Conv.)	850	2600	2400	48 (64)	5.5
5310/5310N (Augusta built)	PE3029TLV50	RE500442 (DB4)	RE48786 (9.5 mm Conv.)	850	2600	2400	48 (64)	7.0
5310/5310N (Augusta built)	PE3029TLV52	RE500442 (DB4)	RE48786 (9.5 mm Conv.)	850	2600	2400	48 (64)	7.0
5315/5315N (Agritalia built)	CD3029TAT71	RE519328 (DB4)	RE48786 (9.5 mm Conv.)	850	2600	2400	49 (66)	1.0
5320/5320N (Augusta built)	PE3029TLV52	RE500442 (DB4)	RE48786 (9.5 mm Conv.)	850	2600	2400	48 (64)	7.0
5400/5400N (Agritalia built)	CD3029TAT02	RE67453 (DP200)	RE36939 (9.5 mm Conv.)	850	2600	2400	53 (72)	13.0
5403 (Export-Turkey, India built)	PY3029TPY02	RE500442 (DB4)	RE48786 (9.5 mm Conv.)	850	2600	2400	48 (64)	5.5
5403 (Export-Turkey, India built)	PY3029TPY27	RE521065 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	48 (64)	- 0.5

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JOHN DEERE AGRICULTURAL EQUIPMENT								
TRACTOR MODEL	**ENGINE MODEL**	**INJECTION PUMP (type)**	**INJECTION NOZZLE (type)**	**SLOW IDLE rpm**	**FAST IDLE rpm**	**RATED SPEED rpm**	**POWER[a] kW (hp)**	**DYNAMIC TIMING [b] deg**
5403 (Export-U.S. India built)	PY3029TPY24	RE531128 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	55 (74)	0.5
5403 (Export-South Africa, India built).)	PY3029TPY04	RE527527 (MICO-BOSCH)	RE48786 (9.5 mm Conv.)	850	2600	2400	48 (64)	6.0
5410 (India built)	PY3029TPY03	RE522713 (DB4)	RE48786 (9.5 mm Conv.)	850	2600	2400	48 (64)	5.5
5410 (Export-China, India built)	PY3029TPY01	RE527527 (MICO-BOSCH)	RE48786 (9.5 mm Conv.)	850	2600	2400	48 (64)	6.0
5410/5410N (Agritalia built)	CD3029TAT50	RE508602 (DB4)	RE48786 (9.5 mm Conv.)	850	2500	2300	48 (64)	6.0
5503 (Export-Turkey, India built)	PY3029TPY28	RE531128 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	55 (74)	- 0.5
5610 (India built)	PY3029TPY11	RE500442 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	48 (64)	7.0
R40 (Export - China, India built)	PY3029TPY211	RE521065 (DB4)	RE509896 (9.5 mm Conv.)	850	2600	2400	48 (64)	8

[a]Power ratings are for a bare engine without the drag effect of accessories like transmission, fan and other auxiliary drives. The actual power can be found in the documentation of the application.
[b]Minus (-) indicates that timing is after Top Dead Center (TDC)

JOHN DEERE CONSTRUCTION AND FORESTRY EQUIPMENT								
MACHINE MODEL	**ENGINE MODEL**	**INJECTION PUMP (type)**	**INJECTION NOZZLE (type)**	**SLOW IDLE rpm**	**FAST IDLE rpm**	**RATED SPEED rpm**	**POWER[a] kW (hp)**	**DYNAMIC TIMING [b] deg**
Skid Steer Loader								
240	PE3029DKV50	RE501933 (DB2)	RE36935 (9.5 mm Conv.)	1200	2650	2450	36 (48)	17.0
	PE3029DKV51	RE501933 (DB2)	RE36935 (9.5 mm Conv.)	1200	2650	2450	36 (48)	17.0
	PE3029DKV54	RE515384 (DB2)	RE531437 (9.5 mm RSN)	1200	2600	2400	40 (54)	6.0
	PE3029DKV55	RE515384 (DB2)	RE531437 (9.5 mm RSN)	1200	2600	2400	40 (54)	6.0
250	PE3029TKV50	RE504894 (DB4)	RE48786 (9.5 mm Conv.)	1200	2600	2400	48 (64)	7.0
	PE3029TKV51	RE504894 (DB4)	RE48786 (9.5 mm Conv.)	1200	2600	2400	48 (64)	7.0
260	PE3029TKV52	RE500443 (DB4)	RE48786 (9.5 mm Conv.)	1200	2600	2400	54 (72)	5.0
	PE3029TKV53	RE500443 (DB4)	RE48786 (9.5 mm Conv.)	1200	2600	2400	54 (72)	5.0

[a]Power ratings are for a bare engine without the drag effect of accessories like transmission, fan and other auxiliary drives. The actual power can be found in the documentation of the application.
[b]Minus (-) indicates that timing is after Top Dead Center (TDC)

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)								
ENGINE MODEL	**OPTION CODE**	**INJECTION PUMP (type)**	**INJECTION NOZZLE (type)**	**SLOW IDLE rpm**	**FAST IDLE rpm**	**RATED SPEED rpm**	**POWER[a] kW (hp)**	**DYNAMIC TIMING[b] deg**
3029DF120	1602	RE53785 (DB2)	RE36935 (9.5 mm Conv.)	800	2710	2500	43 (58)	17.0
	1603	RE53786 (DB2)	RE36935 (9.5 mm Conv.)		1880	1800	35 (48)	15.0
	1641	RE64241 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	31 (42)	15.0
	1642	RE67271 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
	1644	RE41939 (DB2)	RE36935 (9.5 mm Conv.)		1880	1800	34 (46)	15.0
	1645	RE67003 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	37 (50)	17.0
	1648	RE64242 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	30 (40)	15.0
	1650	RE41938 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
	1655	RE53785 (DB2)	RE36935 (9.5 mm Conv.)	1700	2700	2500	43 (58)	15.0
	169T	RE41939 (DB2)	RE36935 (9.5 mm Conv.)		1880	1800	34 (46)	15.0
	169U	RE64242 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	30 (40)	15.0
3029DF121	1602	RE53785 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
	1650	RE41938 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
3029DF122	1603	RE53786 (DB2)	RE36935 (9.5 mm Conv.)		1880	1800	35 (48)	15.0
	1641	RE64241 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	31 (42)	15.0
	1644	RE41939 (DB2)	RE36935 (9.5 mm Conv.)		1880	1800	34 (46)	15.0
	1648	RE64242 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	30 (40)	15.0
3029DF123	16BS	RE53785 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
3029DF124	1641	RE64241 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	31 (42)	15.0
3029DF128	1603	RE53786 (DB2)	RE36935 (9.5 mm Conv.)		1880	1800	35 (48)	15.0
	1641	RE64241 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	31 (42)	15.0
	1644	RE41939 (DB2)	RE36935 (9.5 mm Conv.)		1880	1800	34 (46)	15.0
	1648	RE64242 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	30 (40)	15.0
	169T	RE41939 (DB2)	RE36935 (9.5 mm Conv.)		1880	1800	34 (46)	15.0
	169U	RE64242 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	30 (40)	15.0

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)								
ENGINE MODEL	**OPTION CODE**	**INJECTION PUMP (type)**	**INJECTION NOZZLE (type)**	**SLOW IDLE rpm**	**FAST IDLE rpm**	**RATED SPEED rpm**	**POWER[a] kW (hp)**	**DYNAMIC TIMING[b] deg**
3029DF150	16DP	RE501258 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
		RE502217 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
	16DQ	RE501259 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	37 (50)	7.0
	16EG	RE501983 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
	16EQ	RE501258 (DB4)	RE50833 (9.5 mm Conv.)	1700	2700	2500	43 (58)	8.0
		RE502182 (DB4)	RE50833 (9.5 mm Conv.)	1700	2700	2500	43 (58)	8.0
		RE502509 (DB4)	RE50833 (9.5 mm Conv.)	1700	2700	2500	43 (58)	8.0
	16HW	RE501259 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	36 (49)	7.0
	16PN	RE502217 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
3029DF151	16DZ	RE501258 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
		RE502217 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
3029DF152	16KZ	RE502217 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
3029DF160	1602	RE53785 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
	1632	RE51940 (DB2)	RE36935 (9.5 mm Conv.)	800	2400	2200	37 (50)	17.0
	1641	RE64241 (DB2)	RE36935 (9.5 mm Conv.)		1565	1500	31 (42)	15.0
	1643	RE67271 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
	1650	RE41938 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
3029DF161	1602	RE53785 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
3029DF162	1632	RE51940 (DB2)	RE36935 (9.5 mm Conv.)	800	2400	2200	37 (50)	17.0
	16YG	RE51940 (DB2)	RE36935 (9.5 mm Conv.)	800	2400	2200	37 (50)	17.0
3029DF163	1654	RE63523 (DB2)	RE36935 (9.5 mm Conv.)	800	2600	2400	48 (64)	17.0
3029DF164	16DV	RE53785 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
3029DF165	1602	RE53785 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
	16TH	RE53785 (DB2)	RE36935 (9.5 mm Conv.)	800	2700	2500	43 (58)	17.0
3029DF166	16JM	RE503017 (DB2)	RE36935 (9.5 mm Conv.)	800	2500	2300	33 (44)	19.0

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)								
ENGINE MODEL	OPTION CODE	INJECTION PUMP (type)	INJECTION NOZZLE (type)	SLOW IDLE rpm	FAST IDLE rpm	RATED SPEED rpm	POWER[a] kW (hp)	DYNAMIC TIMING[b] deg
3029DF180	16DR	RE501258 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
		RE502217 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
	16DS	RE501259 (DB4)	RE50833 (Conv.)	850	2700	2500	36 (48)	7.0
	16EH	RE501983 (DB4)	RE50833 (Conv.)	850	2700	2500	43 (58)	6.5
	16NP	RE502217 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	6.5
	168V	RE501259 (DB4)	RE50833 (9.5 mm Conv.)	850	2700	2500	43 (58)	7.0
3029DF186	16ZK	RE508603 (DB4)	RE50833 (9.5 mm Conv.)	850	2500	2300	40 (54)	6.5
3029DFG21	16JM	RE66492 (DP200)	RE36935 (9.5 mm Conv.)	800	2500	2300	33 (45)	17.0
		RE503017 (DB2)	RE36935 (9.5 mm Conv.)	800	2500	2300	33 (45)	18.0
3029DGF22	16JN	RE57288 (DP200)	RE36935 (9.5 mm Conv.)	800	2500	2300	42 (57)	18.0
		RE503019 (DB2)	RE36935 (9.5 mm Conv.)	800	2500	2300	42 (57)	17.0
3029DFG50	16YW	RE508603 (DB4)	RE50833 (9.5 mm Conv.)	850	2500	2300	40 (54)	6.5
3029DFG51	16KM	RE501258 (DB4)	RE50833 (9.5 mm Conv.)	850	2500	2300	43 (58)	6.5
		RE502217 (DB4)	RE50833 (9.5 mm Conv.)	850	2500	2300	43 (58)	6.5
3029HF270	16K7	RE532974 (DB4)	RE48786 (9.5 mm Conv.)		1565	1500	41 (55)	0.0
	16K8	RE533218 (DB4)	RE48786 (9.5 mm Conv.)		1565	1500	41 (55)	0.0
	16K9	RE532973 (DB4)	RE48786 (Conv.)		1565	1500	60 (80)	N/A
	16L1	RE533219 (DB4)	RE48786 (Conv.)		1565	1500	60 (80)	N/A
3029HFU70	16K7	RE532974 (DB4)	RE48786 (9.5 mm Conv.)		1565	1500	41 (55)	0.0
	16K8	RE533218 (DB4)	RE48786 (9.5 mm Conv.)		1565	1500	41 (55)	0.0
3029TF120	1602	RE53783 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
	1632	RE58903 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
	1640	RE53958 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
	16TT	RE506879 (DB4)	RE36939 (9.5 mm Conv.)		1565	1500	42 (57)	6.5
	16TU	RE506880 (DB4)	RE36939 (9.5 mm Conv.)		1565	1500	42 (57)	6.5
3029TF121	1602	RE53783 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
	1632	RE58903 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
3029TF123	16BT	RE53783 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)								
ENGINE MODEL	**OPTION CODE**	**INJECTION PUMP (type)**	**INJECTION NOZZLE (type)**	**SLOW IDLE rpm**	**FAST IDLE rpm**	**RATED SPEED rpm**	**POWER[a] kW (hp)**	**DYNAMIC TIMING[b] deg**
3029TF150	16DE	RE501205 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	59 (80)	6.0
		RE502218 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	59 (80)	6.0
	16DF	RE501207 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
		RE502238 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
	16EJ	RE501985 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	59 (80)	6.0
	16EK	RE501986 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
	16TR	RE506877 (DB4)	RE48786 (9.5 mm Conv.)		1880	1800	48 (64)	6.5
	16TS	RE506877 (DB4)	RE48786 (9.5 mm Conv.)		1880	1800	48 (64)	6.5
3029TF152	16EA	RE501205 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	59 (80)	6.0
		RE502218 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	59 (80)	6.0
3029TF158	16TR	RE506877 (DB4)	RE48786 (9.5 mm Conv.)		1880	1800	48 (64)	6.5
	16TS	RE506877 (DB4)	RE48786 (9.5 mm Conv.)		1880	1800	48 (64)	6.5
	16TT	RE506879 (DB4)	RE36939 (9.5 mm Conv.)		1565	1500	42 (57)	6.5
	16TU	RE506880 (DB4)	RE36939 (9.5 mm Conv.)		1565	1500	42 (57)	6.5
3029TF160	1602	RE53783 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
	1632	RE58903 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
	1633	RE51979 (DB4)	RE36939 (9.5 mm Conv.)	800	2300	2200	46 (62)	17.0
	1634	RE53783 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
	1640	RE53958 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
3029TF161	16EV	RE53958 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
	1634	RE53783 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0
3029TF162	1633	RE51979 (DB4)	RE36939 (9.5 mm Conv.)	800	2300	2200	46 (62)	17.0
3029TF163	1602	RE53783 (DB4)	RE36939 (9.5 mm Conv.)	800	2700	2500	59 (80)	11.0

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)								
ENGINE MODEL	OPTION CODE	INJECTION PUMP (type)	INJECTION NOZZLE (type)	SLOW IDLE rpm	FAST IDLE rpm	RATED SPEED rpm	POWER[a] kW (hp)	DYNAMIC TIMING[b] deg
3029TF180	16DG	RE501205 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	59 (80)	6.0
		RE520218 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	59 (80)	6.0
	16DH	RE501207 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
		RE502238 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
	16EL	RE501985 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
	16EM	RE501986 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
	16ZB	RE522238 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
3029TF270	164D	RE522349 (DB4)	RE509896 (9.5 mm Conv.)	850	2700	2500	48 (64)	1.0
	164E	RE522350 (DB4)	RE509896 (9.5 mm Conv.)	850	2700	2500	48 (64)	1.0
	164F	RE522351 (DB4)	RE509896 (9.5 mm Conv.)	850	2700	2500	53 (71)	2.0
	164G	RE522352 (DB4)	RE509896 (9.5 mm Conv.)	850	2700	2500	53 (71)	2.0
	164H	RE519015 (DB4)	RE48786 (9.5 mm Conv.)		1880	1800	48 (64)	-1.0
	164I	RE519016 (DB4)	RE48786 (9.5 mm Conv.)		1880	1800	48 (64)	-1.0
	16K5	RE532960 (DB4)	RE48786 (9.5 mm Conv.)		1565	1500	30 (40)	0.0
	16K6	RE533217 (DB4)	RE48786 (9.5 mm Conv.)		1565	1500	31 (42)	0.0
	168W	RE522351 (DB4)	RE509896 (9.5 mm Conv.)	850	2700	2500	53 (71)	2.0
	168X	RE522353 (DB4)	RE509896 (9.5 mm Conv.)	850	2700	2500	53 (71)	2.0
	16ZE	RE522353 (DB4)	RE509896 (9.5 mm Conv.)	850	2700	2500	53 (71)	2.0
3029TFG21	16JP	RE66496 (DP200)	RE36939 (9.5 mm Conv.)	800	2500	2300	52 (70)	15.0
		RE503021 (DB2)	RE36939 (9.5 mm Conv.)	800	2500	2300	52 (70)	15.0
3029TFG50	16YX	RE508602 (DB4)	RE48786 (9.5 mm Conv.)	850	2500	2300	52 (70)	6.0
3029TFG51	16KN	RE501207 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
		RE502238 (DB4)	RE48786 (9.5 mm Conv.)	850	2700	2500	52 (70)	6.0
3029TFG71	164F	RE522351 (DB4)	RE509896 (9.5 mm Conv.)	850	2700	2500	52 (70)	2.0
	167Z	RE521533 (DB4)	RE509896 (9.5 mm Conv.)	850	2700	2500	52 (70)	2.0
3029TFG80	16BJ	RE547815 (DB4)	RE509896 (9.5 mm Conv.)		1565	1500	31 (42)	-2.0
	16BR	RE547816 (DB4)	RE509896 (9.5 mm Conv.)		1565	1500	31 (42)	-2.0
3029TFU70	16K5	RE532960 (DB4)	RE48786 (9.5 mm Conv.)		1565	1500	30 (40)	0.0
	16K6	RE533217 (DB4)	RE48786 (9.5 mm Conv.)		1565	1500	31 (42)	0.0

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JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)								
ENGINE MODEL	**OPTION CODE**	**INJECTION PUMP (type)**	**INJECTION NOZZLE (type)**	**SLOW IDLE rpm**	**FAST IDLE rpm**	**RATED SPEED rpm**	**POWER[a] kW (hp)**	**DYNAMIC TIMING[b] deg**
3029TFU80	16BJ	RE547815 (DB4)	RE509896 (9.5 mm Conv.)		1565	1500	31 (42)	-2.0
	16BR	RE547816 (DB4)	RE509896 (9.5 mm Conv.)		1565	1500	31 (42)	-2.0

[a] *Power ratings are for a bare engine without the drag effect of accessories like transmission, fan and other auxiliary drives. The actual power can be found in the documentation of the application.*
[b] *Minus (-) indicates that timing is after Top Dead Center (TDC)*

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Diagnostic and Test Specifications

Item	Measurement	Specification
Engine compression pressure		
Minimum	Pressure	2400 kPa (24 bar; 350 psi)
Maximum	Difference between cylinders	350 kPa (3.5 bar; 50 psi)
Engine oil pressure (minimum)		
At 800 rpm	Pressure	100 kPa (1 bar; 15 psi)
At rated speed (1500 or 1800 rpm)	Pressure	275 kPa (2.75 bar; 40 psi)
At rated speed (more than 1800 rpm)	Pressure	350 kPa (3.5 bar; 50 psi)
Engine blow-by at crankcase vent tube		
3029D	Maximum flow rate at full load rated speed	4 m^3/h (141 cu-ft/h)
3029T and 3029H	Maximum flow rate at full load rated speed	6 m^3/h (225 cu-ft/h)
Engine oil consumption	Normal	Up to 0.5% of fuel consumption rate
	Overhaul point	Up to 0.625% of fuel consumption rate
Cooling System Test	Pressure	70 kPa (0.7 bar) (10 psi)
Wastegate push rod travel at 114 kPa (1.14 bar; 16.5 psi)	Distance	0.13 to 0.63 mm (0.005 to 0.025 in.)
Fuel supply pump (Rotary fuel injection pump)	Pressure	15—30 kPa (0.15—0.30 bar; 2—4.5 psi)
Fuel supply pump (MICO - BOSCH in-line fuel injection pump)	Pressure	350 kPa (3.5 bar; 50 psi)
Shut-off solenoid (DELPHI/LUCAS)	Torque	15 N·m (11 lb-ft)
Cold start switch-to-thermostat cover	Torque	5 N·m (3.5 lb-ft) (42 lb-in.)

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