JOHN DEERE

COMPONENT TECHNICAL MANUAL

POWERTECH® 2.9 L
Diesel Engines

CTM125 (14JUN01) English

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. An application listing in the introduction identifies product-model/component type-model relationship. 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 –19–03JAN01–1/1

John Deere Dealers

The changes listed below make your CTM obsolete. **Discard CTM 125 dated 26JUN98 and replace with this new manual.** Also, copy these pages and route through your Service Department.

INTRODUCTION

- Updated engine application charts.

GROUP 01

- Updated engine model designation.
- Updated engine oil and coolant application guidelines.

GROUP 02

- Updated engine lifting and cleaning procedures.

GROUP 03

- Updated sealant application guidelines.
- Updated engine break-in procedure.

GROUP 05

- Revised procedure for installation of rocker arm shaft.

GROUP 10

- Added general information on connecting rods to include new Precision Joint™ connecting rod.
- Revised procedures for removal, inspection and installation of connecting rods, bearings and caps.
- Updated information for cap and plug installation in cylinder block.

GROUP 15

- Added procedure to remove crankshaft pulley with bolt-in weights.

GROUP 20

- Added procedure to remove crankshaft front oil seal.
- Added procedure to remove timing gear cover.

GROUP 25

- Revised torque specification for oil drain plug.

GROUP 30

- Updated information to install coolant heater.
- Added exploded view showing radiator installed by John Deere.

GROUP 35

- Updated turbocharger boost pressure specifications.
- Added exploded view showing air filters installed by John Deere.

GROUP 40

- Updated injection pump specifications including dynamic timing and power rate.
- Added procedure to replace throttle lever on STANADYNE pump.
- Added procedure to adjust aneroid on STANADYNE pump.
- Added procedure to remove and install DELPHI/LUCAS fuel injection pump.
- Added information on Rate Shaping Nozzle (RSN).

GROUP 110

- Added procedure to test cooling system and radiator cap.

GROUP 120

- Added information for DELPHI/LUCAS fuel injection pump operation.
- Added procedure to test shut-off solenoid on DELPHI/LUCAS pump.
- Added information on cold start advance operation and test.

Precision Joint is a trademark of Deere & Company

CD03523,00000DC –19–03JAN01–1/2

- Added information on light load advance operation and test.
- Added information on Rate Shaping Nozzle (RSN).

GROUP 200

- All essential tools listed throughout this manual are consolidated in this group for ease of reference.

GROUP 205

- All service equipment and recommended tools listed throughout this manual are consolidated in this group for ease of reference.

GROUP 210

- All dealer fabricated tools listed throughout this manual are consolidated in this group for ease of reference.

GROUP 300

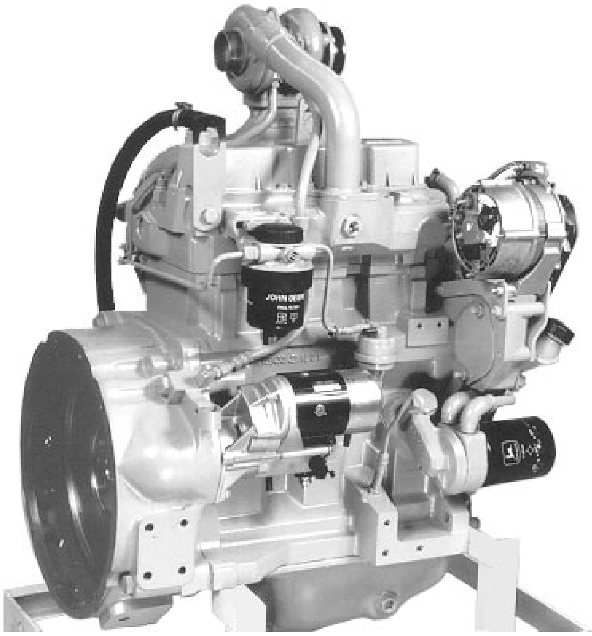
- All repair specifications listed throughout this manual are consolidated in this group for ease of reference.

GROUP 305

- All test and diagnostic specifications listed throughout this manual are consolidated in this group for ease of reference.

CD03523,00000DC –19–03JAN01–2/2

PowerTech® 2.9 L Engines

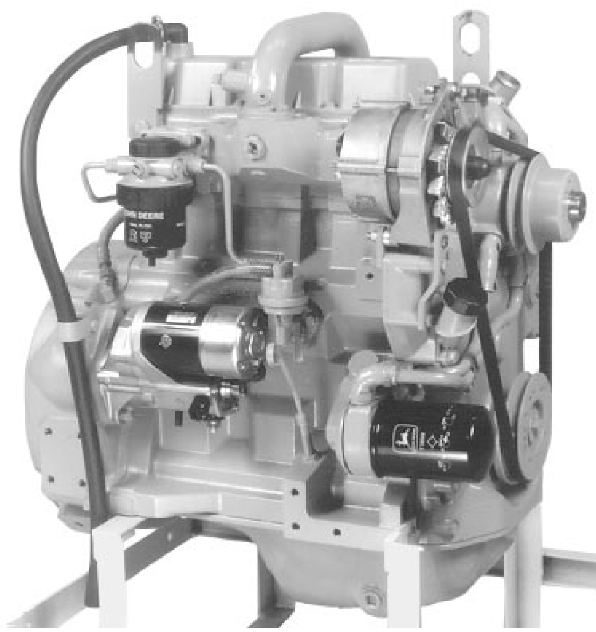


CD30517A –UN–23FEB01

3/4 Right Rear View

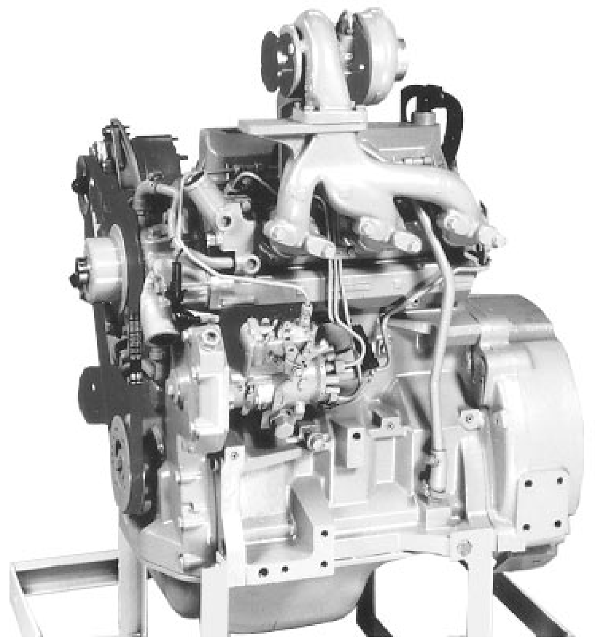
CD30518A –UN–22FEB01

3/4 Left Rear View



CD30519A –UN–23FEB01

3/4 Right front View



CD30520A –UN–23FEB01

3/4 Left front View

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DPSG,OUOE003,33 –19–28DEC98–1/1

Engine application chart

This component technical manual (CTM125) covers repair of POWERTECH® 2.9 L engines produced by John Deere SARAN “CD” (France) and by John Deere TORREON “PE” (Mexico). Refer to the chart below to know which applications is covered by this manual.

NOTE: Information on how to remove and reinstall the engine in the vehicle is contained in the relevant Technical Manual.

5000-SERIES TRACTORS (Agritalia-built)	ENGINE MODEL	OBSERVATIONS
5300/5300N	CD3029DAT01	Non-Certified
5400/5400N	CD3029TAT02	Non-Certified
5010-SERIES TRACTORS (Agritalia-built)	**ENGINE MODEL**	**OBSERVATIONS**
5310/5310N	CD3029DAT50	Certified
5410/5410N	CD3029TAT50	Certified
5010-SERIES TRACTORS (Augusta-built)	**ENGINE MODEL**	**OBSERVATIONS**
5105	PE3029DLV51	Certified
5205	PE3029DLV52	Certified
5210	CD3029DLV50	Certified
5210	PE3029DLV50	Certified
5210	PE3029DLV53	Certified
5210	PE3029DLV54	Certified
5310/5310N	CD3029TLV50	Certified
5310/5310N	PE3029TLV50	Certified
5310/5310N	PE3029TLV52	Certified
5020-SERIES TRACTORS (Augusta-built)	**ENGINE MODEL**	**OBSERVATIONS**
5220	PE3029DLV53	Certified
5320/5320N	PE3029TLV52	Certified

ENGINES FOR GOLDONI TRACTORS

Engine model	Observations
CD3029DFG21	Non-Certified
CD3029DFG22	Non-Certified
CD3029TFG21	Non-Certified
CD3029DFG51	Certified
CD3029TFG51	Certified

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CD,CTM125,002 –19–03JAN01–1/2

OEM Engines (Non-Certified)			
Engine Model	**Observations**	**Engine Model**	**Observations**
CD3029DF120		CD3029TF120	
CD3029DF121		CD3029TF121	
CD3029DF122		CD3029TF123	
CD3029DF123		CD3029TF160	Auxiliary drive
CD3029DF124		CD3029TF161	Auxiliary drive
CD3029DF128	Power Unit	CD3029TF162	Auxiliary drive
CD3029DF160	Auxiliary drive	CD3029TF163	Auxiliary drive
CD3029DF161	Auxiliary drive	PE3029TF120	
CD3029DF162	Auxiliary drive	PE3029TF160	Auxiliary drive
CD3029DF163	Auxiliary drive		
CD3029DF164	Auxiliary drive		
CD3029DF165	Auxiliary drive		
PE3029DF120			
PE3029DF160	Auxiliary drive		

OEM Engines (Certified)			
Engine Model	**Observations**	**Engine Model**	**Observations**
CD3029DF150		CD3029TF150	
CD3029DF151		CD3029TF151	
CD3029DF152		CD3029TF152	
CD3029DF180		CD3029TF180	Auxiliary drive
PE3029DF150		PE3029TF150	
PE3029DF180	Auxiliary drive	PE3029TF180	Auxiliary drive

CD,CTM125,002 –19–03JAN01–2/2

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

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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.

INDX

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Handle Fluids Safely—Avoid Fires

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

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

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

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

TS227 –UN–23AUG88

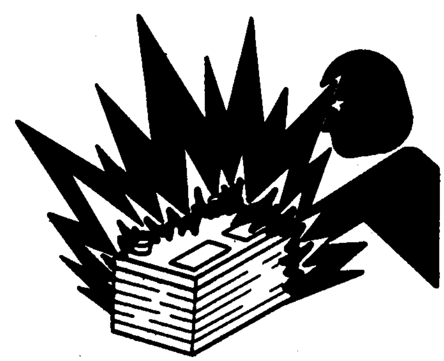
DX,FLAME –19–29SEP98–1/1

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–23AUG88

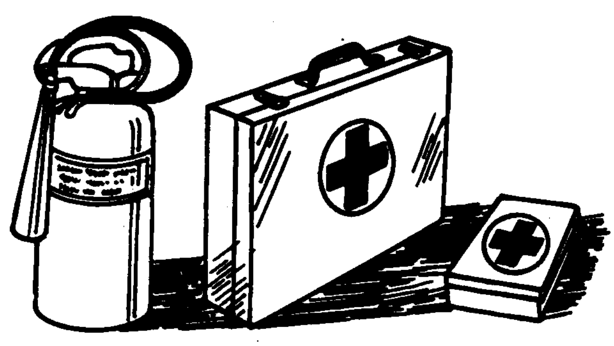
DX,SPARKS –19–03MAR93–1/1

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–23AUG88

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:

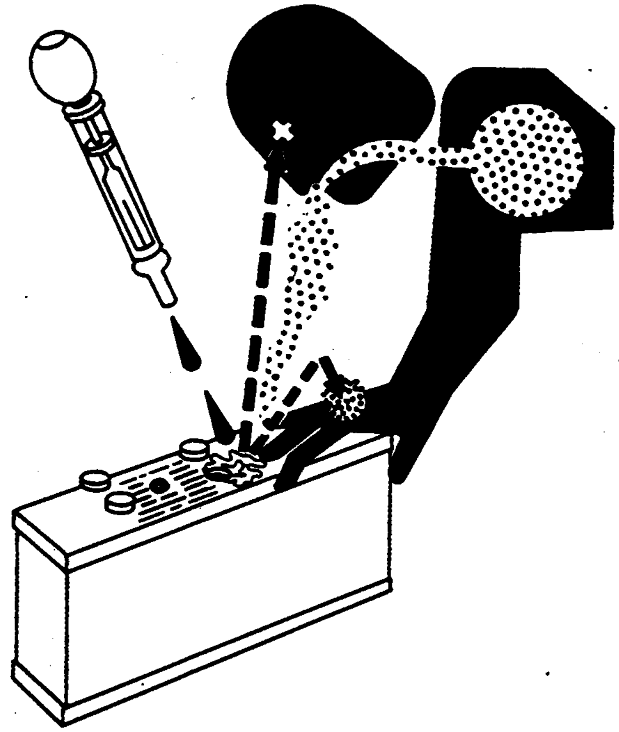
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

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:

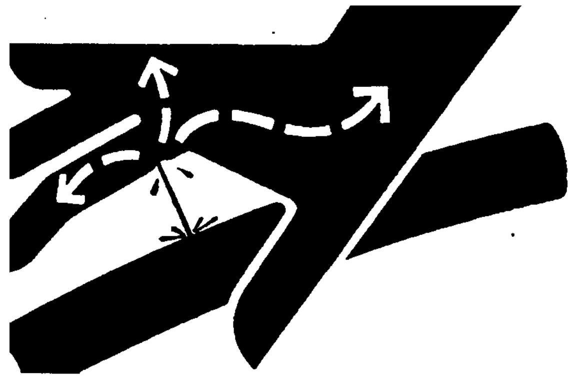
1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.



TS203 –UN–23AUG88

DX,POISON –19–21APR93–1/1

Avoid High-Pressure Fluids


X9811 –UN–23AUG88

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

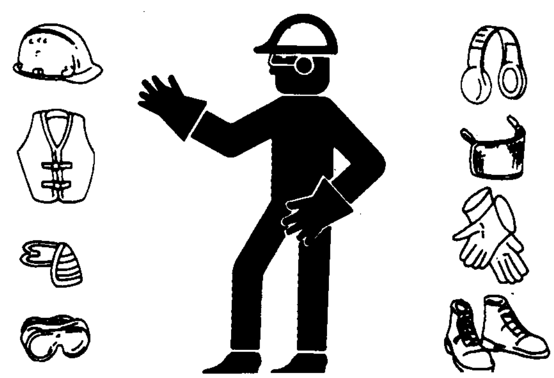
Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

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 from Deere & Company Medical Department in Moline, Illinois, U.S.A.

DX,FLUID –19–03MAR93–1/1

Wear Protective Clothing


TS206 –UN–23AUG88

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.

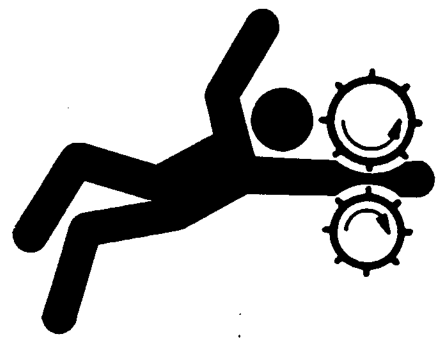
Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

DX,WEAR –19–10SEP90–1/1

Service Machines Safely

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

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



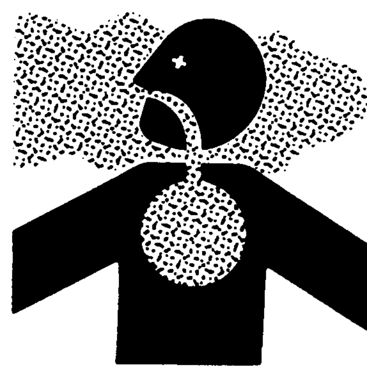
TS228 –UN–23AUG88

DX,LOOSE –19–04JUN90–1/1

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



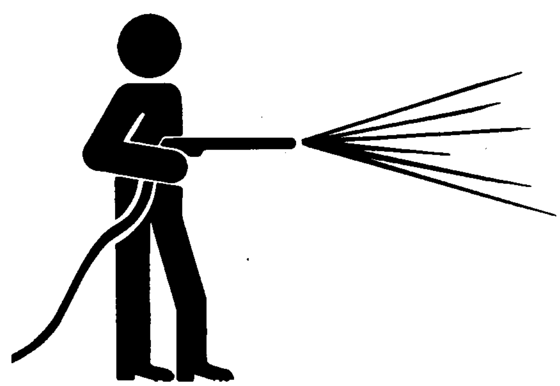
TS220 –UN–23AUG88

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

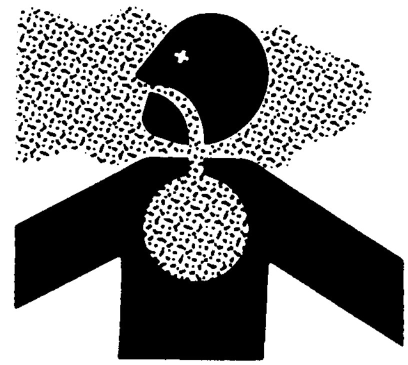
Avoid potentially toxic fumes and dust.

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

Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

- 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.



TS220 –UN–23AUG88

DX,PAINT –19–03MAR93–1/1

Avoid Heating Near Pressurized Fluid Lines

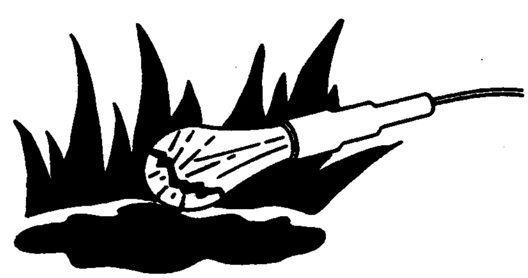
Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond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

TS953 –UN–15MAY90

DX,TORCH –19–03MAR93–1/1

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.



TS223 –UN–23AUG88

DX,LIGHT –19–04JUN90–1/1

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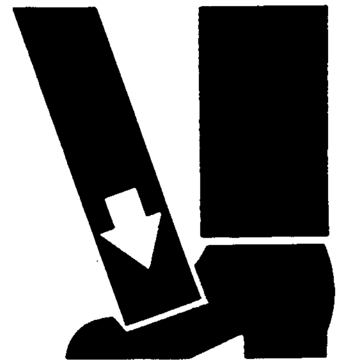
Use Proper Lifting Equipment

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

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



TS226 –UN–23AUG88

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.

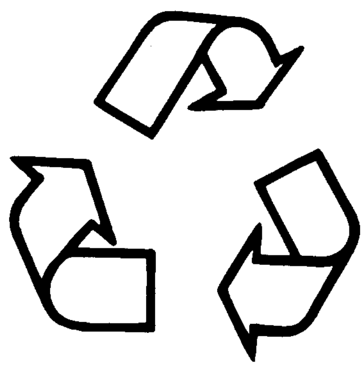
Use power tools only to loosen threaded parts and fasteners.

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.

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.

DX,DRAIN –19–03MAR93–1/1

Live With Safety

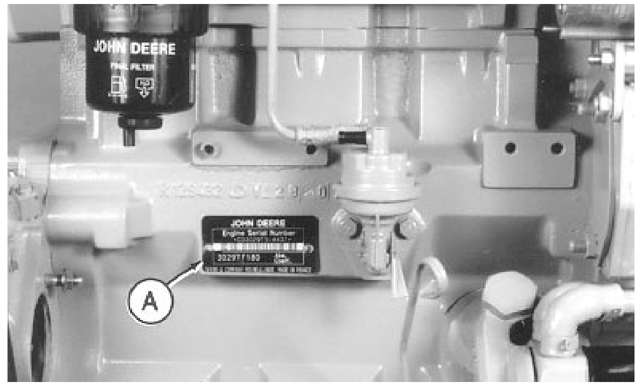
Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

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.



CD30521 –UN–30APR98

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

CD3029D500000

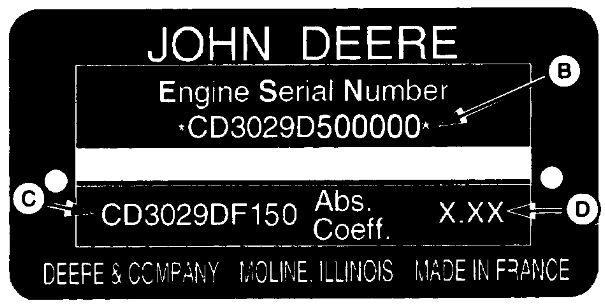
CD	Producing factory CD= Saran-FRANCE PE= Torreon-MEXICO
3029	Engine model designation 3 = Number of cylinders 029 = Total displacement (029 = 2.9 liters)
D	Aspiration code D= Naturally Aspirated T= Turbocharger
500000	Sequential serial number

2. The second line of information (C) identifies the engine/machine or OEM relationship. See “ENGINE APPLICATION CHART” earlier in this manual.

3029DF150

3029D	See above
F	User code AT= Agritalia-built tractors F = OEM applications FG= Goldony (Italy) KV= John Deere Knoxville LV== John Deere Augusta
150	Application number

3. The second line can also contains the absorption coefficient (D) of smoke emissions (Saran-built engines only).



CD30522 –UN–17JUN98

Saran Engine Plate

CD30523 –UN–17JUN98

Torreon Engine Plate

CD,CTM125,003 –19–04JAN01–1/1

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.

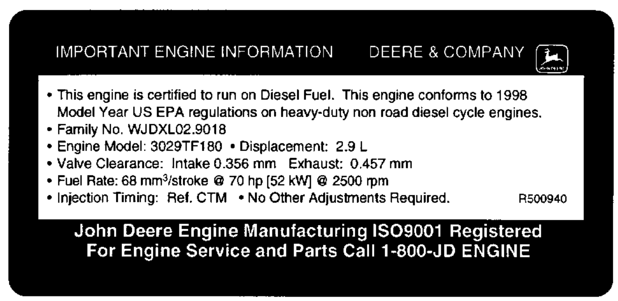
CD30524 –UN–27MAY98

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.

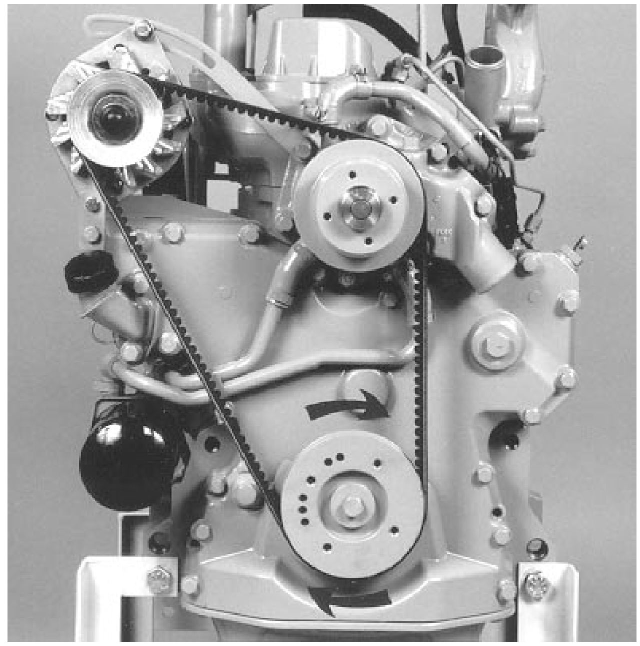


CD30697 –UN–17JUN98

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.

CD,CTM125,005 –19–01DEC97–1/1

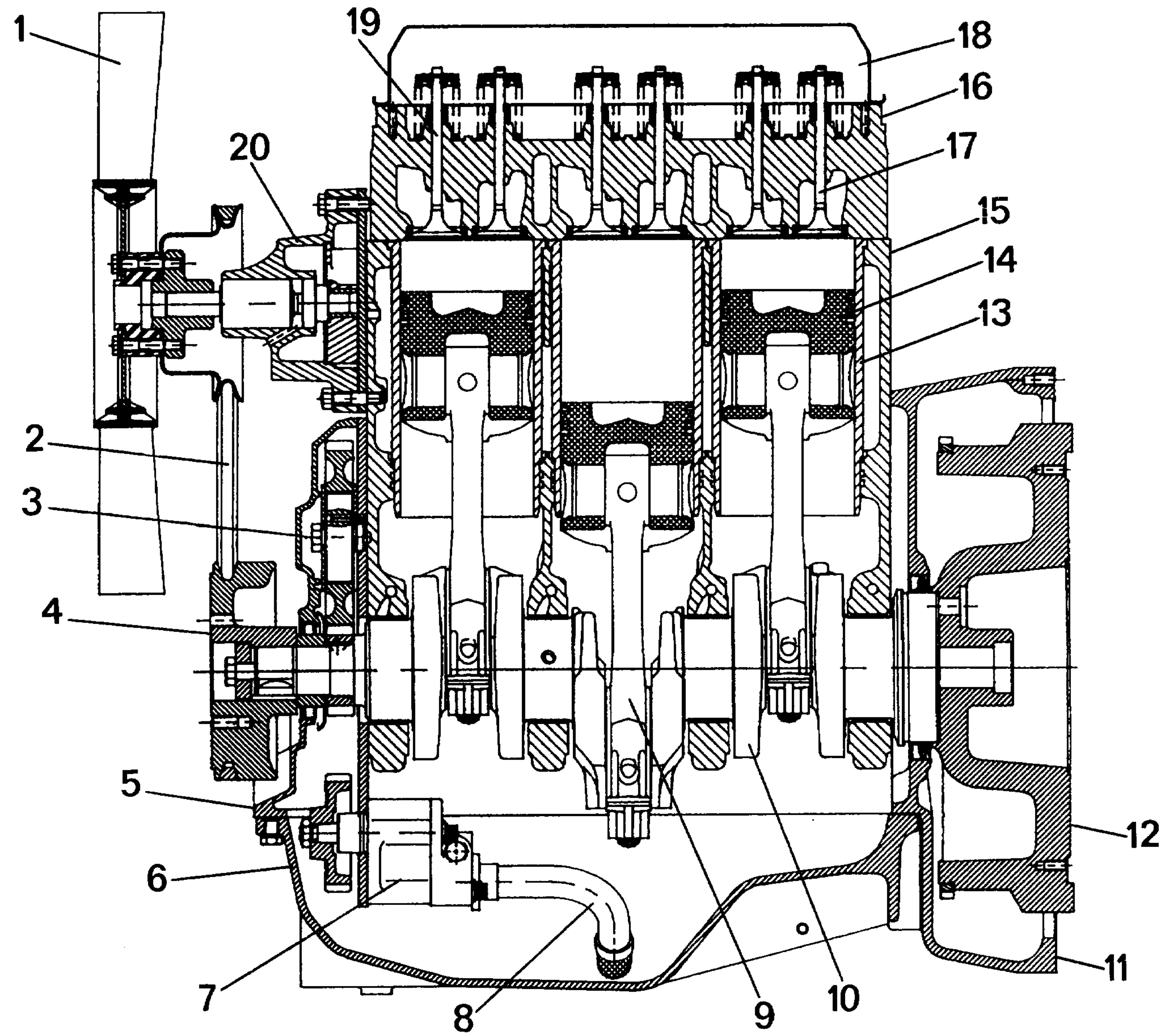
Basic Engine Specifications

		UNIT of Measure	3029D	3029T
Number of Cylinders		---	3	3
Bore		mm	106.5	106.5
		(in.)	(4.19)	(4.19)
Stroke		mm	110	110
		(in.)	(4.33)	(4.33)
Displacement		L	2.9	2.9
		(in.^{3})	(179)	(179)
Compression Ratio		---	17.8:1	17.8:1
Firing Order		---	1-2-3	1-2-3
Injection System		---	Direct	Direct
Aspiration		---	Natural	Turbocharged
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	
	@ 1500 rpm	(hp)	(42)	
Weight (dry)		kg	323	330
		(lbs)	(712)	(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 –19–01DEC97–1/1

Longitudinal Cut-Away

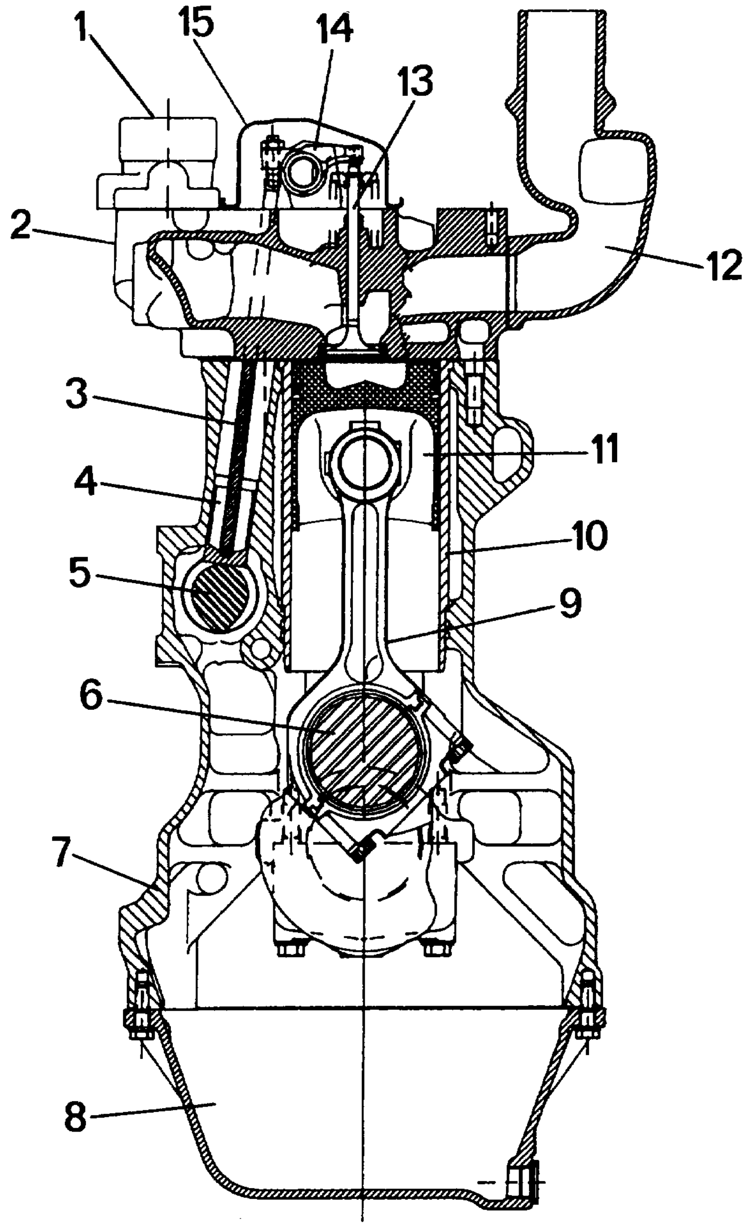


CD30529 –UN–16JUN98

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

CD,CTM125,013 –19–01DEC97–1/1

Transversal Cut-Away



CD30530 –UN–16JUN98

1—Air inlet
2—Cylinder head
3—Push rod
4—Cam follower
5—Camshaft
6—Crankshaft
7—Cylinder block
8—Oil pan
9—Connecting rod
10—Cylinder liner
11—Piston
12—Exhaust manifold
13—Valve
14—Rocker arm
15—Rocker arm cover

CD,CTM125,014 –19–01DEC97–1/1

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.

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.

CD,CTM125,206 –19–01DEC97–1/1

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.

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

Cetane number of 40 minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).

Cold Filter Plugging Point (CFPP) below the expected low temperature OR **Cloud Point** at least 5°C (9°F) below the expected low temperature.

Fuel lubricity should pass a minimum of 3100 gram load level as measured by the BOCLE scuffing test.

Sulfur content:

- Sulfur content should not exceed 0.5%. Sulfur content less than 0.05% is preferred.
- If diesel fuel with sulfur content greater than 0.5% sulfur content is used, reduce the service interval for engine oil and filter by 50%.
- DO NOT use diesel fuel with sulfur content greater than 1.0%.

Bio-diesel fuels may be used ONLY if the fuel properties meet DIN 51606 or equivalent specification.

DO NOT mix used engine oil or any other type of lubricant with diesel fuel.

DX,FUEL1 –19–24JAN00–1/1

Handling and Storing Diesel Fuel

CAUTION: 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.

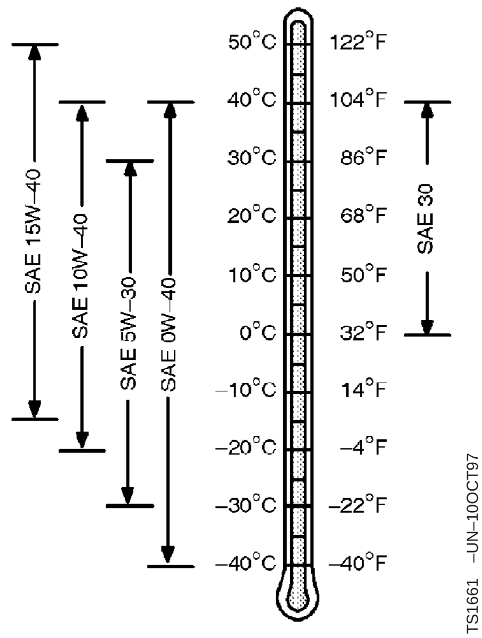
Fill the fuel tank at the end of each day’s operation to prevent condensation and freezing during cold weather.

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 for recommendations.

DX,FUEL4 –19–18MAR96–1/1

Diesel Engine Oil



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

The following oil is preferred:

- John Deere PLUS-50®

The following oil is also recommended:

- John Deere TORQ-GARD SUPREME®

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

- API Service Classification CH-4
- API Service Classification CG-4
- API Service Classification CF-4
- ACEA Specification E3
- ACEA Specification E2

Multi-viscosity diesel engine oils are preferred.

If diesel fuel with sulfur content greater than 0.5% is used, reduce the service interval by 50%.

Extended service intervals may apply when John Deere preferred engine oils are used. Consult your John Deere dealer for more information.

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

DX,ENOIL –19–24JAN00–1/1

Lubricant Storage

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

Use clean containers to handle all lubricants.

Whenever possible, 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 –19–18MAR96–1/1

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

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F).

John Deere COOL-GARD is preferred for service.

If John Deere COOL-GARD is not available, use a low silicate ethylene glycol base coolant concentrate in a 50% mixture of concentrate with quality water.

The coolant concentrate shall be of a quality that provides cavitation protection to cast iron and aluminum parts in the cooling system. John Deere COOL-GARD meets this requirement.

A 50% mixture of ethylene glycol engine coolant in water provides freeze protection to -37°C (-34°F). If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

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

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

Coolant Drain Intervals

Drain the factory fill engine coolant, flush the cooling system, and refill with new coolant after the first 3 years or 3000 hours of operation. Subsequent drain intervals are determined by the coolant used for service. At each interval, drain the coolant, flush the cooling system, and refill with new coolant.

When John Deere COOL-GARD is used, the coolant drain interval is 3 years or 3000 hours of operation.

If COOL-GARD is not used, the drain interval is reduced to 2 years or 2000 hours of operation.

DX,COOL8 –19–12FEB99–1/1

Operating in Warm Temperature Climates

John Deere engines are designed to operate using glycol base engine coolants.

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

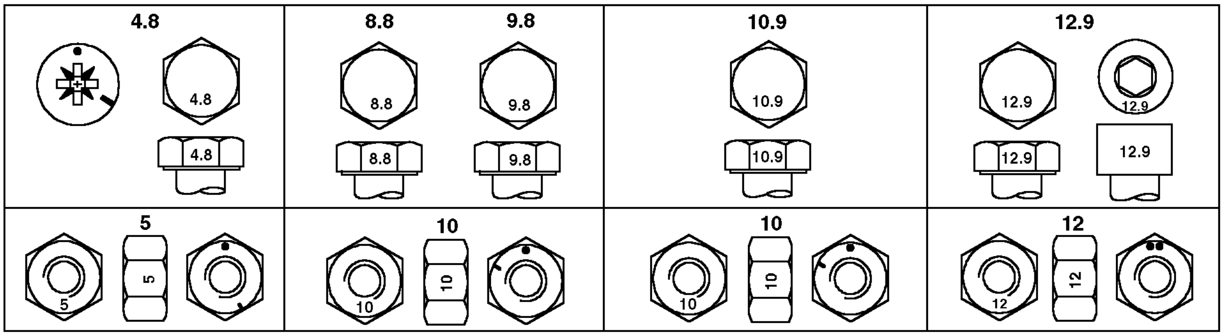
IMPORTANT: Water may be used as coolant *in emergency situations only.*

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

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

DX,COOL6 –19–18MAR96–1/1

Metric Bolt and Cap Screw Torque Values



TORQ2 –UN–07SEP99

Top, Property Class and Head Markings; Bottom, Property Class and Nut Markings

	Class 4.8		Class 8.8 or 9.8		Class 10.9		Class 12.9	
Size	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**
M6	4.7 (3.5)	6 (4.4)	9 (6.6)	11.5 (8.5)	13 (9.5)	16.5 (12.2)	15.5 (11.5)	19.5 (14.5)
M8	11.5 (8.5)	14.5 (10.7)	22 (16)	28 (20.5)	32 (23.5)	40 (29.5)	37 (27.5)	47 (35)
M10	23 (17)	29 (21)	43 (32)	55 (40)	63 (46)	80 (59)	75 (55)	95 (70)
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)

[a] "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

[b] "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

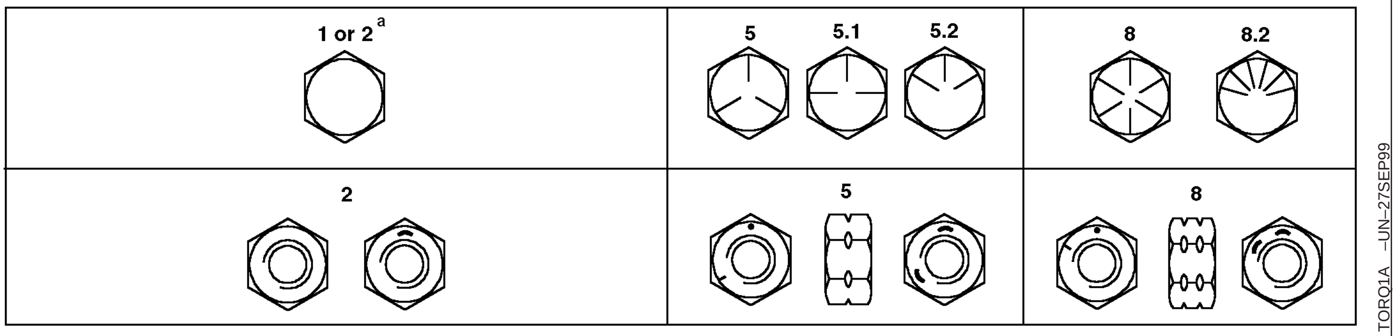
Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

DX,TORQ2 –19–01OCT99–1/1

Unified Inch Bolt and Cap Screw Torque Values



Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

	Grade 1 (No Mark)		Grade 2[a] (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
Size	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**
1/4	3.8 (2.8)	4.7 (3.5)	6 (4.4)	7.5 (5.5)	9.5 (7)	12 (9)	13.5 (10)	17 (12.5)
5/16	7.7 (5.7)	9.8 (7.2)	12 (9)	15.5 (11.5)	19.5 (14.5)	25 (18.5)	28 (20.5)	35 (26)
3/8	13.5 (10)	17.5 (13)	22 (16)	27.5 (20)	35 (26)	44 (32.5)	49 (36)	63 (46)
7/16	22 (16)	28 (20.5)	35 (26)	44 (32.5)	56 (41)	70 (52)	80 (59)	100 (74)
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)

[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, or fasteners with phosphate and oil coatings.

[c] "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

DX,TORQ1 –19–01OCT99–1/1

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.

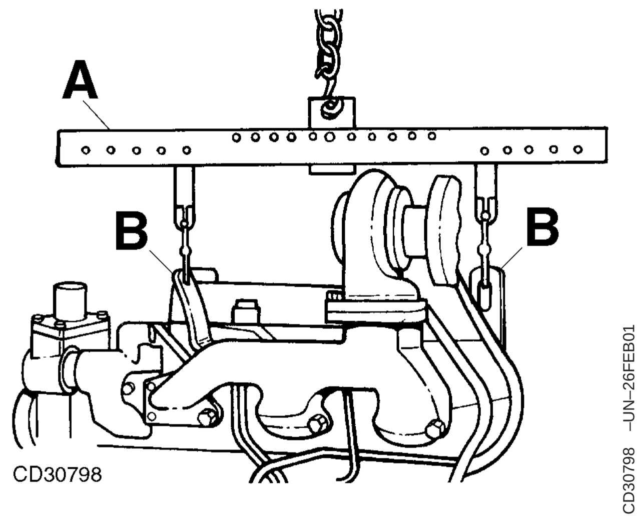
2. Steam-clean engine thoroughly.

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

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



JDG23 Engine Lifting Sling

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.

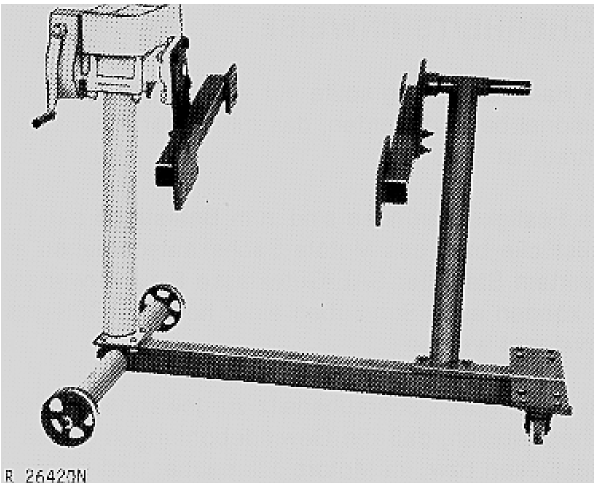
NOTE: If engine lifting straps are misplaced, they should be procured through Service Parts channel under part number JD-244 (or JD244).

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.

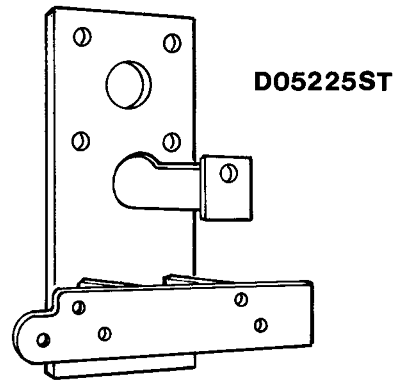
CD,CTM125,007 –19–04JAN01–1/1

Engine Repair Stand



R26420N –UN–22MAY95

D01003AA Repair Stand



D05225ST –UN–22MAY95

D05225ST Adapter

To facilitate engine repair, the D01003AA 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. When engine weight is more than 450 kg (992 lb.), it is recommended to use additional support.

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.

CD,CTM125,008 –19–04JAN01–1/1

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).

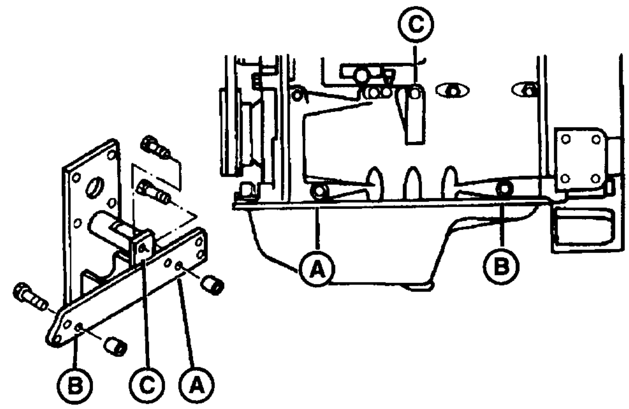
2. Mount engine to adapter using the cap screws listed below at the hole locations as shown:

   - 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)

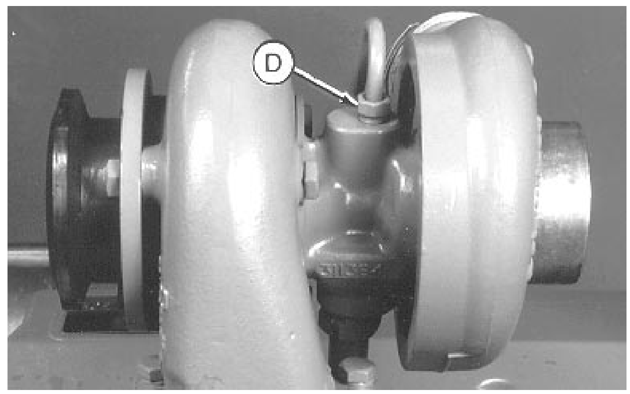
3. Drain all engine oil and coolant

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.

PLASTIGAGE is a trademark of DANA Corp.

Continued on next page

CD,CTM125,010 –19–01DEC97–1/2

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).

CD,CTM125,010 –19–01DEC97–2/2

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

New engines are filled at the factory with John Deere ENGINE BREAK-IN OIL. During the break-in period, add John Deere ENGINE BREAK-IN OIL as needed to maintain the specified oil level.

Change the oil and filter after the first 100 hours of operation of a new or rebuilt engine.

After engine overhaul, fill the engine with John Deere ENGINE BREAK-IN OIL.

If John Deere ENGINE BREAK-IN OIL is not available, use a diesel engine oil meeting one of the following during the first 100 hours of operation:

- API Service Classification CE
- ACEA Specification E1

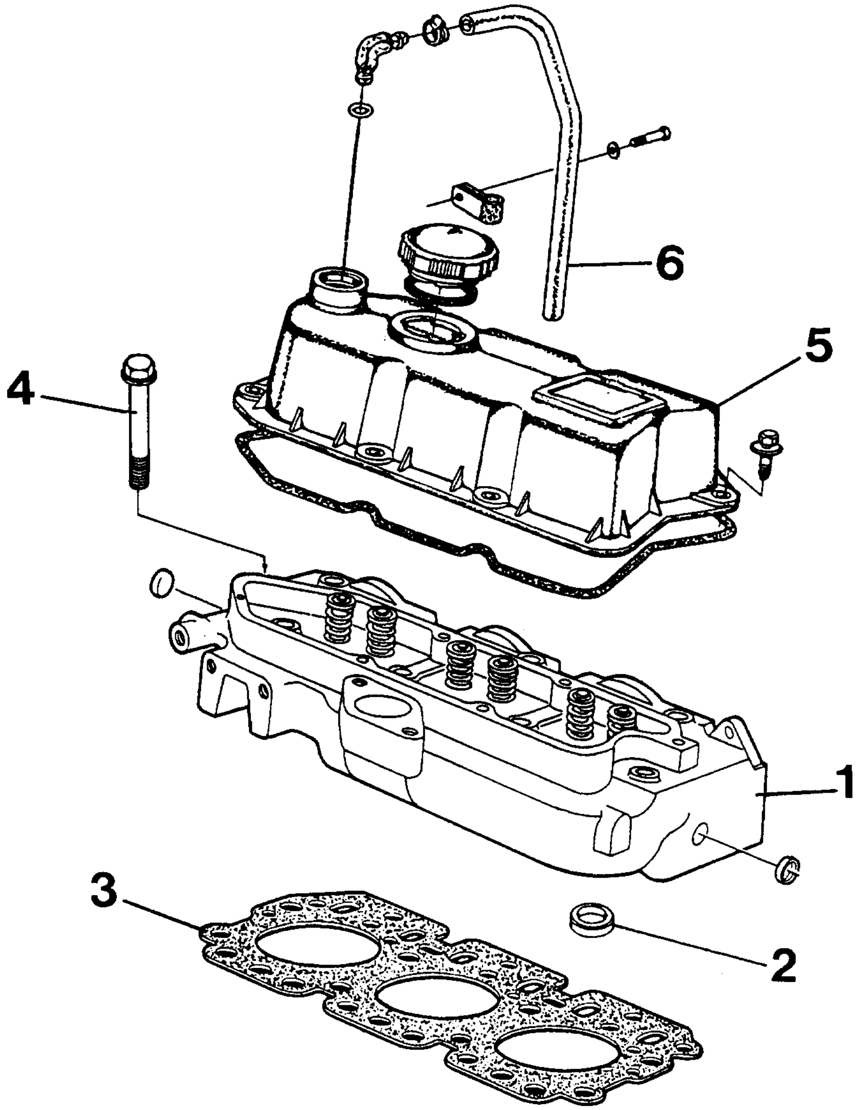
After the break-in period, use John Deere PLUS-50® or other diesel engine oil as recommended in this manual.

IMPORTANT: Do not use PLUS-50 oil or engine oils meeting API CH-4, API CG4, API CF4, ACEA E3, or ACEA E2 performance levels during the first 100 hours of operation of a new or rebuilt engine. These oils will not allow the engine to break-in properly.

PLUS-50 is a registered trademark of Deere & Company.

DX,ENOIL4 –19–24JAN00–1/1

Cylinder Head - Exploded View



CD30531 –UN–17JUN98

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

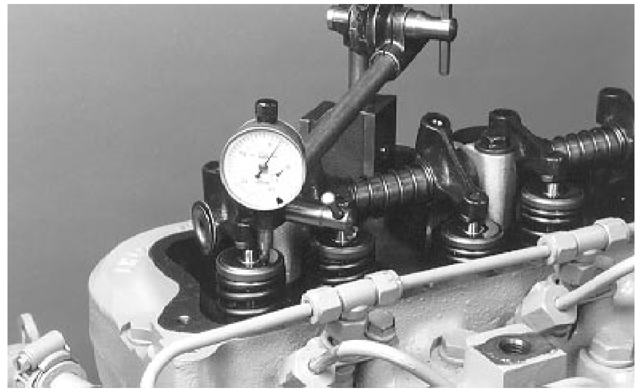
CD,CTM125,017 –19–01DEC97–1/1

Check Valve Lift

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.)



CD30532 –UN–04MAY98

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

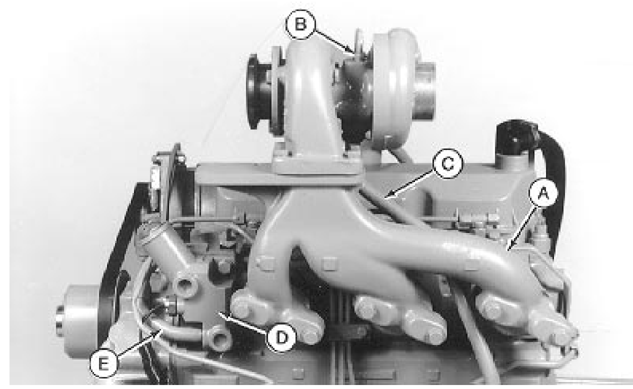
Remove Cylinder Head

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.



CD30533A –UN–26FEB01

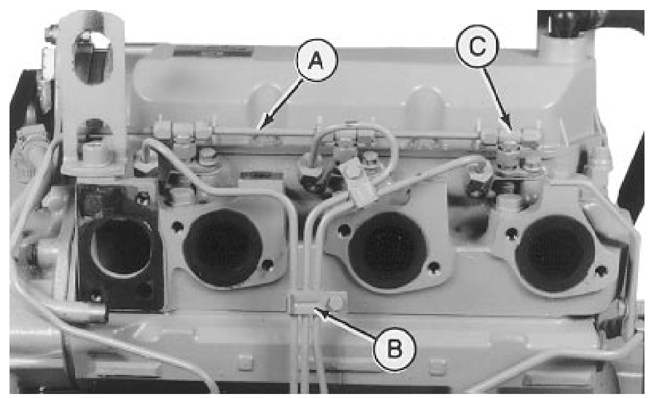
A—Exhaust manifold
B—Turbocharger oil inlet line
C—Turbocharger oil return line
D—Thermostat housing
E—Coolant by-pass tube

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

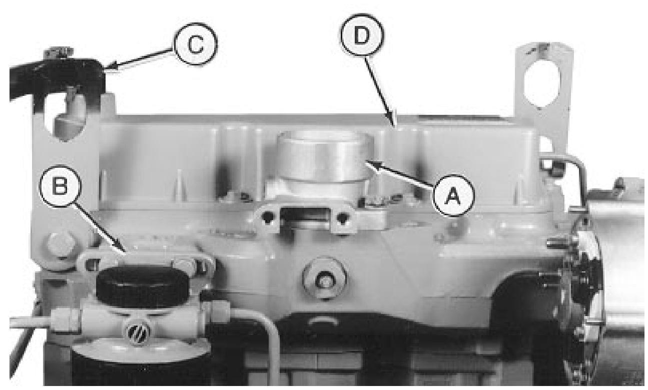
CD,CTM125,024 –19–01DEC97–2/6

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

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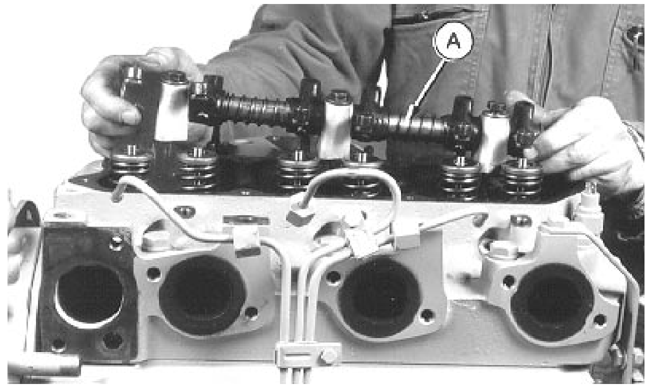
CD,CTM125,024 –19–01DEC97–3/6

10. Remove rocker arm assembly (A).

11. Remove all push rods.



CD,CTM125,024 –19–01DEC97–4/6

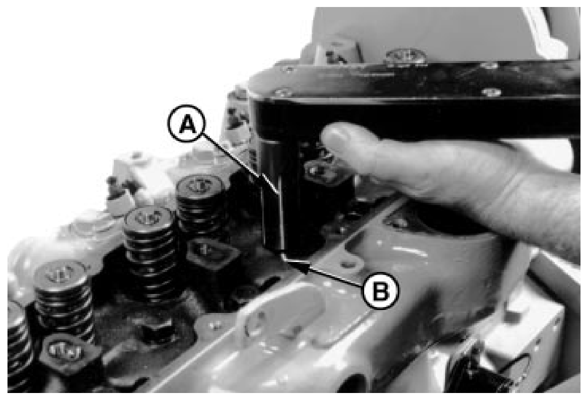
12. In case of cylinder head failure, record torque of each bolt before removing. These values can be asked by the factory for further investigations. To record bolt torque, proceed as follows:

    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

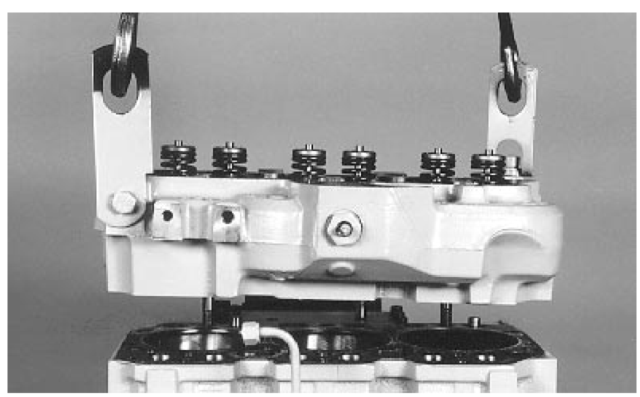
13. Remove all cylinder head bolts.



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.

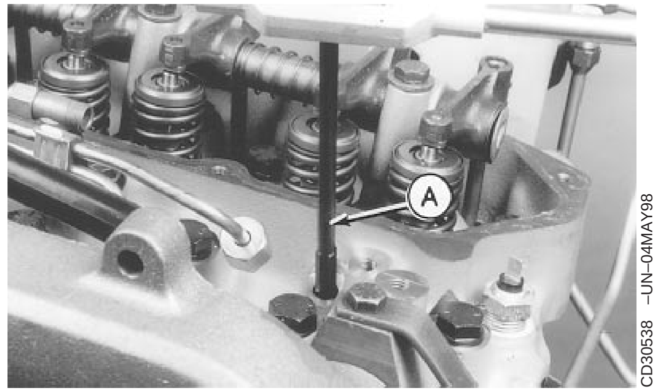


CD,CTM125,024 –19–01DEC97–6/6

Clean Injection Nozzle Bores

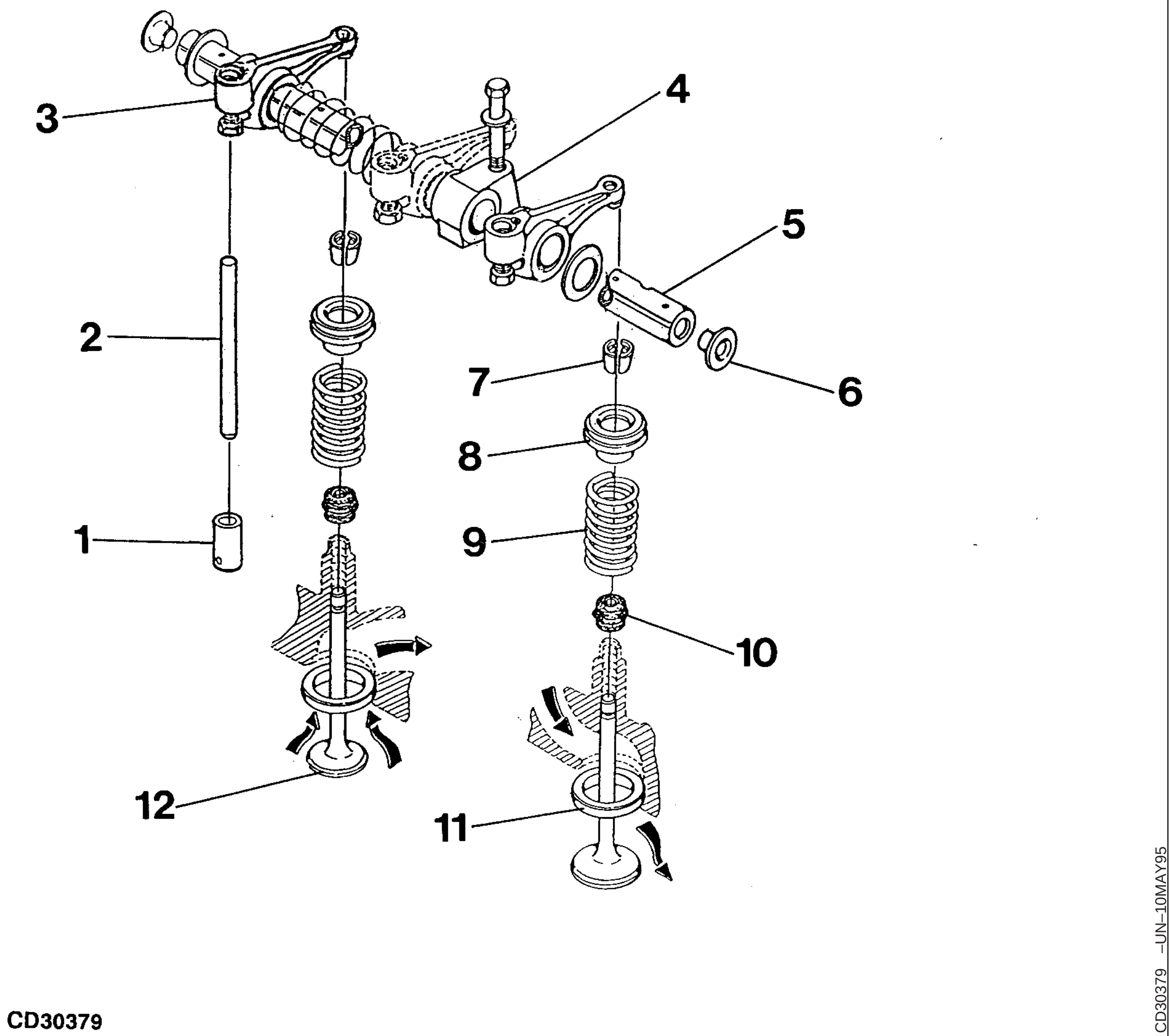
Using special tool JDE39 (A), remove carbon deposits from bores of fuel injection nozzles.

IMPORTANT: Always turn the tool clockwise through the bore, even when pulling back. Otherwise tool will get dull.



CD,CTM125,025 –19–01DEC97–1/1

Valve Actuating Parts

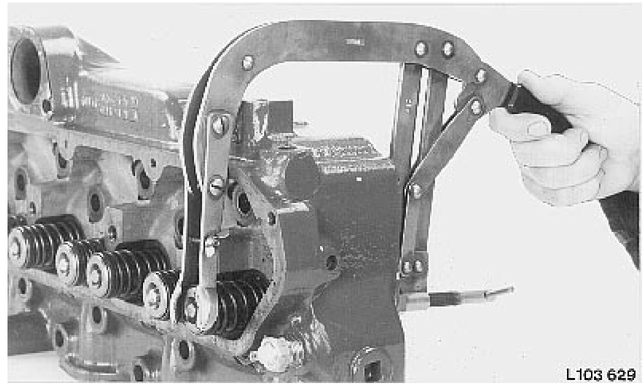


1—Cam follower	**4—Support**	**7—Keepers**	**10—Metering seal**
2—Push rod	**5—Shaft**	**8—Rotator**	**11—Valve seat insert**
3—Rocker arm	**6—Plug**	**9—Spring**	**12—Valve**

CD,3274,G05,54 –19–01FEB94–1/1

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.



L103629 –UN–07MAR95

CD,3274,G05,8 –19–24FEB92–1/1

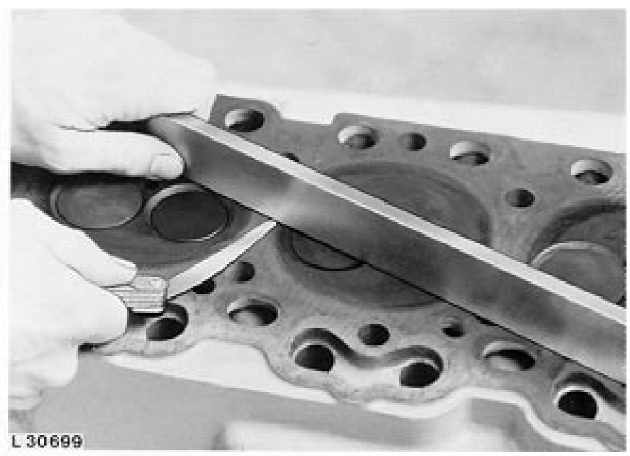
Checking Cylinder Head Flatness

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.



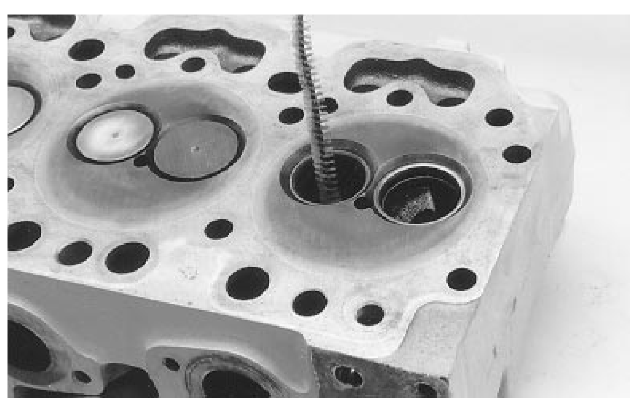
L30699 –UN–08AUG89

CD,3274,G05,6 –19–04JAN01–1/1

Clean Valve Guides

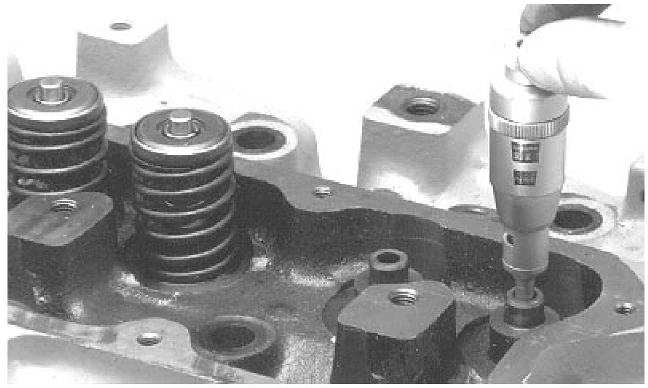
Using a plastic brush, clean valve guides.

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


CD30539 –UN–04MAY98

CD,CTM125,026 –19–01DEC97–1/1

Measure Valve Guides



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

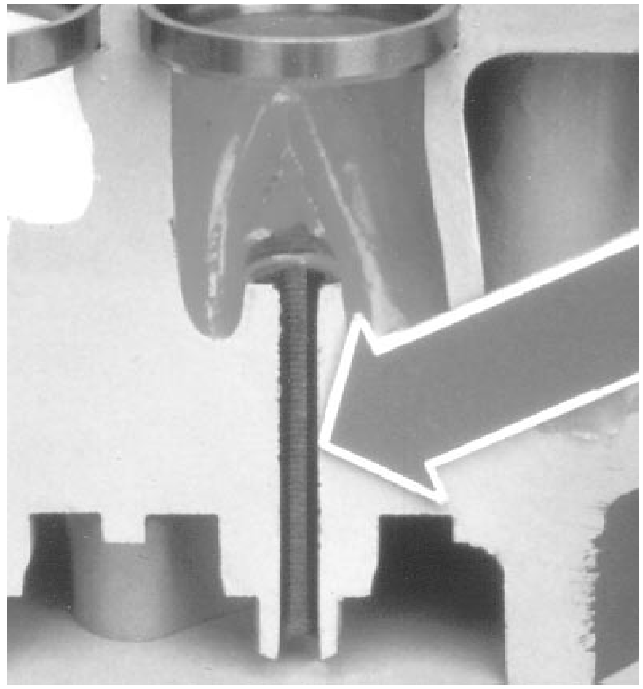
1st size—Diameter .... + 0.38 mm (0.015 in.)
2nd size—Diameter .... + 0.76 mm (0.015 in.)

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

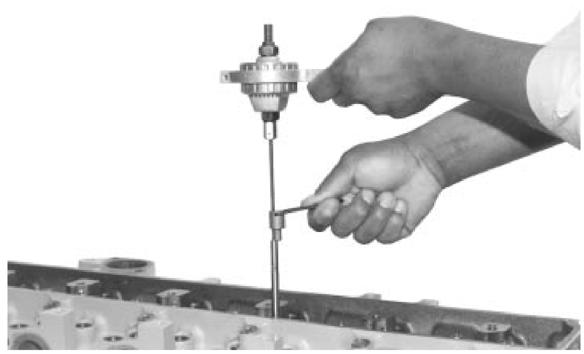
Knurl Valve Guides

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.

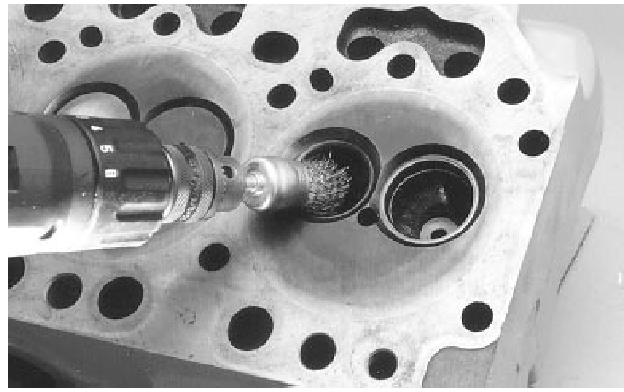
2. After knurling, ream valve guide to finished size to provide specified stem-to-guide clearance.


RG7437 –UN–23NOV97

Knurling Valve Guides

CD03523,0000129 –19–26FEB01–1/1

Clean and Inspect Valve Seats



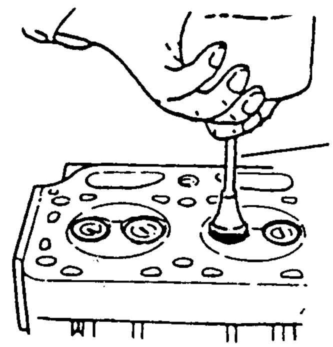
CD30540 –UN–04MAY98

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.

CD,CTM125,028 –19–04JAN01–1/1

Lapping Valve Seats



CD30380

CD30380 –UN–10MAY95

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.

CD,3274,G05,55 –19–04JAN01–1/1

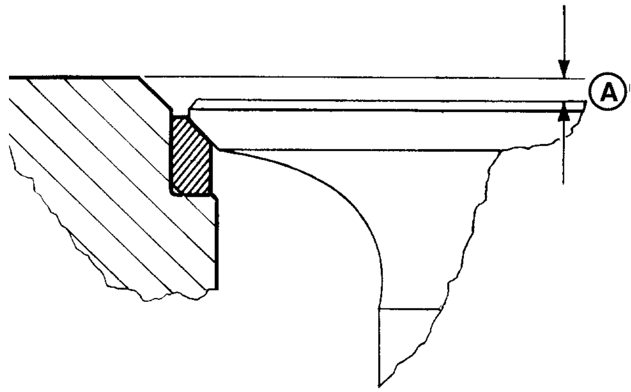
Check Valve Recess

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

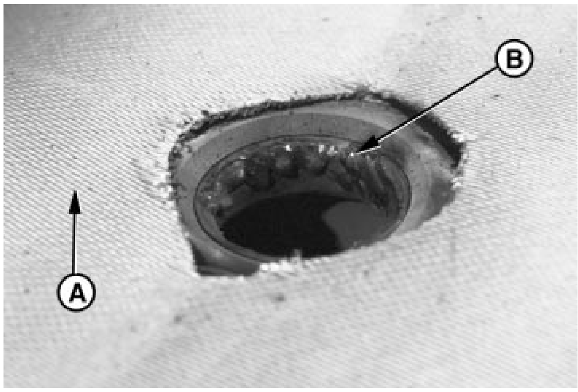
CD,CTM125,029 –19–04JAN01–1/1

Remove Valve Seat Inserts

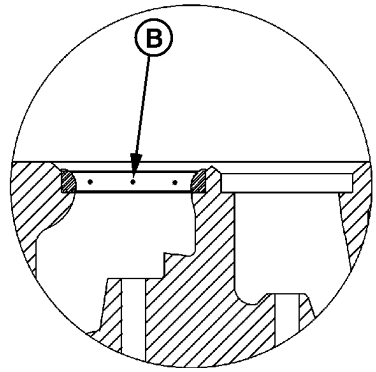
Valve seat inserts are made of sintered metal. Following methods, performed by experienced personnel or specialized workshop, can be used to remove inserts.

Continued on next page

CD,CTM125,031 –19–04JAN01–1/3



RG7761 –UN–10NOV97



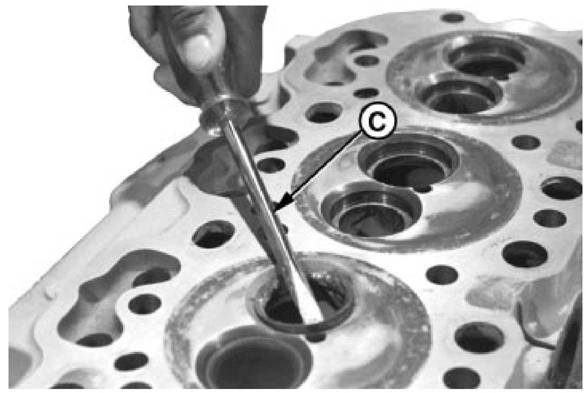
RG7813 –UN–13NOV97

Using an Arc Welder

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

Continued on next page CD,CTM125,031 –19–04JAN01–2/3

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.

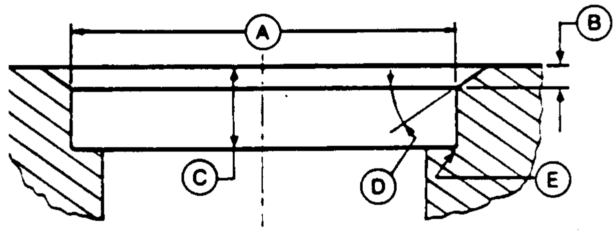
2. Remove rest of material and clean valve seat bore.

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–10MAR90

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

CD,CTM125,031 –19–04JAN01–3/3

Valve Seat Insert Installation

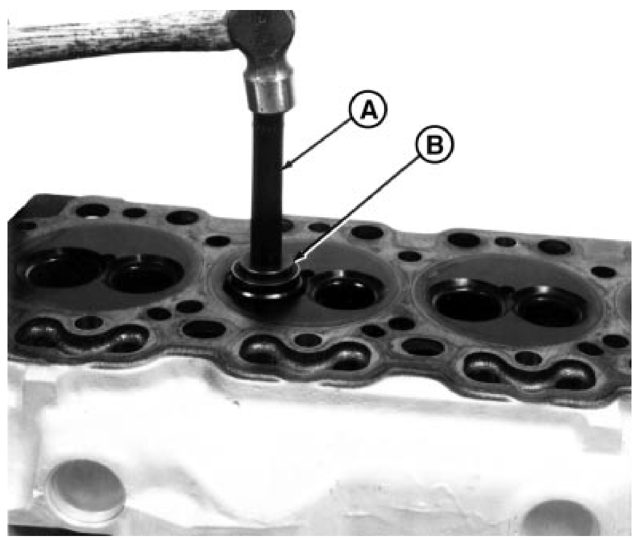
1. Freeze the valve seat inserts to -30°C (-22°F).

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)



RG5653 –UN–31OCT97

CD,3274,G05,16 –19–04JAN01–1/1

Check Valves

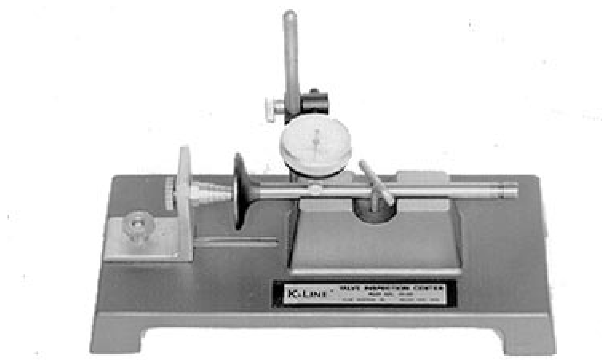
Thoroughly clean and inspect valves to help determine if they can be reused. Replace valves that are burned, cracked, eroded, or chipped.


T82053 –UN–07NOV88

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).



RG4234 –UN–05DEC97

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.

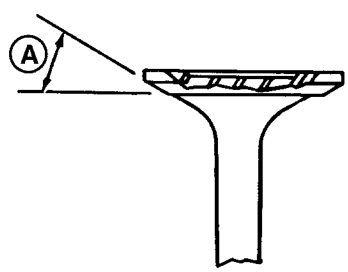
Specification

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).



RG4755 –UN–31OCT97

Specification

Valve face—Angle	29.25° ± 0.25°

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).

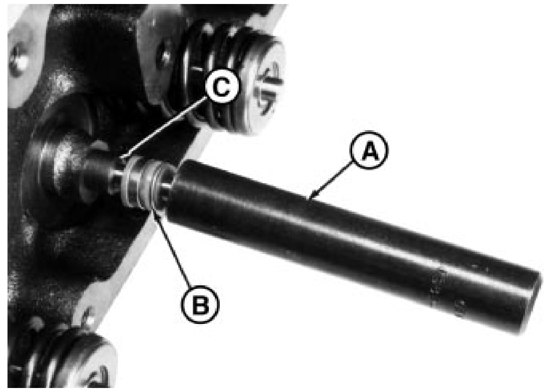
NOTE: Valves must move freely and seat properly.

Continued on next page

CD,3274,G05,21 –19–05JAN01–1/4

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

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

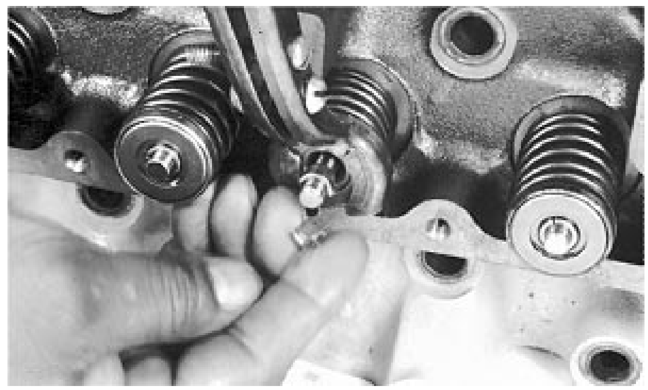


RG5654 –UN–31OCT97

CD,3274,G05,21 –19–05JAN01–2/4

4. Install valve springs and rotators.

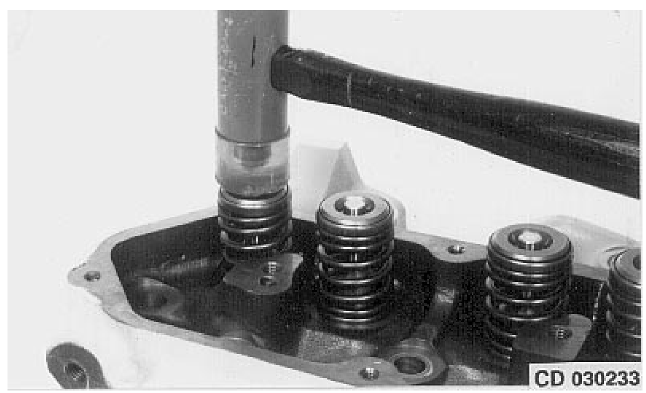
5. Compress valve springs using JDE138 Valve Spring Compressor and install new keepers on valves.



RG5655 –UN–12APR90

CD,3274,G05,21 –19–05JAN01–3/4

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 –19–05JAN01–4/4

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.

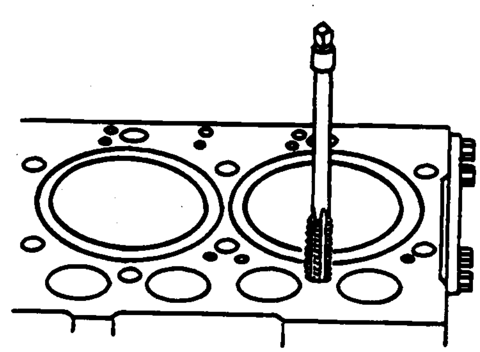
2. Install new cylinder head gasket dry (without sealant)

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.

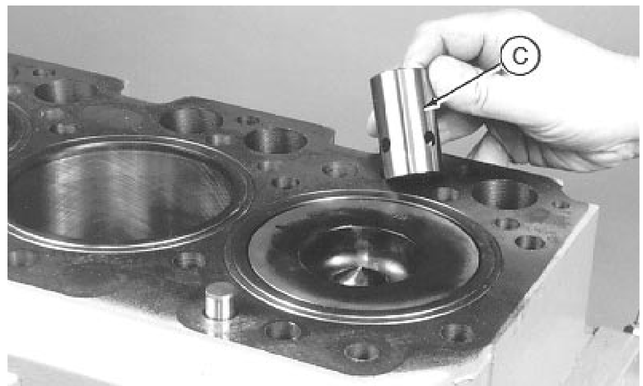
3. Install two guide studs in cylinder block at locating holes (B).
4. Position cylinder head over guide studs and lower into place on cylinder block.
5. Dip cap screws entirely in clean engine oil.
6. Remove guide studs and install cap screws in all open bores.
7. Tighten cap screws in sequence to the torque specified, beginning with No. 1, then torque turn to specified angle. Use JD-307 Torque Wrench Adapter if necessary.

Cylinder head bolts—Specification

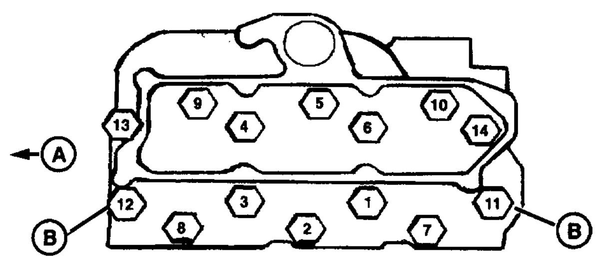
1st step—Torque	100 N•m (75 lb-ft)
2nd step—Torque	150 N•m (110 lb-ft)
Recheck after 5 minutes—Torque	150 N•m (110 lb-ft)
Final step—Torque Turn	60° ± 10°



RG4718 –UN–13DEC88



CD30693 –UN–04MAY98



CD30543 –UN–17JUN98

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

CD,CTM125,034 –19–05JAN01–1/1

Torque Turn Tightening Method

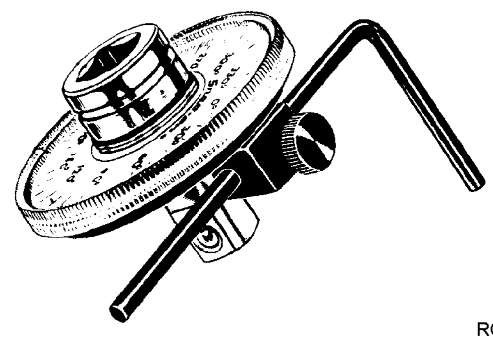
After tightening cap screws to 150 N•m (110 lb-ft), use JT05993 Torque Angle Gauge or the line scribble method below to tighten each cap screw an additional 60° angle.

Line scribe method:

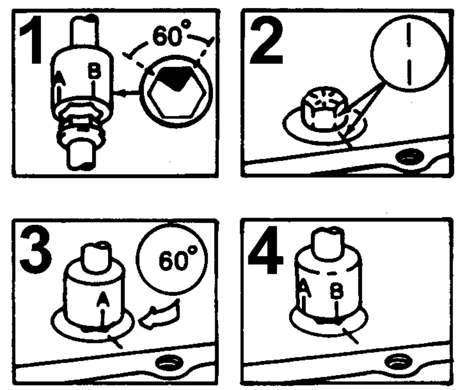
1. Make a mark on socket and make a second mark 60° counterclockwise from the first.
2. Make a mark on cylinder head next to each cap screw.
3. Place socket on cap screw so that first mark aligns with mark on cylinder head.
4. Tighten (in sequence) all cap screws until second mark on socket aligns with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

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.

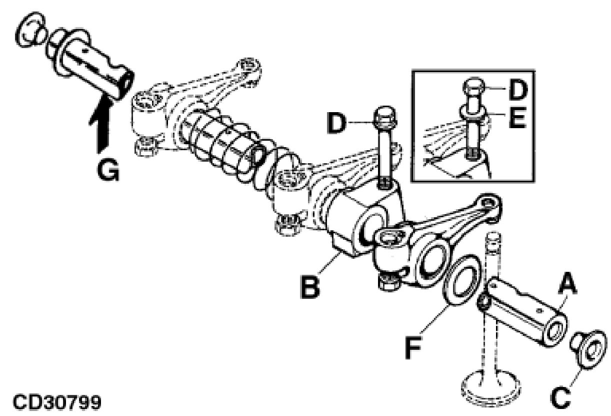
4. Check all parts for good condition.

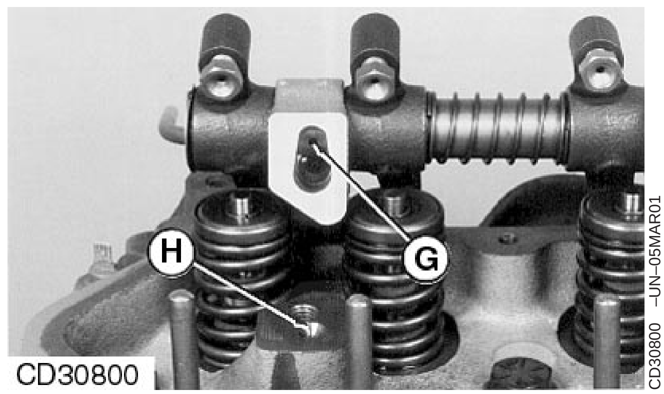
Rocker arm—Specification

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.

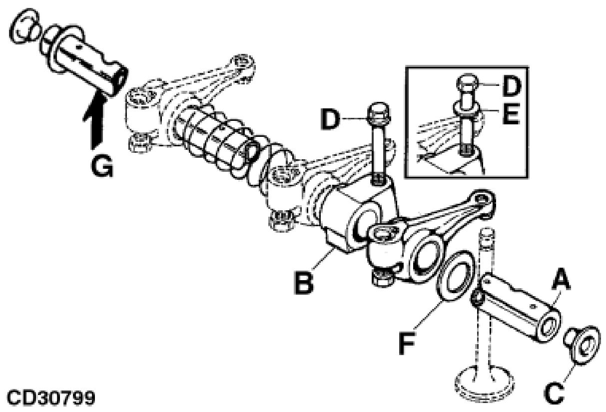




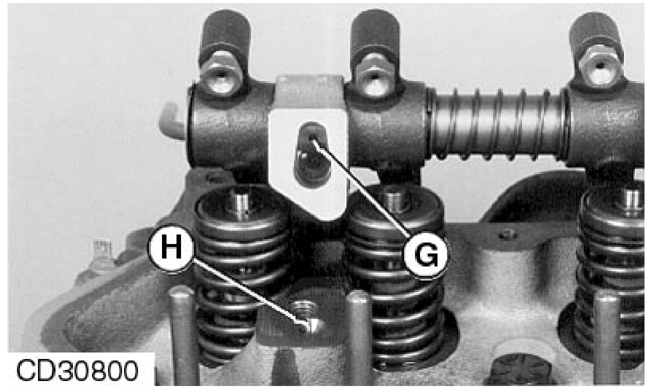
A—Rocker arm shaft
B—Support
C—Plug
D—Cap screw
E—Washer
F—Bowed washer
G—Oil supply hole in rocker arm shaft
H—Oil supply hole in cylinder head

CD,3274,G05,56 –19–05JAN01–1/1

Reassembling Rocker Arm Shaft



CD30799 –UN–05MAR01



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

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.

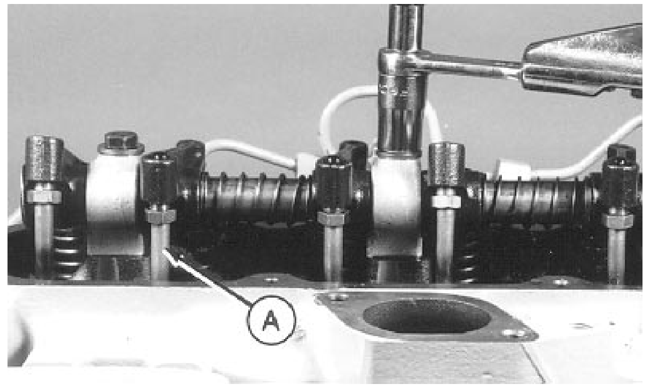
2. Slide springs, rocker arms and supports onto shaft. Assemble in the same order in which they were removed during disassembly.

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



CD30694 –UN–19MAY98

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.

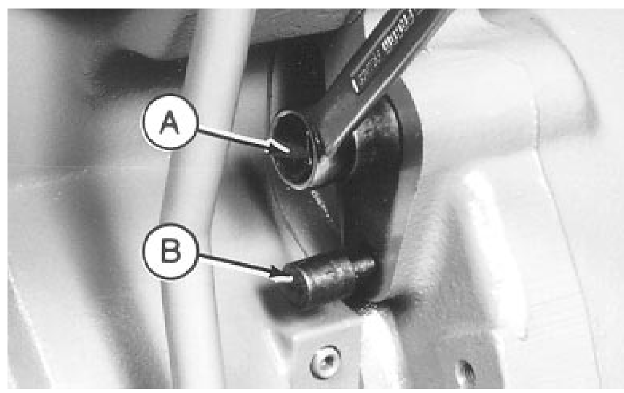
4. Tighten attaching cap screws to specifications.

Specification

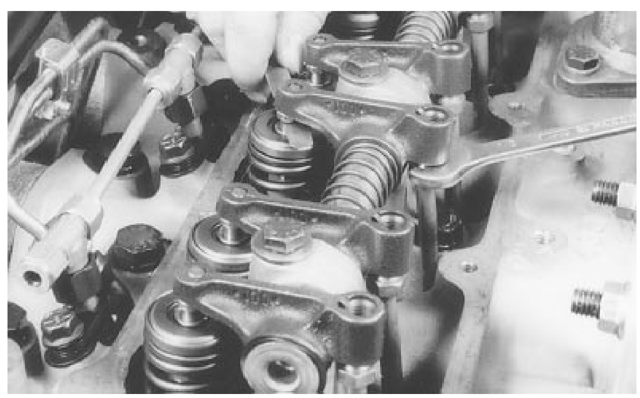
Rocker arm support cap screw—
Torque .... 50 N•m (35 lb-ft)

CD,CTM125,033 –19–08JAN01–1/1

Valve Clearance



CD30544 –UN–19MAY98


CD30545 –UN–19MAY98

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 (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.)

Adjust valve clearance as directed in the following module.

CD,CTM125,036 –19–08JAN01–1/1

Valve Adjustment Sequence

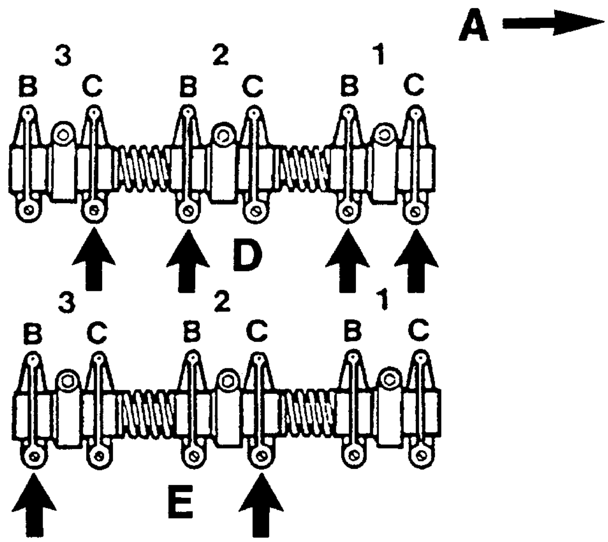
Specification

3-cylinder engine—Firing order 1-2-3

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.

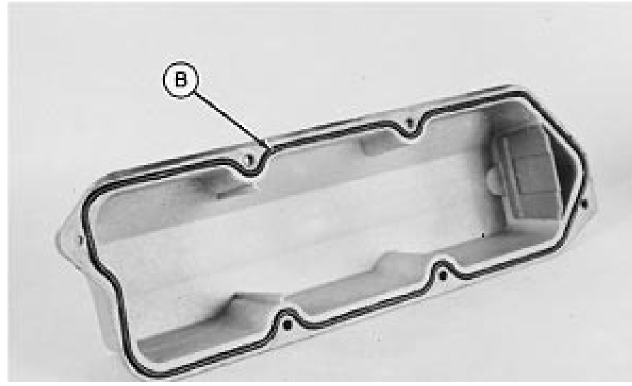


CD30549 –UN–16JUN98

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

CD,CTM125,037 –19–08JAN01–1/1

Install Rocker Arm Cover



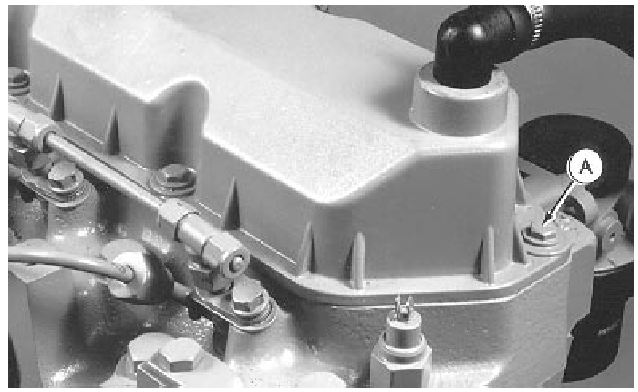
RG6322 –UN–03AUG92

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)



CD30546 –UN–04MAY98

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

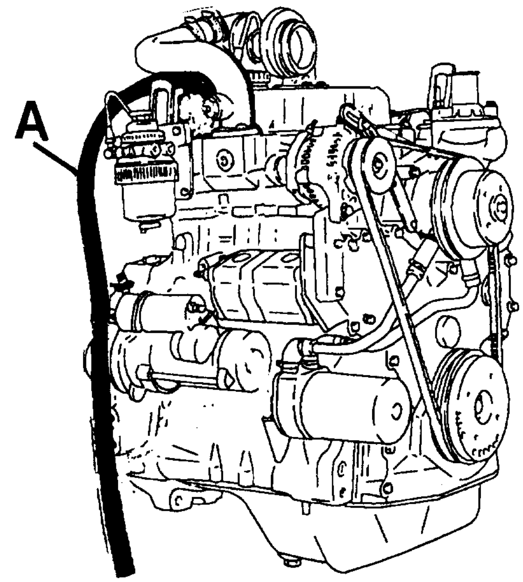
1. Re-install parts previously removed.

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.

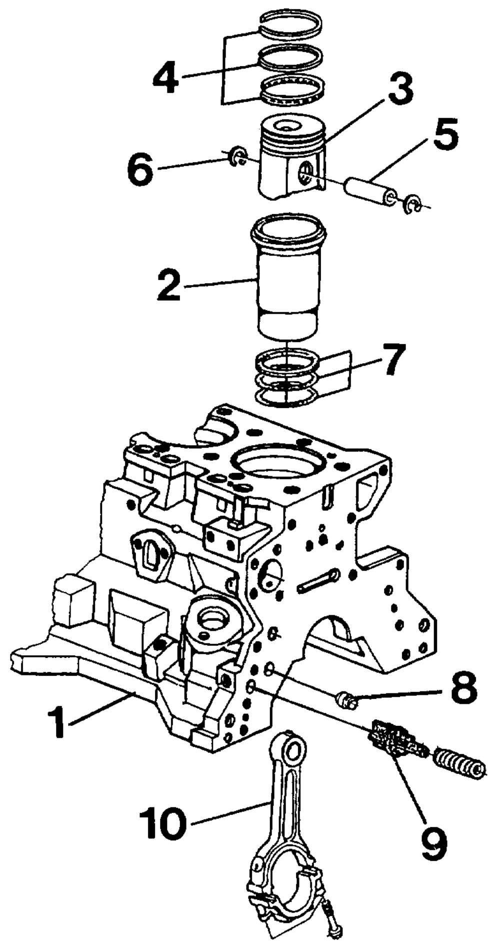
NOTE: Retorque of cylinder head bolts is not required.



CD30547 –UN–17JUN98

CD,CTM125,039 –19–08JAN01–1/1

Exploded View

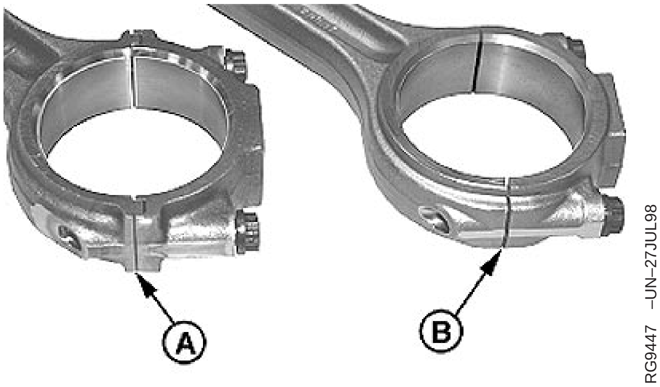


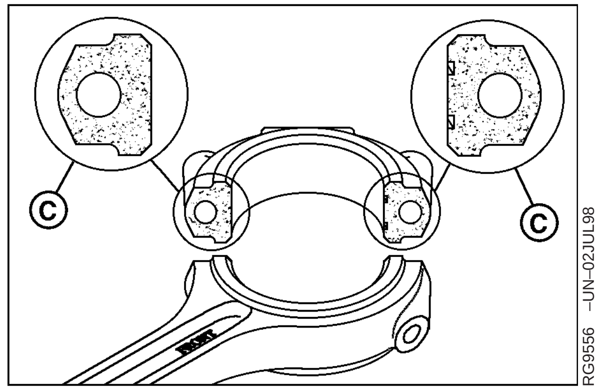
CD30551 –UN–16JUN98

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





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).

- 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.

PRECISION JOINT is a trademark of Deere & Company

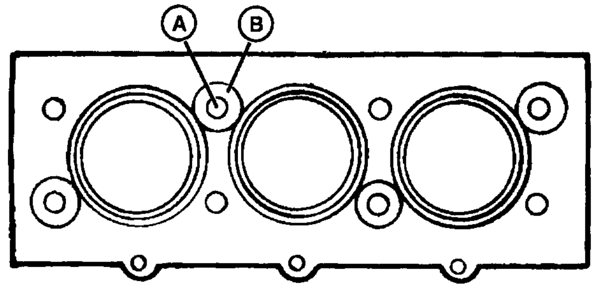
CD03523,00000ED –19–11JAN01–1/1

Remove Pistons and Connecting Rods

1. Remove cylinder head, oil pan and oil pump.

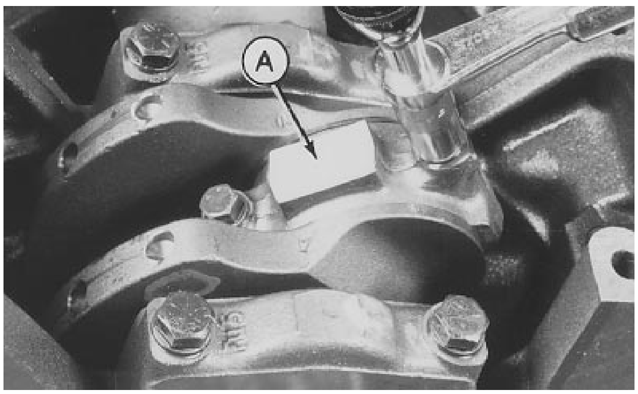
2. Install large flat washers (A) with 1/2-13 UNC cap screws (B) to hold cylinder liners down.

3. Decarbonize cylinder liners.

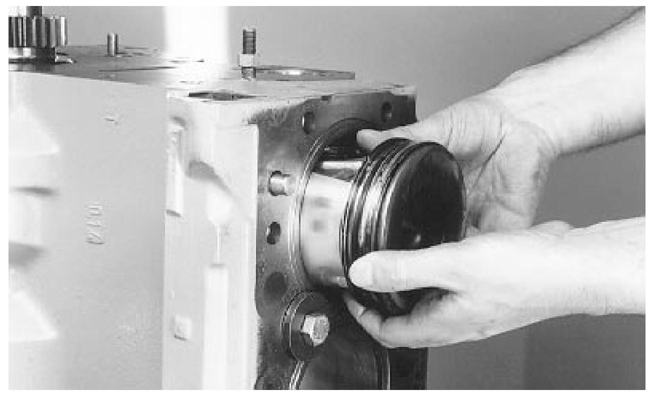


CD30552 –UN–16JUN98

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

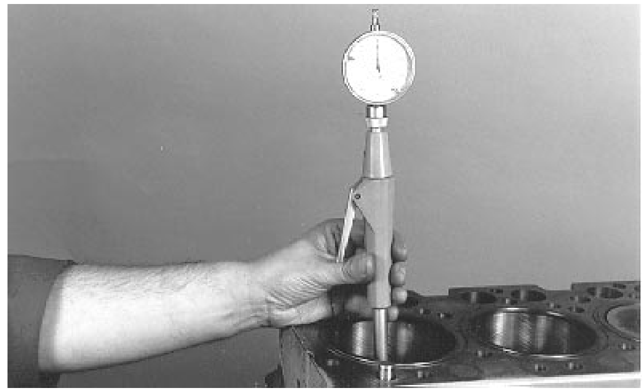
7. Remove and discard piston pin snap rings.

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.

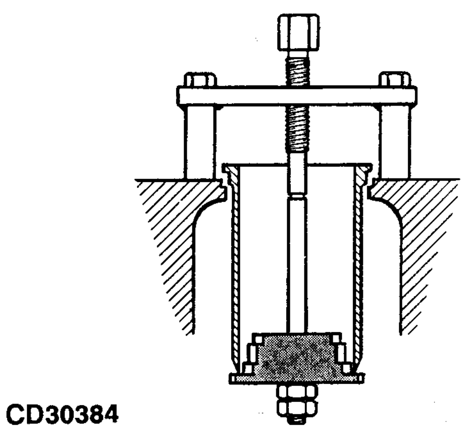
Specification

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

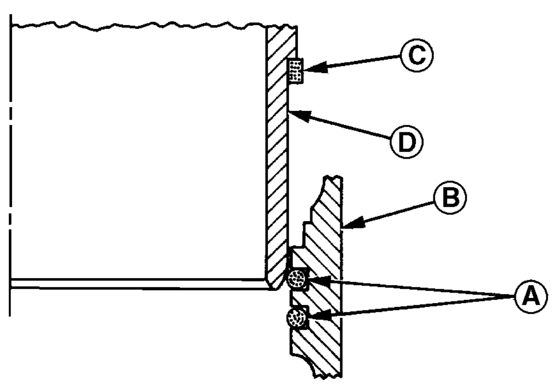
NOTE: Oversize liners do not exist. Install a complete set including standard liner and piston.

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

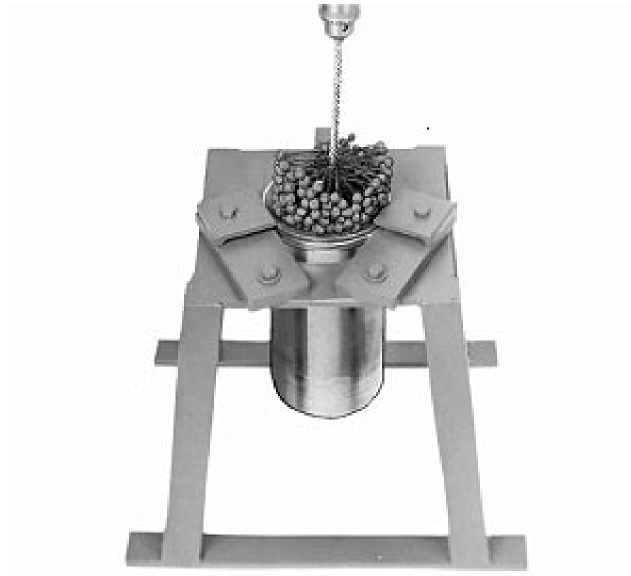
Cylinder Liner Deglazing

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

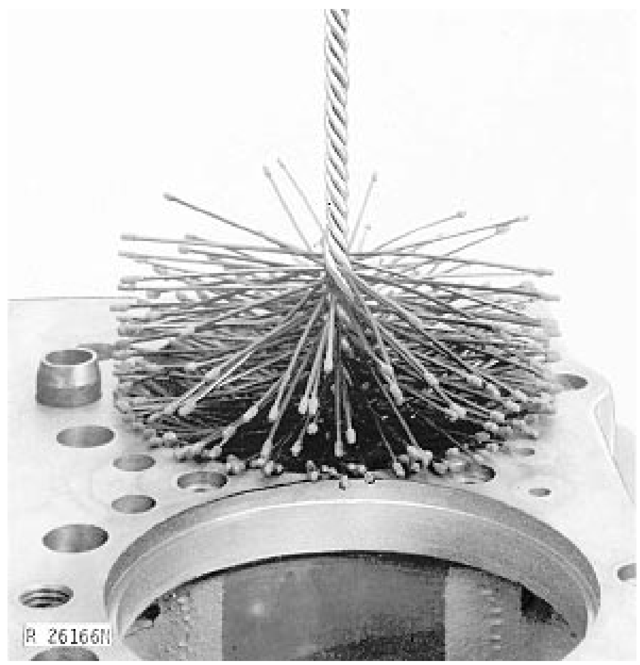
CD,3274,G10,20 –19–12JAN01–1/1

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.

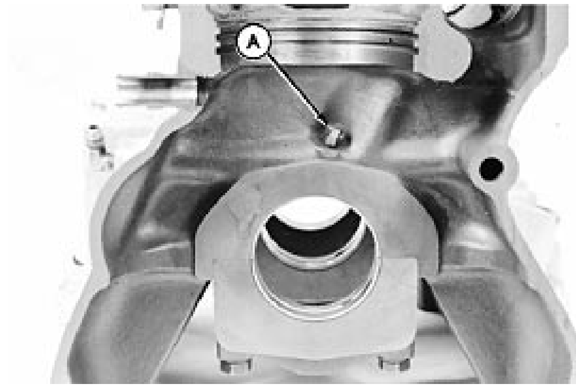
3. Use D17015BR cleaning brush to clean liner O-ring grooves.



R26166 –UN–13DEC88

CD,3274,G10,21 –19–12JAN01–1/1

Check Piston Cooling Jets



RG6426 –UN–17SEP92

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.

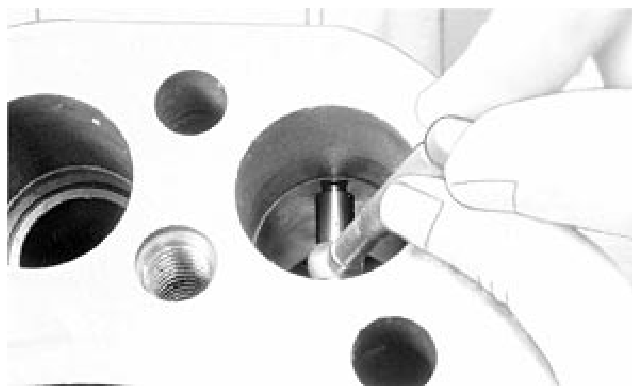
2. Reinstall jets and tighten to specifications.

Specification

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

CD,CTM125,053 –19–12JAN01–1/1

Cam Follower Bore Measure



T81656 –UN–01NOV98

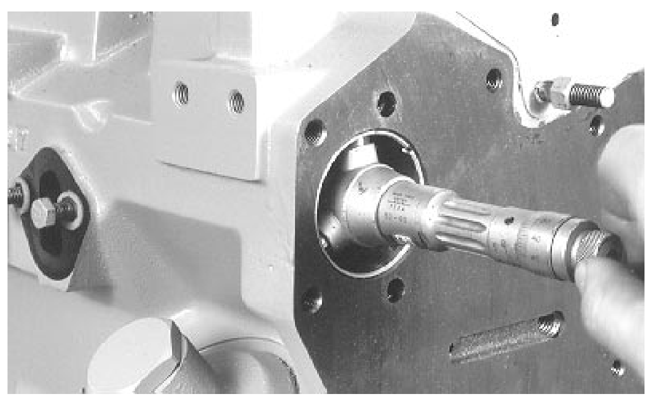
Specification

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.

CD,3274,G10,35 –19–12JAN01–1/1

Measure Camshaft Bore



CD30557 –UN–04MAY98

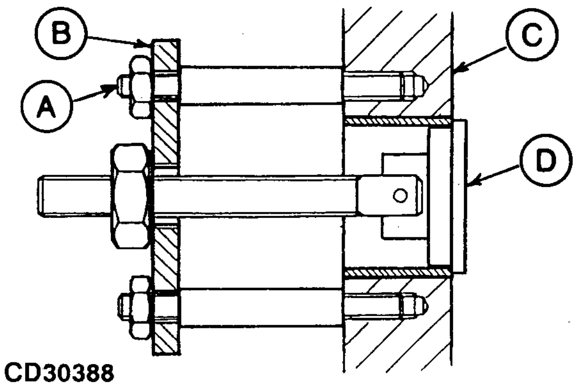
Camshaft bore—Specification

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.)

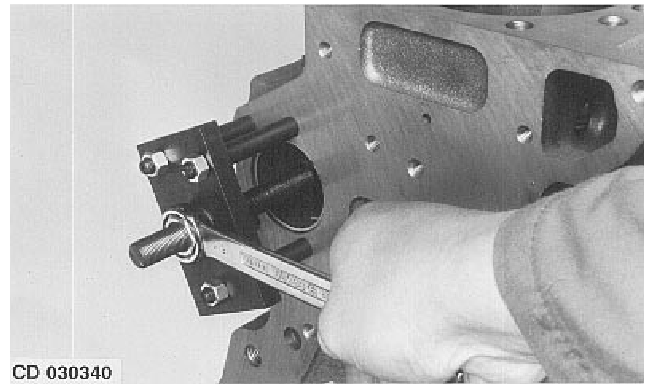
If only diameter of No.1 camshaft bore with bushing is more than specified, replace the bushing. In other cases, install a new cylinder block.

CD,CTM125,050 –19–12JAN01–1/1

Remove Camshaft Bushing



CD30388 –UN–10MAY95



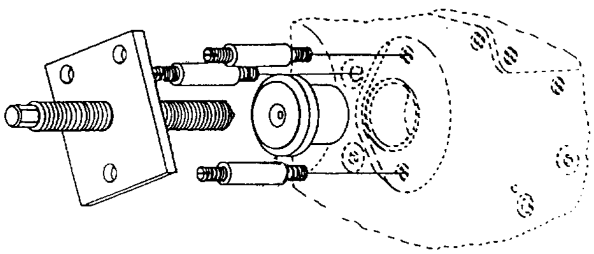
CD30340 –UN–17FEB95

Extract camshaft bushing using JDG739B tool as follows:

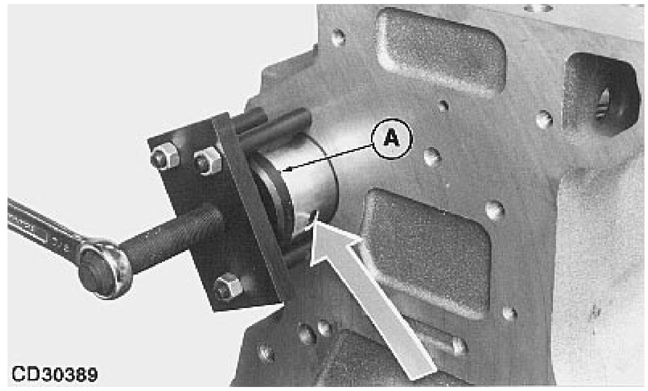
1. Assemble threaded spacers (A) and forcing plate (B) to cylinder block (C).
2. Insert bushing puller (D) into camshaft bushing bore.
3. Tighten hex. nut until bushing is free of block bore.

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.

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.

[1]*Available as service part.*

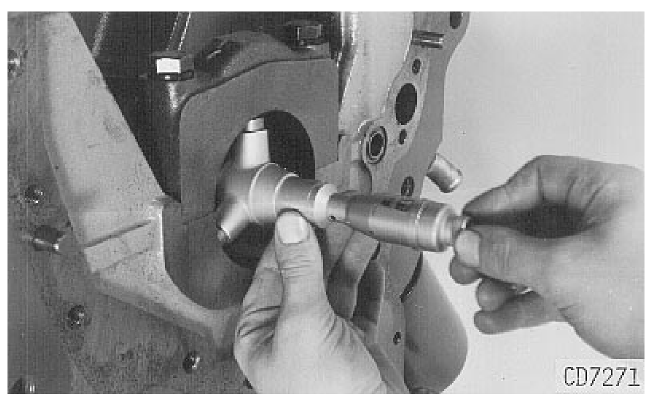
CD,CTM125,052 –19–01DEC97–1/1

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.



CD7271 –UN–07MAR95

CD,CTM125,054 –19–12JAN01–1/1

Replace Crankshaft Bearing Caps

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

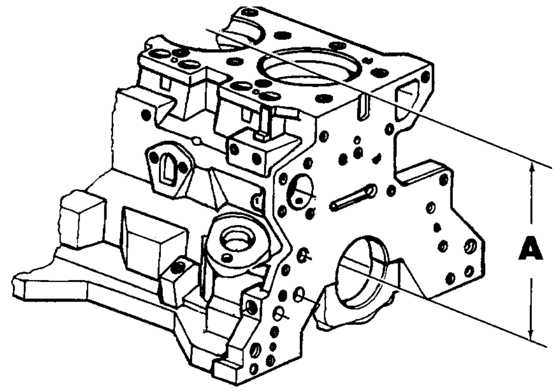
1. Install replacement cap in block and tighten cap screws to 135 N•m (100 lb-ft).

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.



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

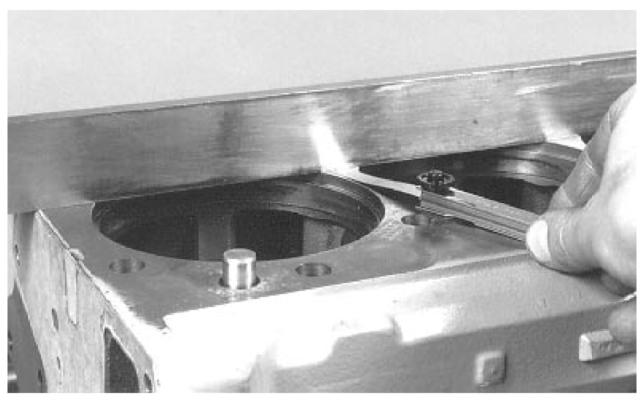
CD,CTM125,078 –19–12JAN01–1/1

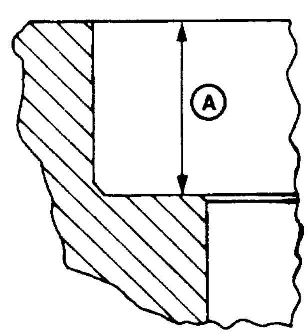
Cylinder Block Top Desk Flatness

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

Specification

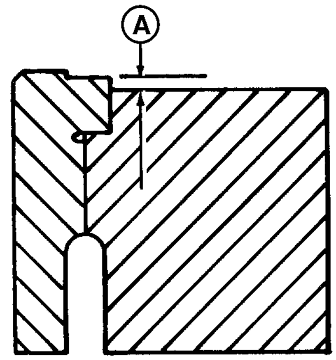
Top Desk—Out-of Flat for every 150 mm (5.90 in.) length or width	0.025 mm (0.001 in.)
Surface finish (CLA)	0.8—3.2 micron (32—128 micro-in)
Maximum wave deep	8 micron (320 micro-in)
Crankshaft bore centerline-to-top desk—Distance	301.98—302.11 mm (11.889—11.894 in.)
Liner counterbore—Depth (A)	5.95—5.99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



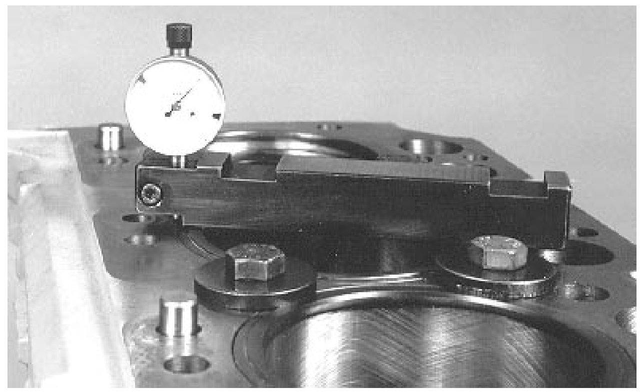


CD,CTM125,055 –19–12JAN01–1/1

Measure Cylinder Liner Protrusion



RG6439 –UN–03NOV97



CD30563 –UN–04MAY98

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).

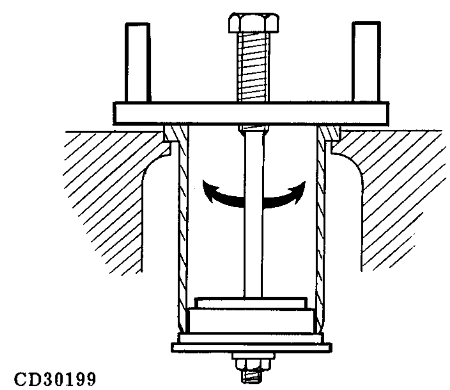
3. Using KJD10123 Gauge, measure liner protrusion (A) at four points.

Specification

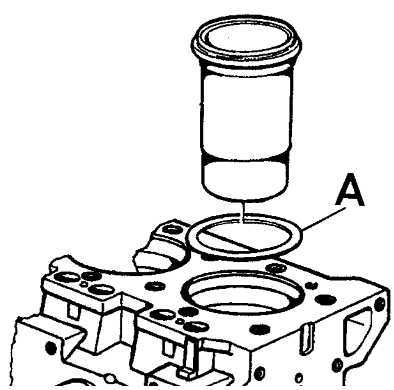
Liner—Protrusion...................................... 0.01—0.10 mm (0.0004—0.004 in.)
Maximum permissible difference between adjacent cylinders....................................... 0.03 mm (0.001 in.)

A—Liner protrusion

CD,CTM125,058 –19–12JAN01–1/2



CD30199 –UN–07MAR95



CD30564 –UN–16JUN98

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.

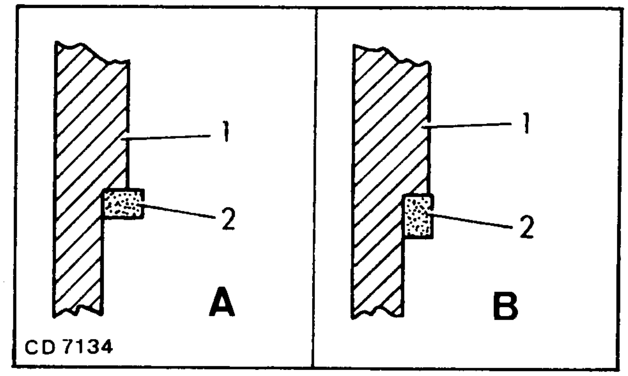
Specification

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.

CD,CTM125,058 –19–12JAN01–2/2

Liner Packing Installation



CD7134 –UN–07MAR95

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

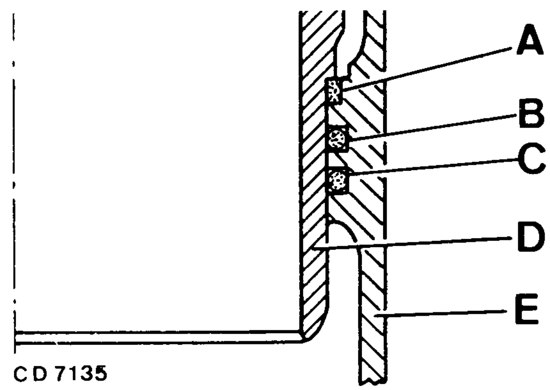
Specification

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

1—Cylinder liner
2—Packing
A—Improper installation
B—Proper installation

CD,3274,G10,27 –19–12JAN01–1/1

Liner O-Ring Installation



CD7135 –UN–07MAR95

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

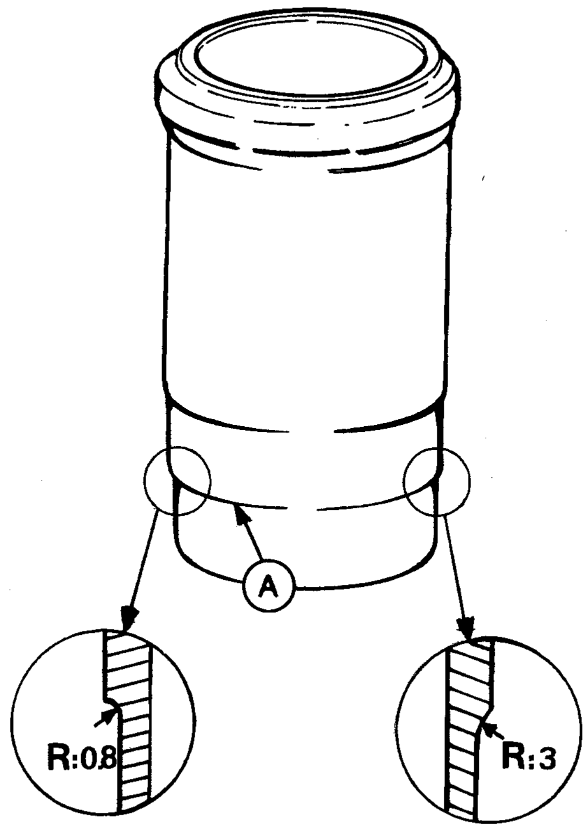
CD,3274,G10,28 –19–18FEB92–1/1

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.

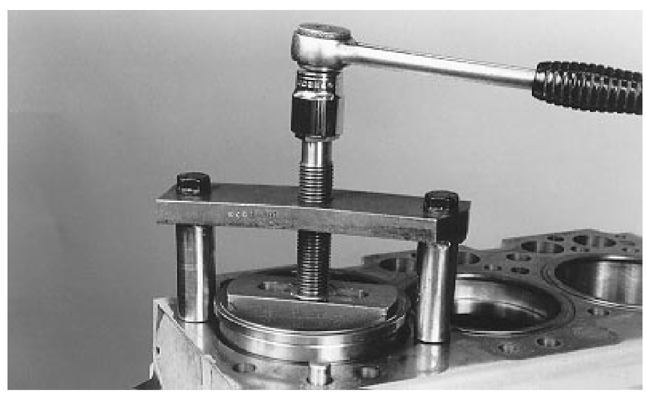


CD30707 –UN–22FEB99

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.



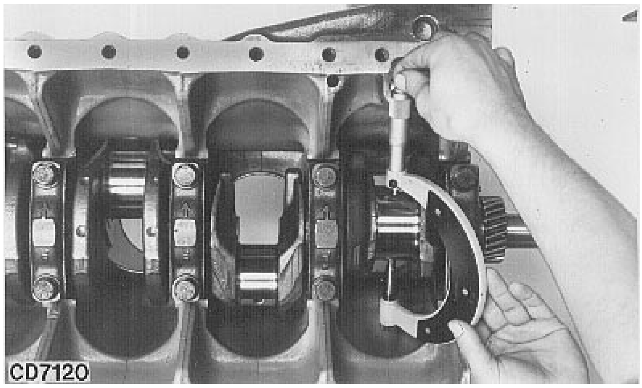
CD30565 –UN–04MAY98

Installation with KCD10001

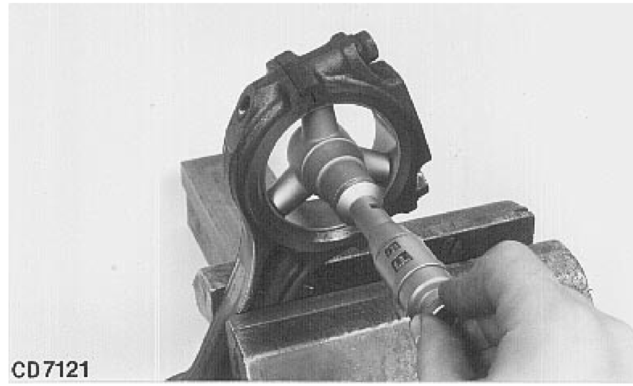
CD,CTM125,059 –19–12JAN01–2/2

10
13

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.

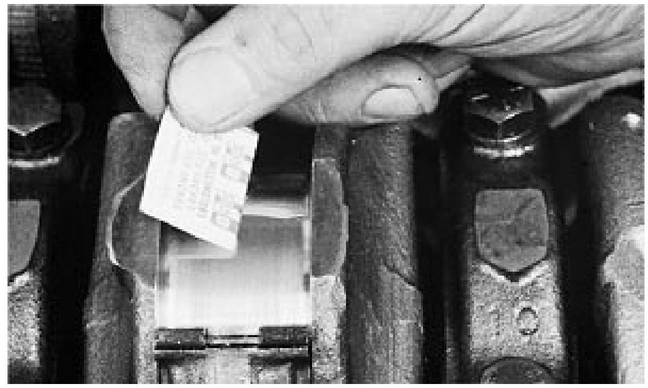
CD,CTM125,060 –19–12JAN01–1/1

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.).



RG6405 –UN–21AUG92

PLASTIGAGE is a trademark of DANA Corp.

CD,3274,G10,1 –19–01FEB94–1/1

Measure Connecting Rod Bushing

CD30566 –UN–04MAY98

Straight Pin-End (3029D)

CD30567 –UN–04MAY98

Tapered Pin-End (3029T)

NOTE: 3029D engines are equipped with straight pin-end connecting rods while 3029T engines receive the tapered pin-end conrods.

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

Connecting rod bushing—Specification

3029D—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.)
3029T—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 –19–12JAN01–1/1

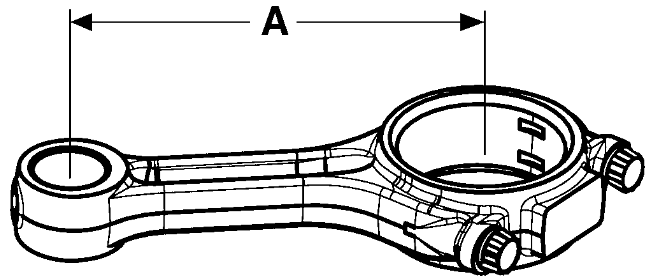
Replace Connecting Rod Bushing (3029D)

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
(3029D)—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 –19–12JAN01–1/1

Replace Connecting Rod Bushing (3029T)

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

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

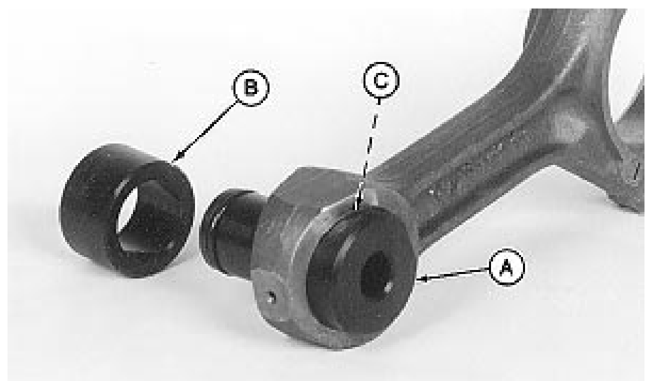
1. Slide driver JDG738-1 (A) into one side of rod bushing (C). Turn driver until taper on driver flange matches up with taper on bushing.

2. Install receiver cup JDG738-3 onto opposite side of rod bushing.

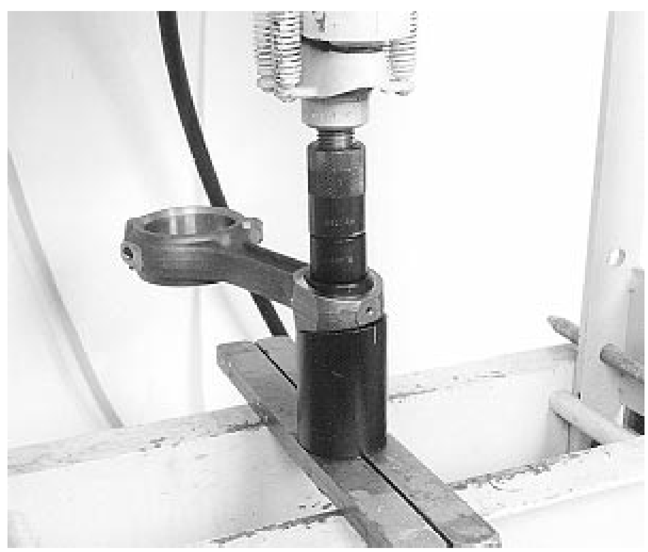
NOTE: Stud in cup keeps rod properly located on the cup. Use JDG738-2 pilot ring (B) as a hollow spacer when pressing bushing out of rod.

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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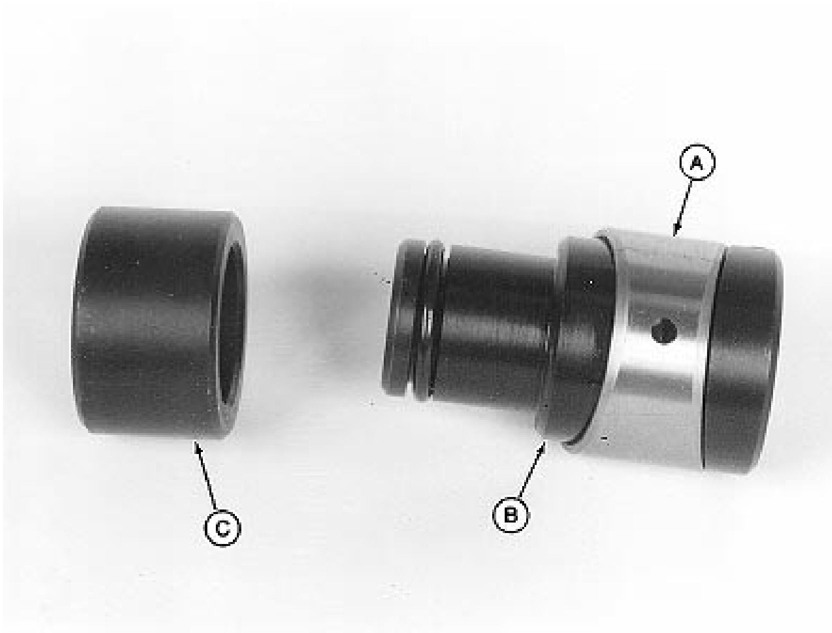
CD,CTM125,063 –19–12JAN01–1/4



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.*

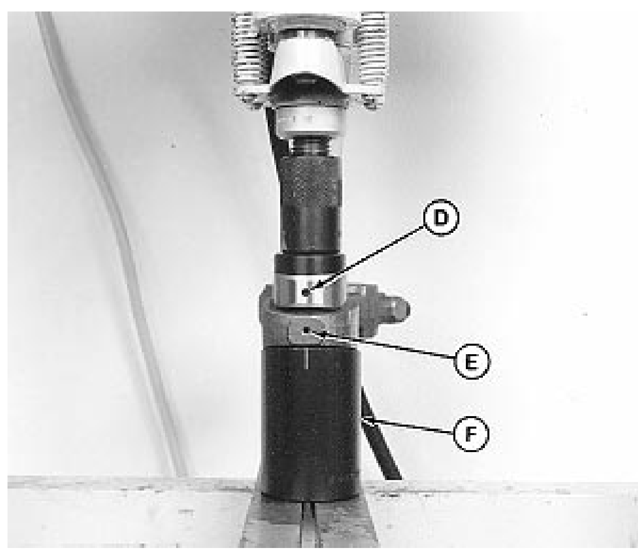
CD,CTM125,063 –19–12JAN01–2/4

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



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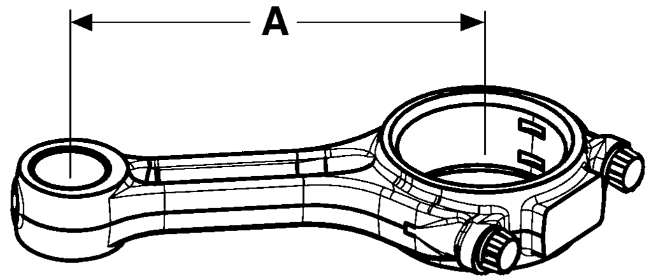
CD,CTM125,063 –19–12JAN01–3/4

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	
(3029T)—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 –19–12JAN01–4/4

Measure Piston Pin

Piston pin—Specification

3029D—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.)
3029T—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 –19–01DEC97–1/1

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

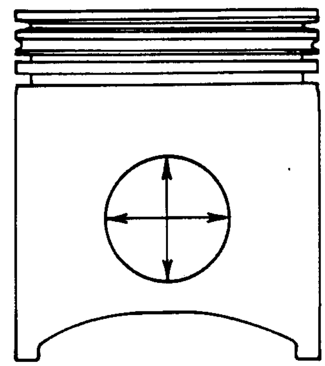
Measure Piston Pin Bore

Piston pin bore—Specification

3029D—Diameter	32.003—32.013 mm (1.2600—1.2603 in.)
3029T—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.



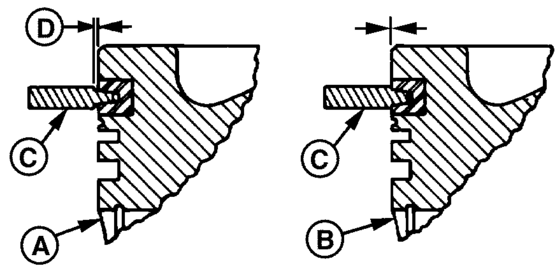
RG6283 –UN–03AUG92

CD,CTM125,065 –19–01DEC97–1/1

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

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”.

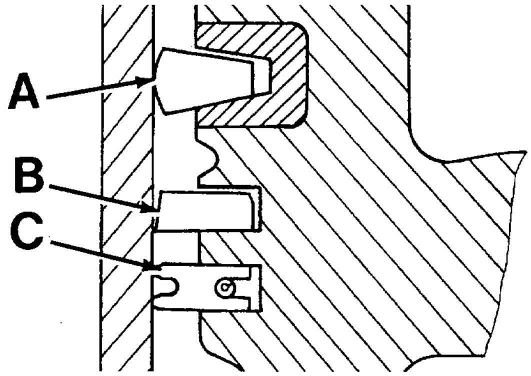
Specification

Piston skirt—Diameter at 11 mm (0.43 in.) from bottom .... 106.381—106.399 mm (4.1882—4.1890 in.)

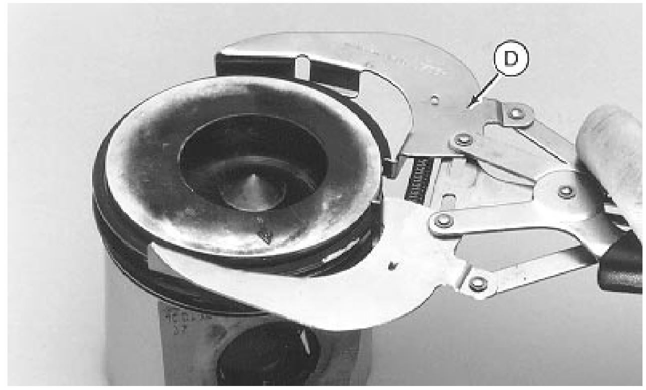
Piston-to-cylinder liner—Clearance .... 0.09—0.14 mm (0.0035—0.0055 in.)

CD,3274,G10,8 –19–01FEB94–1/1

Install Piston Rings



CD30568 –UN–16JUN98



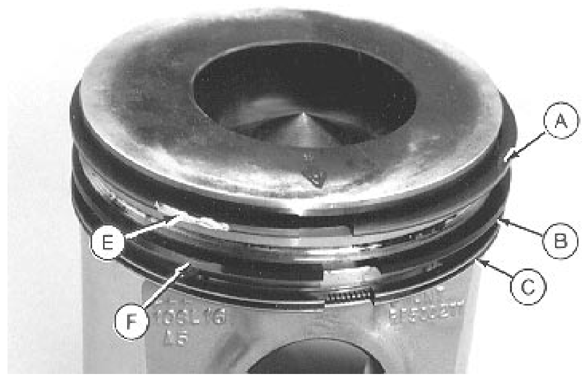
CD30569 –UN–04MAY98

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.



CD30570 –UN–04MAY98

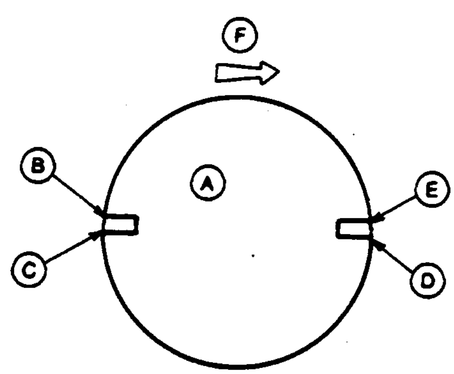
A—Top ring
B—Second ring
C—Oil control ring
D—KJD10140 Piston Ring Expander
E—Blue mark
F—Yellow mark

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—Oil control ring gap
D—Expander ring gap
E—Bottom compression ring gap
F—Front of engine



CD5781 –UN–23FEB89

CD,3274,G10,15 –19–18FEB92–1/1

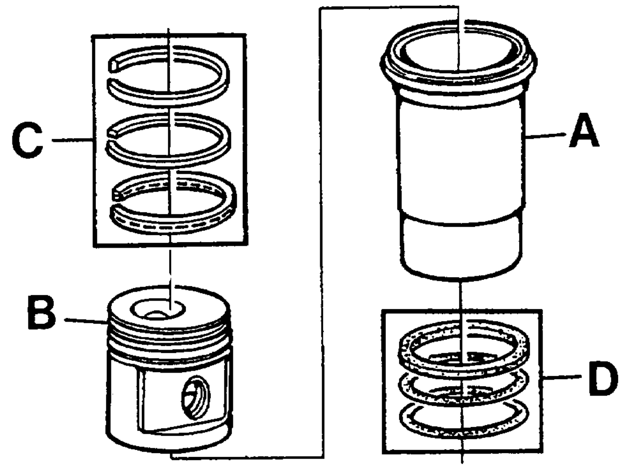
Piston/Liner Set Information

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

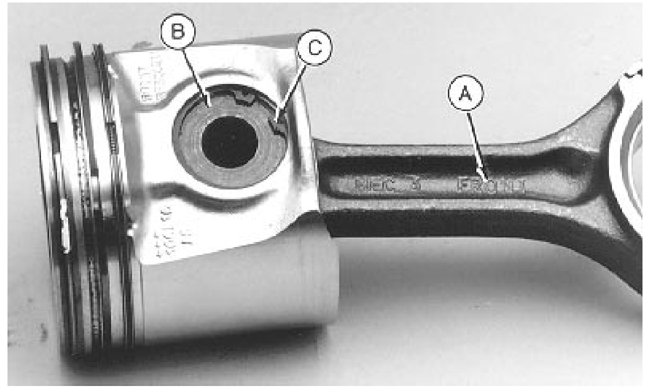
Assemble Piston and Connecting Rod

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.

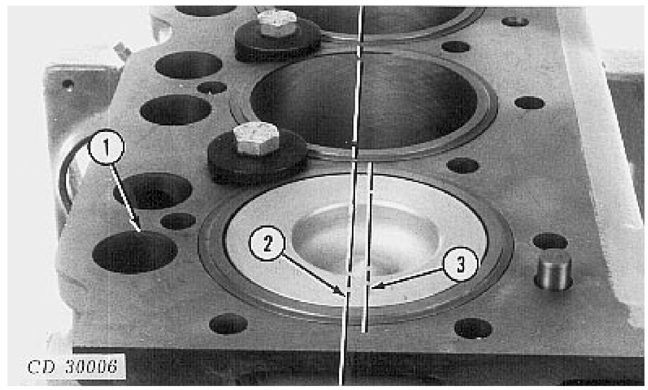
1. Assemble pistons and connecting rods, making sure the word “FRONT” on piston and on connecting rod (A) is on the same side.

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.



CD30571 –UN–04MAY98



CD30006 –UN–18JAN95

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

CD,CTM125,069 –19–12JAN01–1/1

Install Piston and Connecting Rod

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.

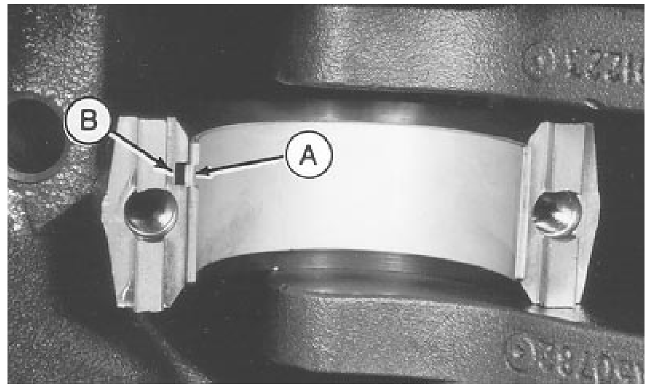
CD30572 –UN–04MAY98

Continued on next page

CD,CTM125,073 –19–15JAN01–1/5

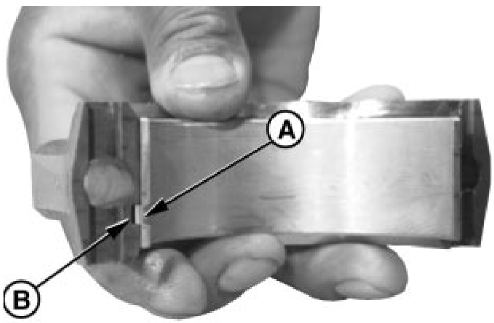
3. Install bearing insert in connecting rod with tang (A) in groove (B).

4. Apply clean engine oil on insert and crankshaft journal. Carefully place connecting rod against crankshaft journal.



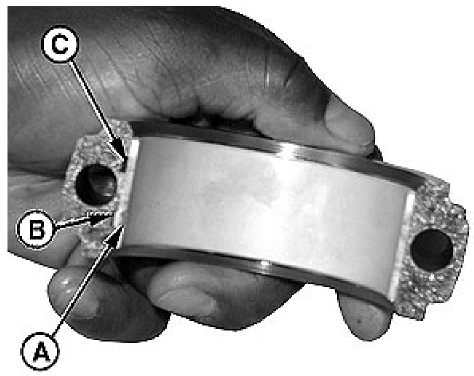
CD30573 –UN–19MAY98

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)**

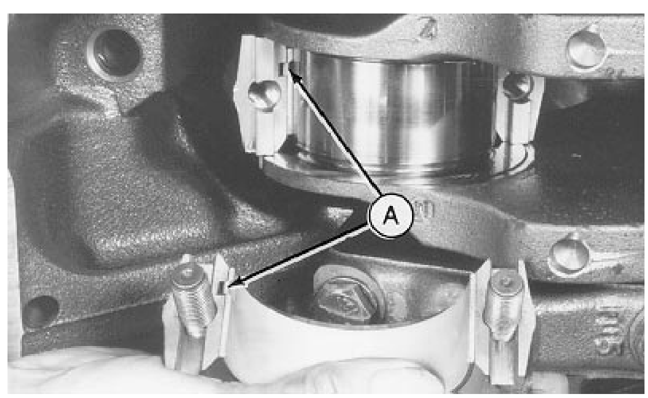
NOTE: Due to the manufacturing process, PRECISION JOINT™ rod and cap have two grooves each, while bearing inserts have a single tang. The extra grooves (C) are not used.

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

PRECISION JOINT is a trademark of Deere & Company

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

PRECISION JOINT is a trademark of Deere & Company

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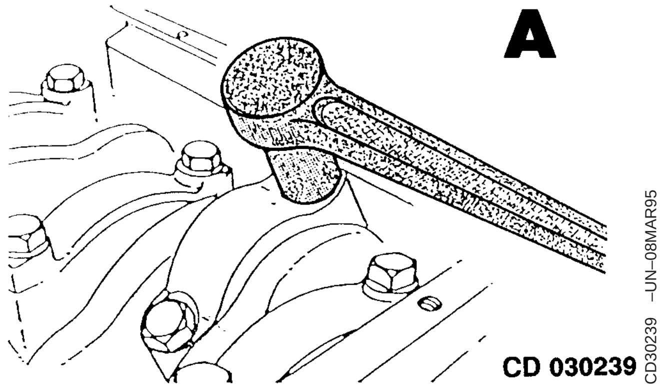
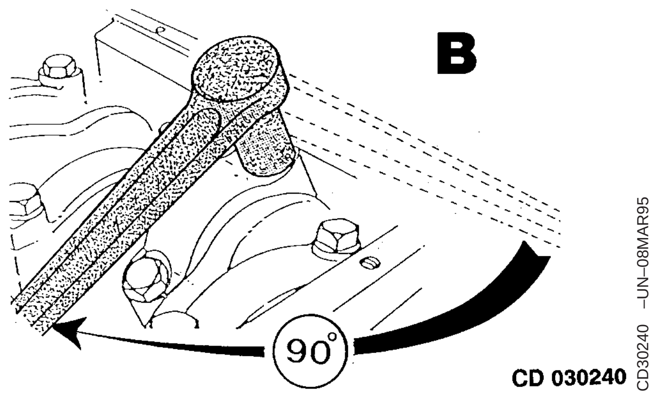
CD,CTM125,073 –19–15JAN01–4/5

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.

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CD,CTM125,073 –19–15JAN01–5/5

Measure Piston Protrusion

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.

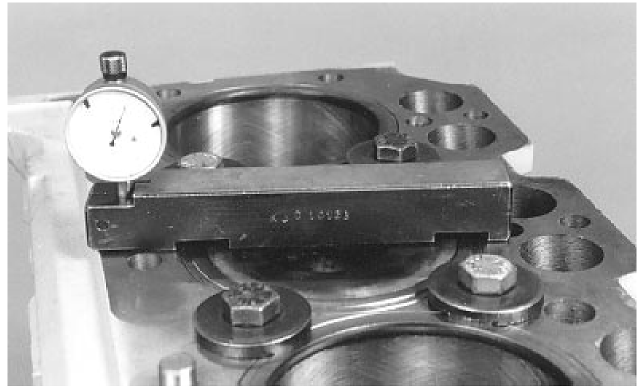
4. Piston protrusion should not exceed 0.25 mm (0.010 in.) when KJD10123 is used.

Specification

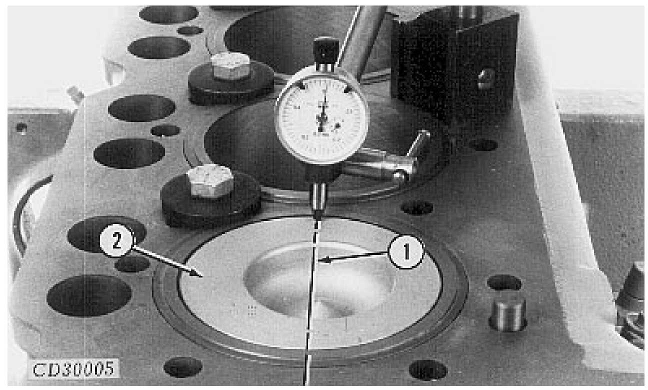
Piston—Protrusion above block .... 0.08—0.35 mm (0.003—0.014 in.)

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.



CD30575 –UN–04MAY98



CD30005 –UN–07FEB95

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.

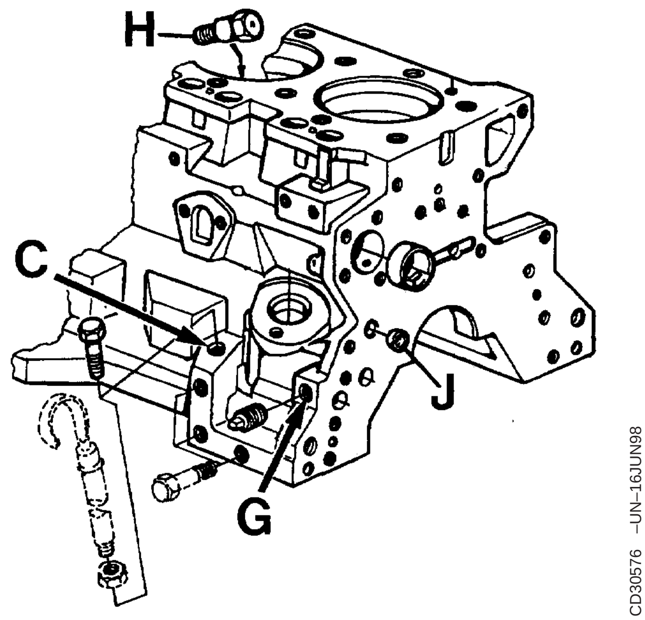
Cylinder block plugs and fittings—Specification

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)

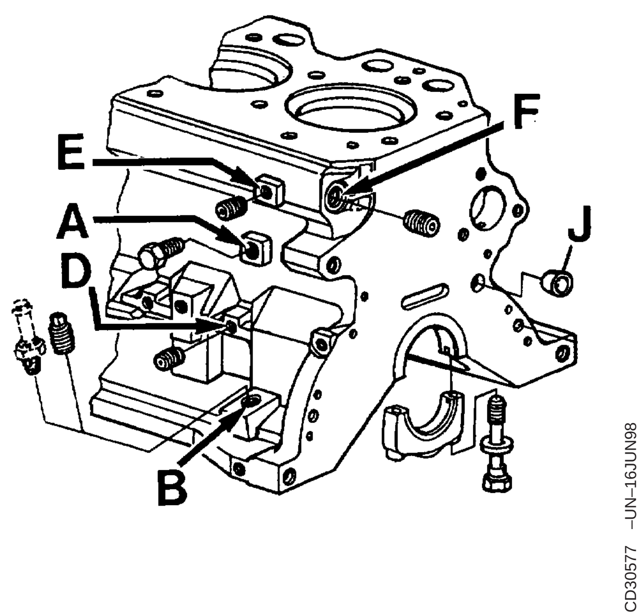
NOTE: Plugs for orifices (A) and (D) are coated with sealant and can be reused several times without addition of sealing compound.

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

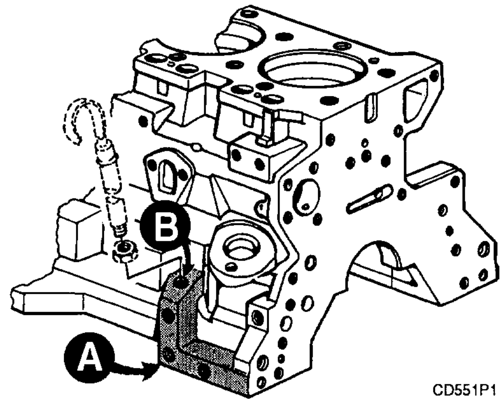


Rear left view

Continued on next page 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

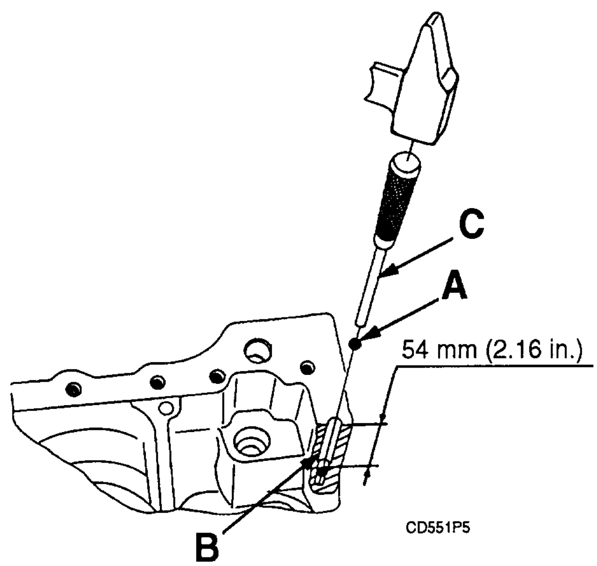
CD,CTM125,077 –19–01DEC97–2/3

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.

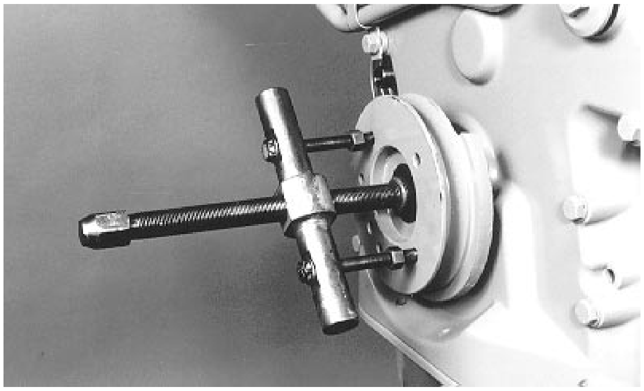
   c. Check for proper installation. The distance between pan rail and top of ball should be approximatively 54 mm (2.16 in.).



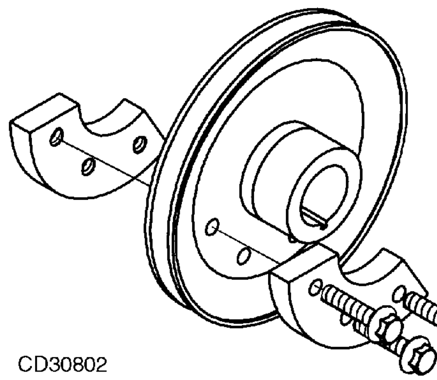
CD551P5 –UN–07NOV96

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

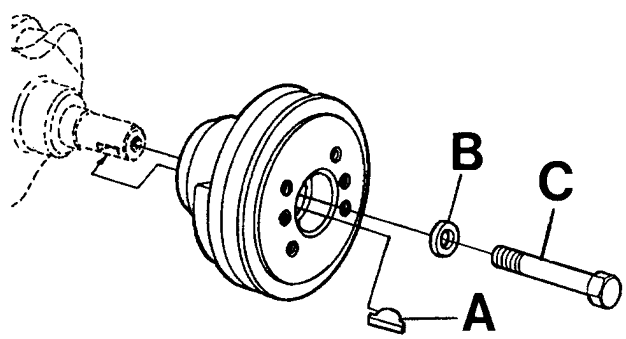
Install Crankshaft Pulley

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)



CD30581 –UN–16JUN98

CD,CTM125,084 –19–16JAN01–1/1

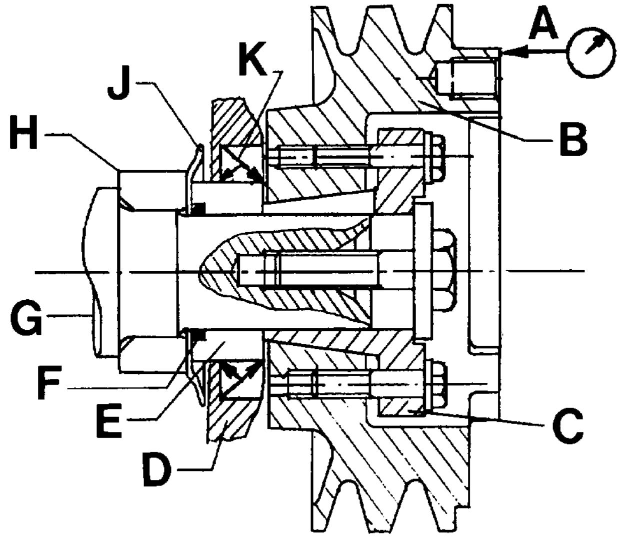
Check Pulley Wobble (Engine With Front PTO)

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.

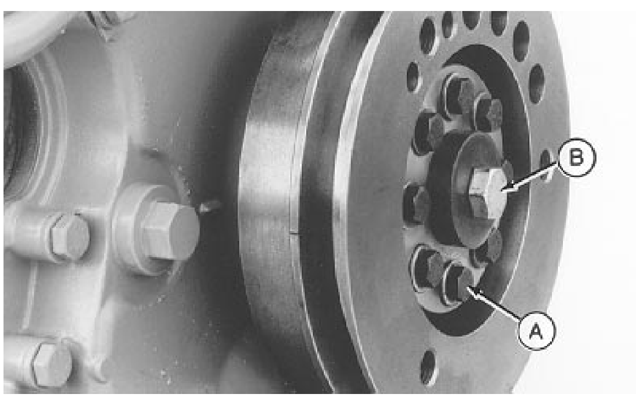


CD30582 –UN–16JUN98

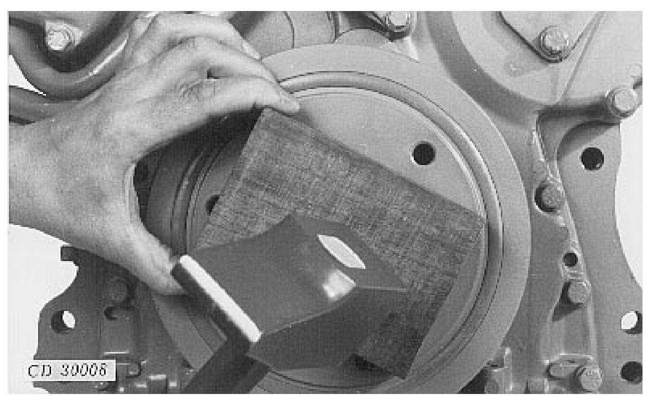
A—Wobble checking with dial indicator
B—Pulley
C—Collet drive
D—Timing gear cover
E—Wear sleeve
F—O'ring
G—Crankshaft
H—Gear
J—Oil deflector
K—Front oil seal

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.

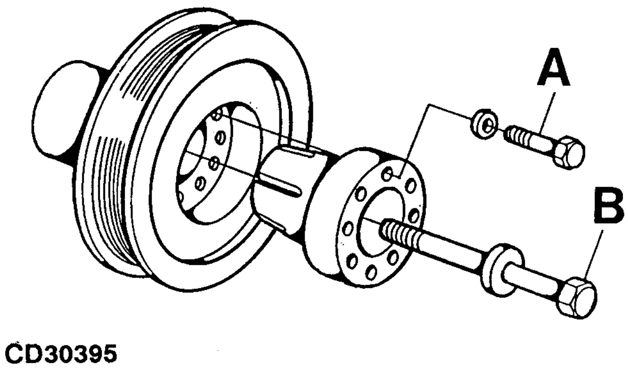
2. Using a wooden block and a hammer, tap on pulley until it loosens from conical seat of collet.

3. Remove collet attaching cap screw (B).

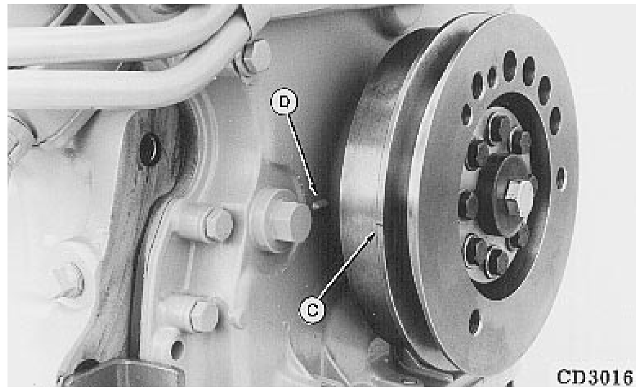
4. Remove collet and pulley.

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.

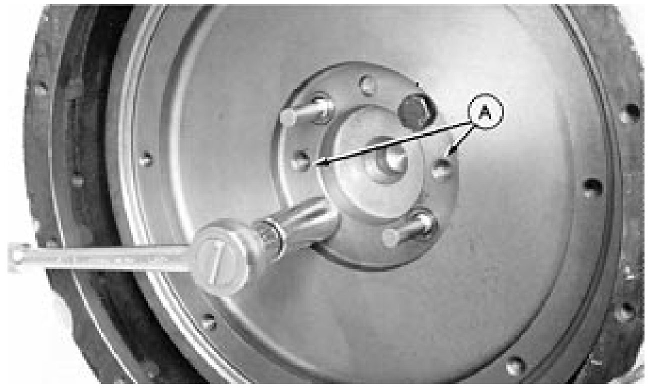
8. Repeat the collet cap screw tightening sequence until all the cap screws have been tightened to the specified torque.

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.

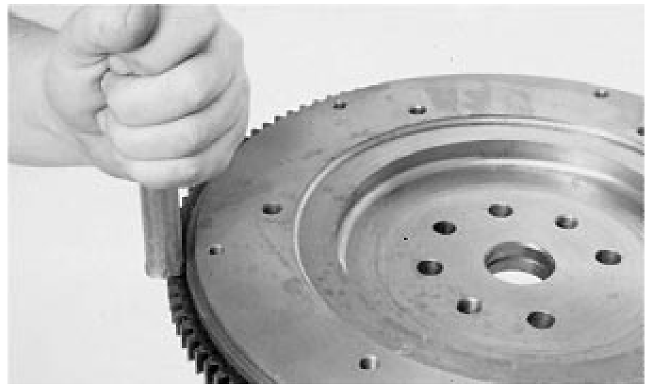
CAUTION: Oil fumes or oil can ignite above 190° C (380°F). When heating ring gear, use a thermometer and do not exceed 180°C (360°F). Heat the oil in a well ventilated area. Plan a safe handling procedure to avoid burns.

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

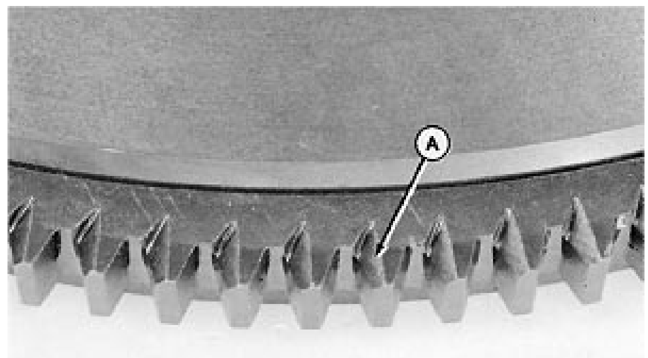
2. Heat new ring gear to 150°C (300°F) using either heated oil, oven heat, or flame heat.

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



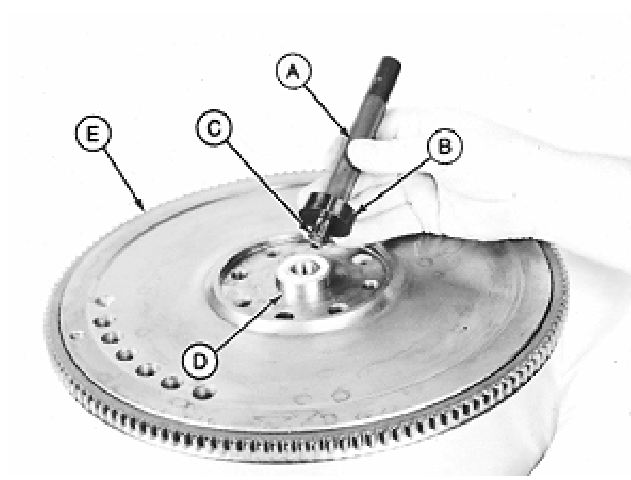
RG3838 –UN–14OCT88

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.



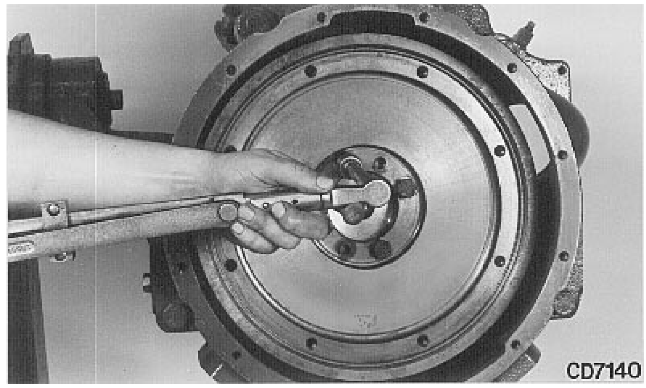
RG6345 –UN–03AUG92

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

CD,CTM125,089 –19–16JAN01–1/1

15
6

Install Flywheel



CD7140 –UN–07MAR95

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.

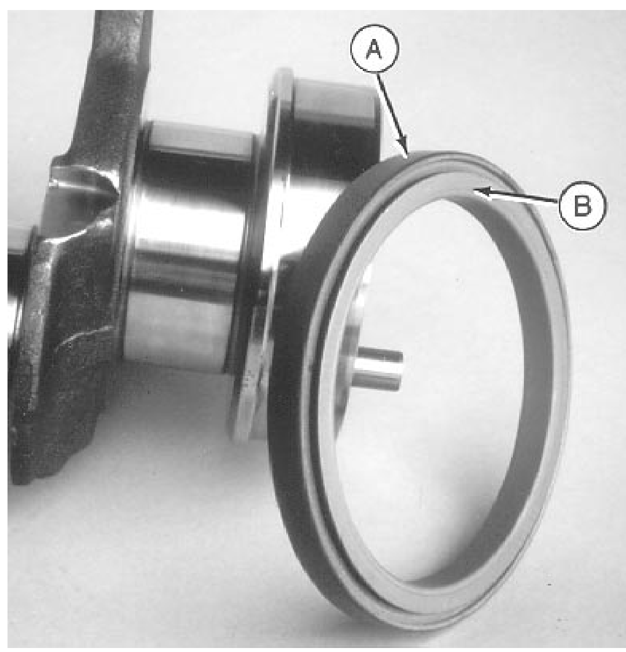
3. Install cap screws and washers if requested, then tighten crosswise to specification.

Specification

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

CD,CTM125,090 –19–16JAN01–1/1

Remove Crankshaft Rear Oil Seal



CD30584 –UN–04MAY98

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.

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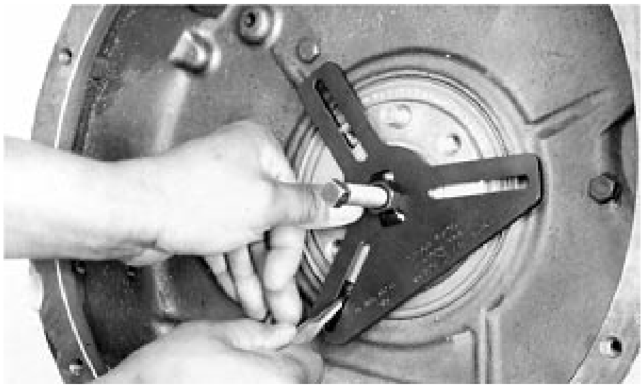
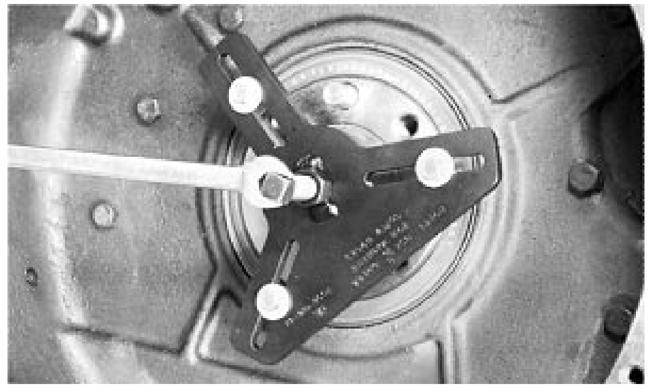
CD,CTM125,094 –19–16JAN01–1/4



RG5638 –UN–02APR90



RG5639 –UN–02APR90

Using JDG698A

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.

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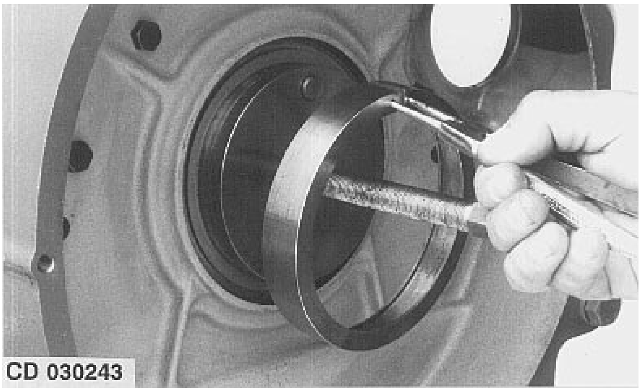
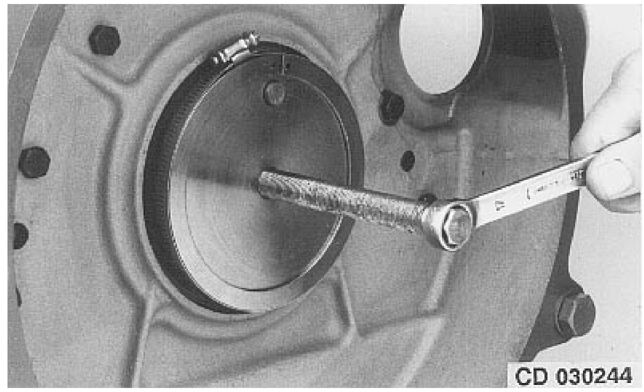
CD,CTM125,094 –19–16JAN01–2/4



CD30243 –UN–06MAR95



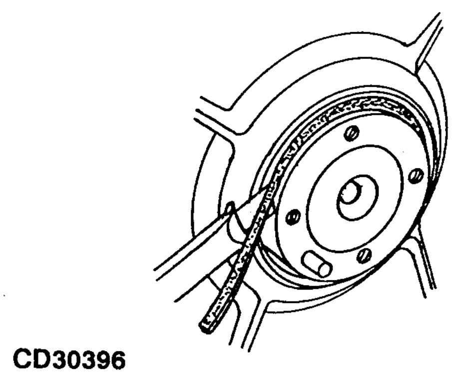
CD30244 –UN–06MAR95

Using JDG645E

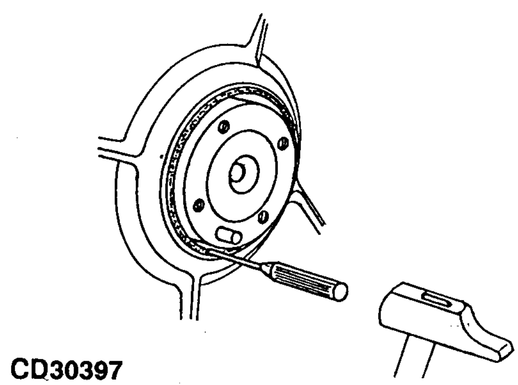
1. Place and center JDG645E cap screws and driver plate assembly onto crankshaft rear face. Then, using snap ring pliers, set the thinner shoulder of ring tool between sleeve flange and seal case.

2. Secure the assembly with a clamp then gradually tighten the screw until wear sleeve is extracted.

CD,CTM125,094 –19–16JAN01–3/4



CD30396 –UN–10MAY95

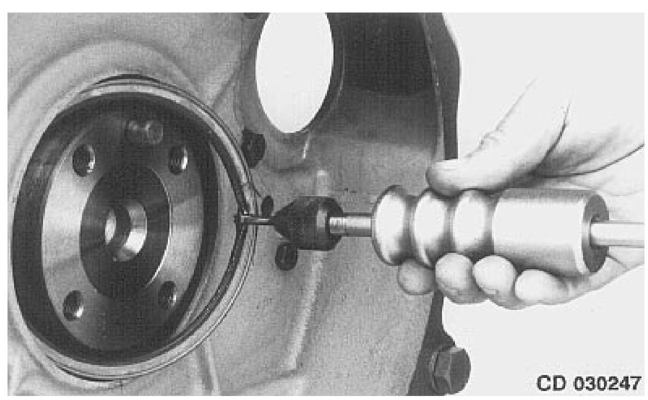


CD30397 –UN–10MAY95

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.

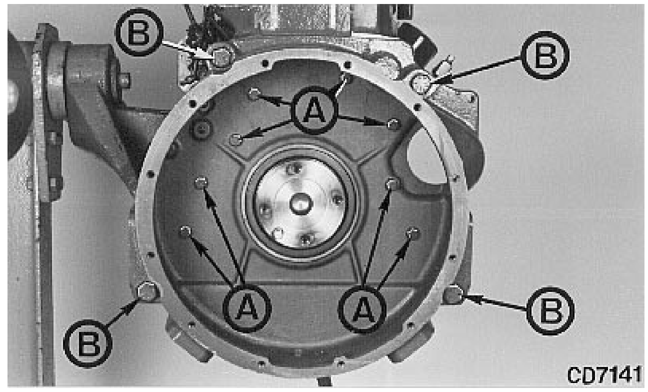
5. Using JDG22 Slide Hammer Puller, extract seal case.



CD30247 –UN–06MAR95

CD,CTM125,094 –19–16JAN01–4/4

Flywheel Housing Replacement



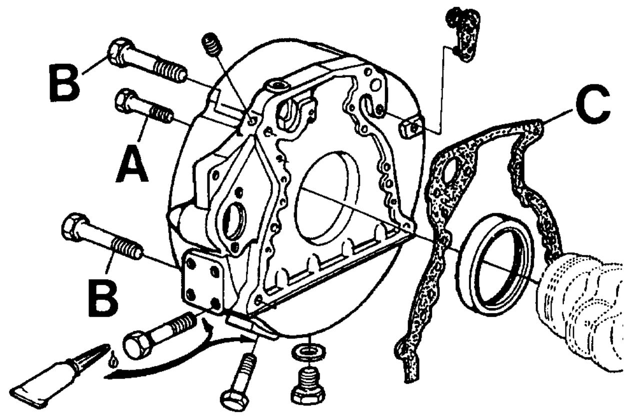
CD7141 –UN–23MAY95

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	
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 application, the open holes need to be obturated. Apply sealing compound on threads of cap screws.



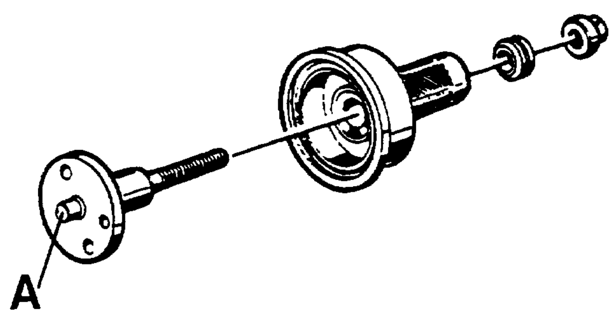
CD30585 –UN–16JUN98

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

CD,CTM125,095 –19–16JAN01–1/1

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 tool. With this modification KCD10002 becomes KCD10002A.



CD30586 –UN–16JUN98

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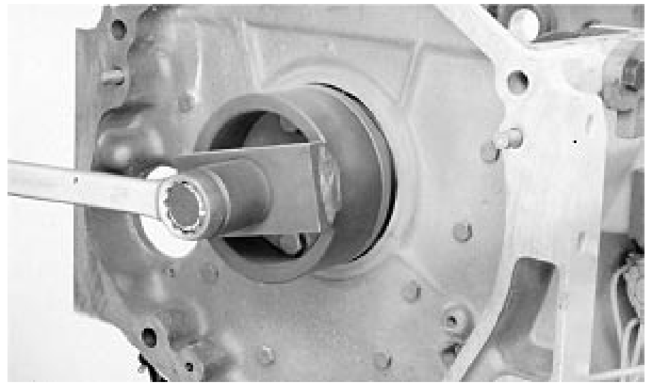
CD,CTM125,097 –19–16JAN01–1/2

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 –19–16JAN01–2/2

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

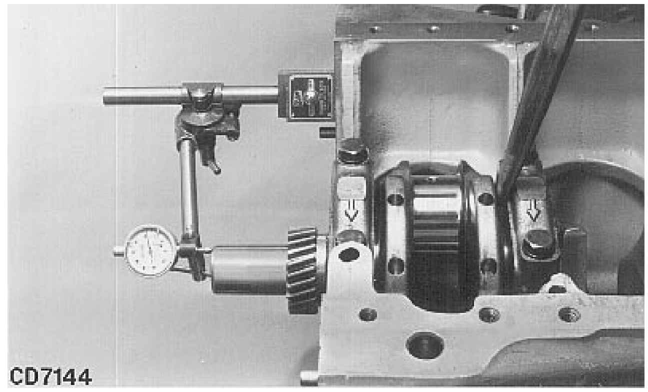
2-piece thrust bearing—End Play	0.13—0.40 mm (0.005—0.016 in.)
Wear tolerance	0.50 mm (0.02 in.)
5/6-piece thrust bearing—End Play	0.03—0.35 mm (0.001—0.014 in.)
Wear tolerance	0.50 mm (0.02 in.)

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.

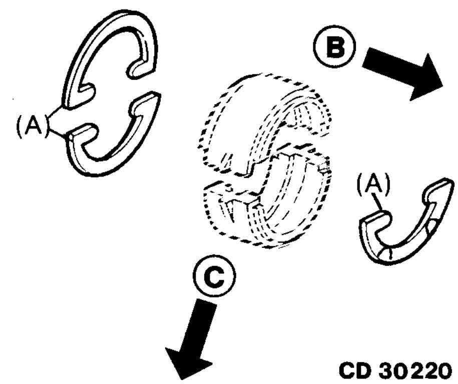
Specification

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

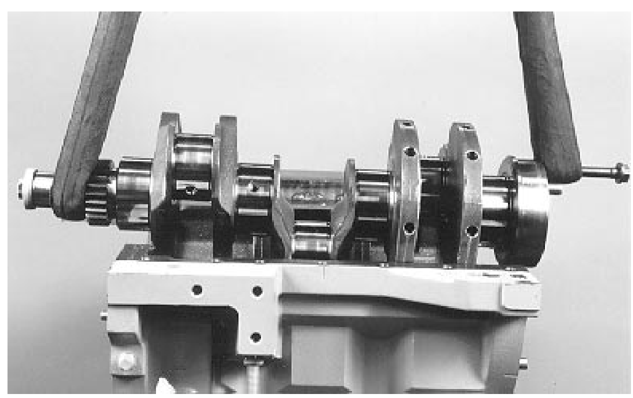
CD,CTM125,098 –19–16JAN01–1/1

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

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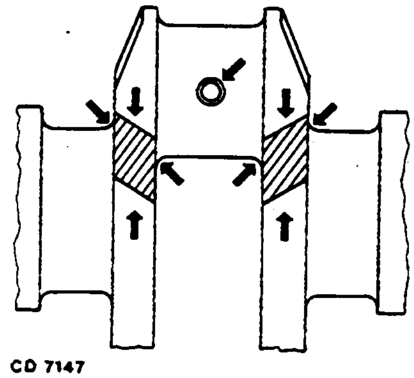
Crankshaft Inspection



CD7147 –UN–23FEB89

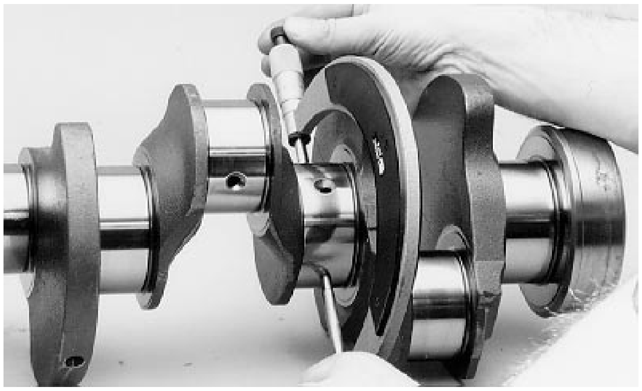
1. Clean crankshaft thoroughly, especially oil passages from crankshaft bearings to connecting rod bearings.

2. Check crankshaft for cracks or signs of load stress (see illustration for critical areas of load stress in a crankshaft).

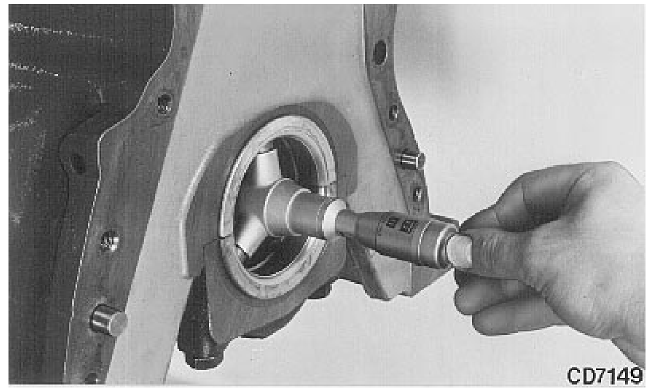
3. Inspect both shoulders of thrust bearing journal for scores or unevenness.

CD,3274,G15,19 –19–01MAR92–1/1

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

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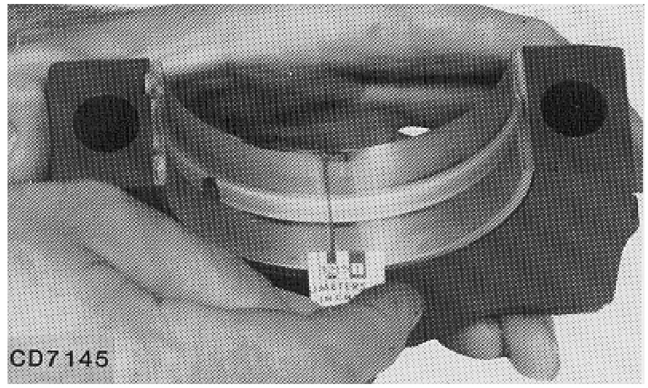
Determine Crankshaft Main Bearing Clearance Using PLASTIGAGE®

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).



CD7145 –UN–23MAY95

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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.

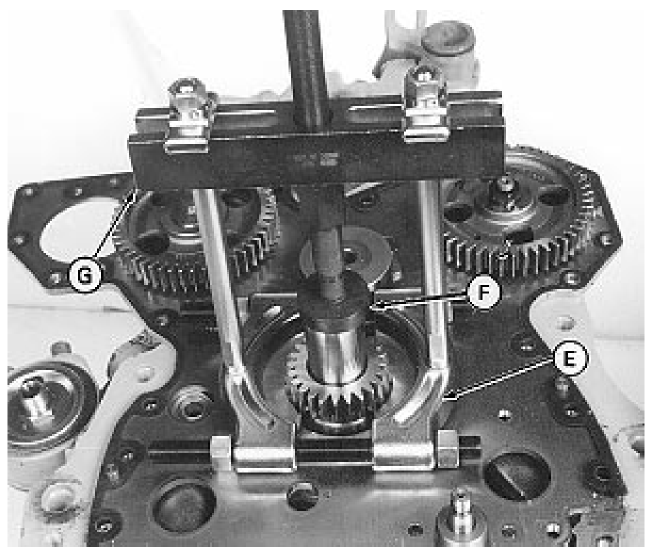
1. Pull gear using D01200AA Push Puller and D01218AA Pulling Attachment or any other suitable puller.

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).



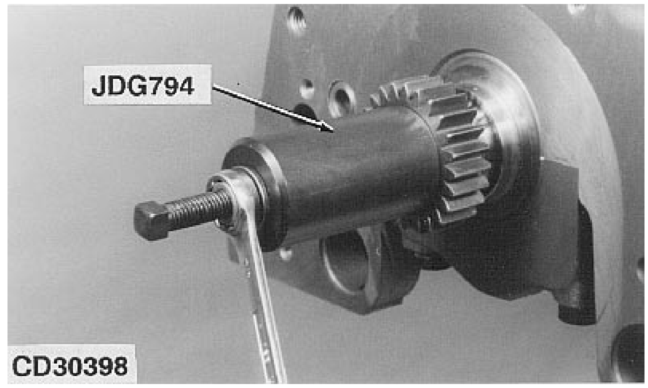
RG7238 –UN–10OCT94

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

Continued on next page

CD,CTM125,104 –19–16JAN01–1/2

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



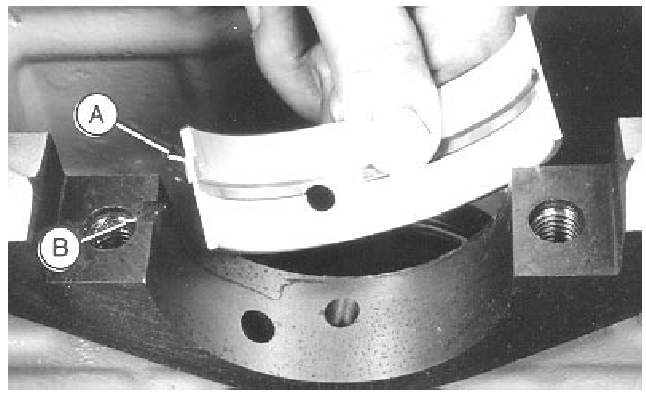
CD30398 –UN–10MAY95

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

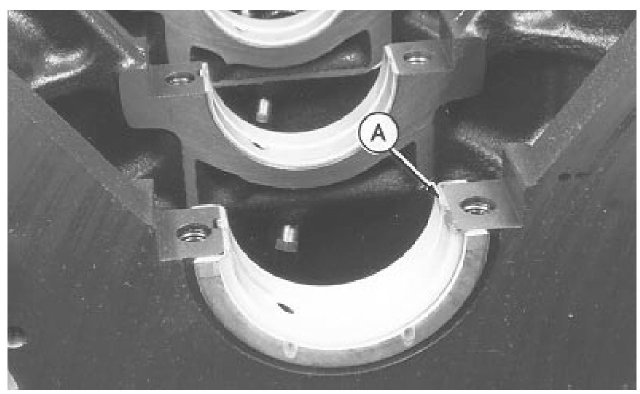


CD30589 –UN–19MAY98

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.



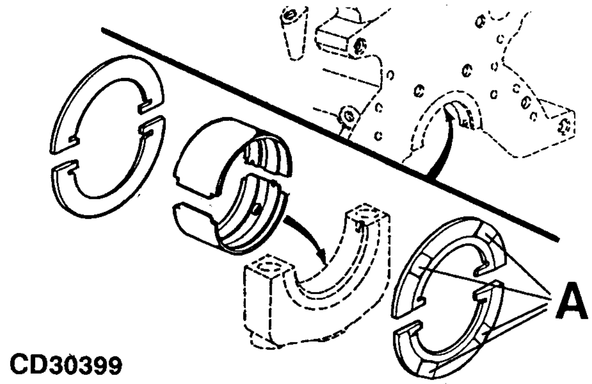
CD30590 –UN–04MAY98

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.

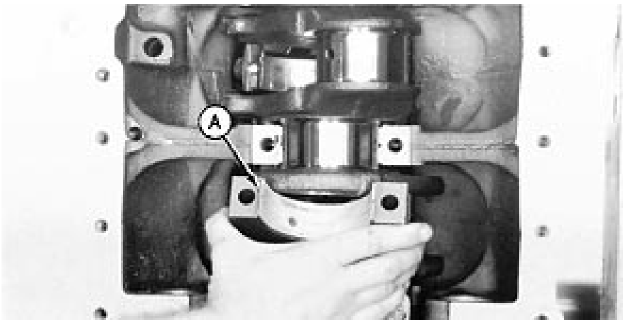


CD30399 –UN–10MAY95

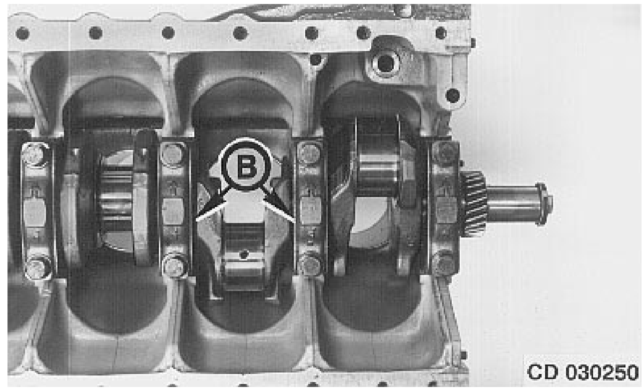
A—Oil grooves

CD,CTM125,107 –19–01DEC97–1/1

Crankshaft Installation



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 all main bearing cap screws in clean engine oil and position them with washers in the bearing caps.

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.

4. Apply a first torque not exceeding 20 N•m (14 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.

IMPORTANT: Before tightening rear cap screws, ensure that rear thrust washer of cap is aligned with rear thrust washer of block.

6. Tighten all cap screws to specification.

Specification

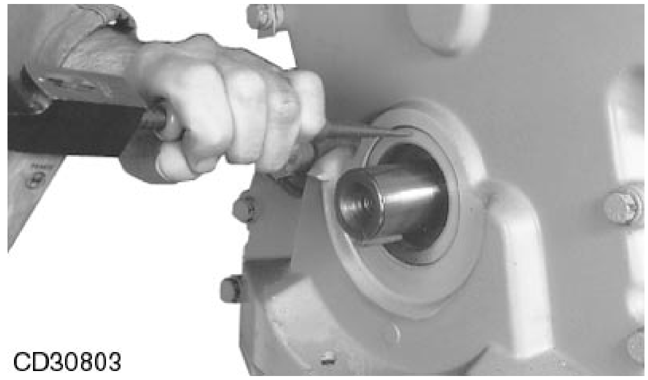
Crankshaft main bearing bolt—
Torque.. 135 N•m (100 lb-ft)

7. Check for free rotation and end play of the crankshaft.

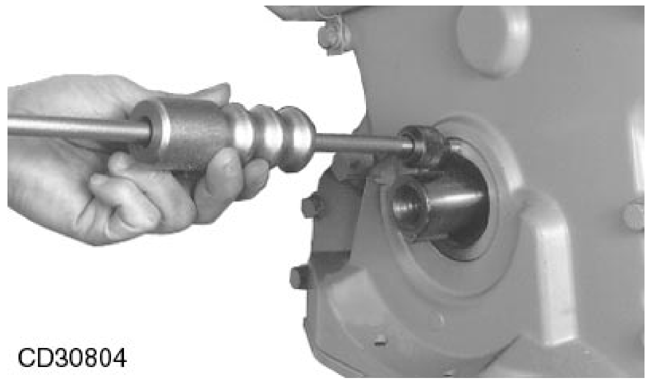
CD,CTM125,108 –19–16JAN01–1/1

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

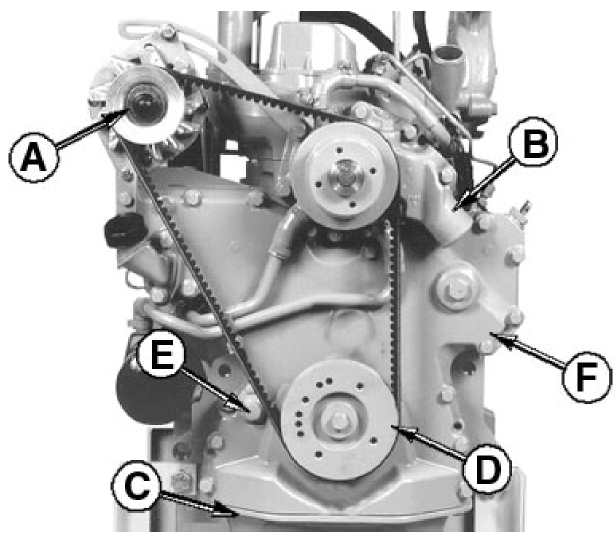


CD30804 –UN–17APR01

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

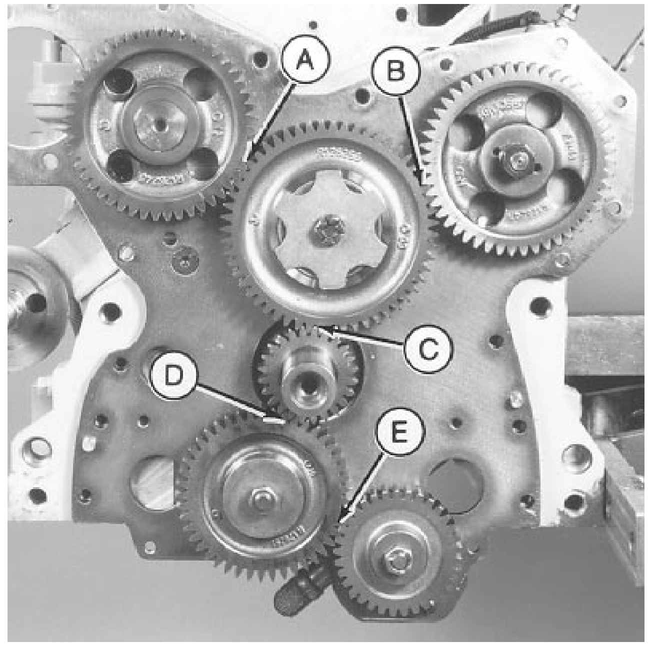
Measure backlash between gears using a dial indicator and compare with specifications.

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.)



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

Continued on next page

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.)

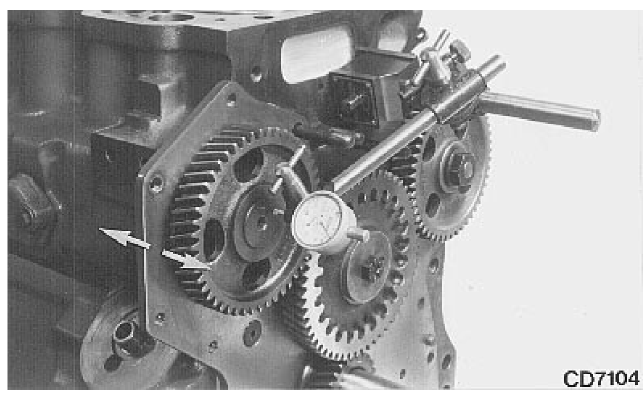
Lower idler/oil pump gear—
Backlash .... 0.01—0.49 mm (0.0004—0.019 in.)

Camshaft/aux. drive gear—
Backlash .... 0.01—0.54 mm (0.0004—0.021 in.)

If backlash is not correct, install new gears.

CD,CTM125,112 –19–17JAN01–2/2

Camshaft End Play Measure



CD7104 –UN–07MAR95

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.

CD,3274,G20,6 –19–17JAN01–1/1

Remove Camshaft

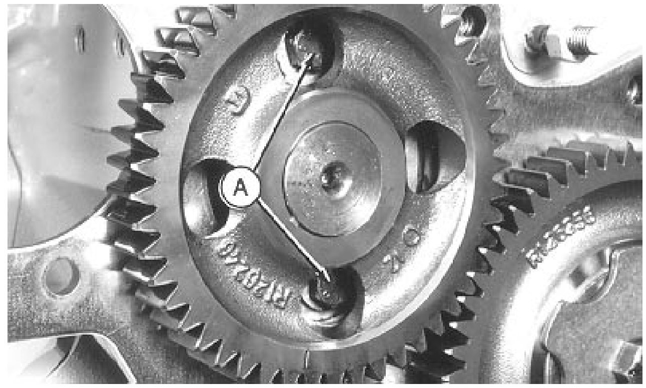
NOTE: Mark parts so that they can be reinstalled in their original positions.

1. Remove cylinder head, cam followers and fuel pump.

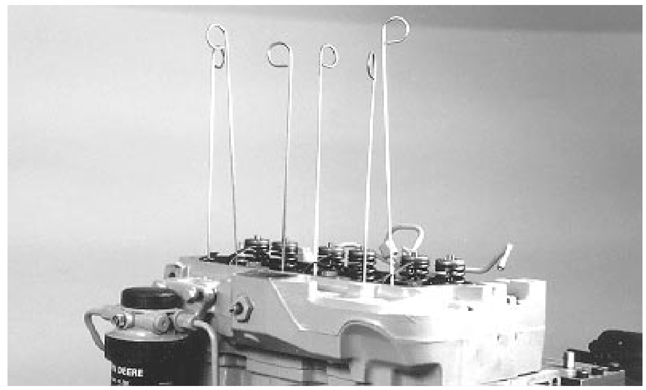
2. Remove cap screws (A) and pull camshaft straight out.

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

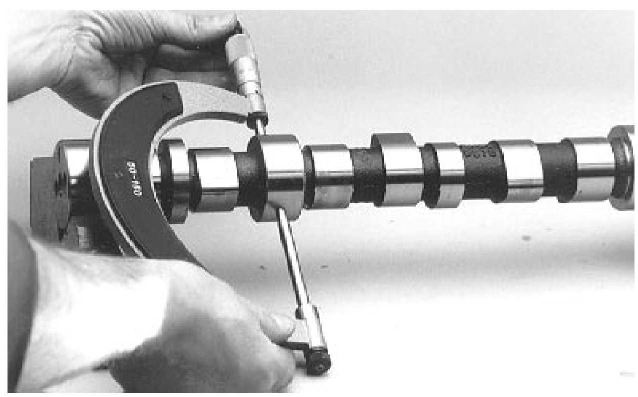
CD,CTM125,113 –19–01DEC97–1/1

Measure Camshaft Journal

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.

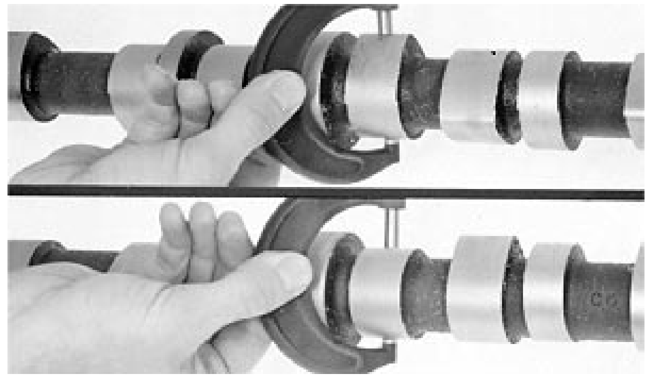


CD30594 –UN–04MAY98

CD,CTM125,114 –19–17JAN01–1/1

Measure Height of Cam Lobe

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.



T81262 –UN–01NOV88

Specification

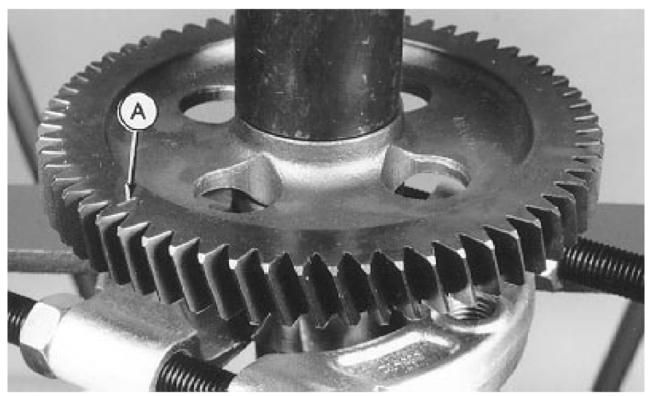
Camshaft Intake Lobe—Height	6.93—7.42 mm (0.273—0.292 in.)
Maximum wear	6.68 mm (0.263 in.)
Camshaft Exhaust Lobe—Height	6.76—7.26 mm (0.266—0.286 in.)
Maximum wear	6.50 mm (0.256 in.)

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

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.

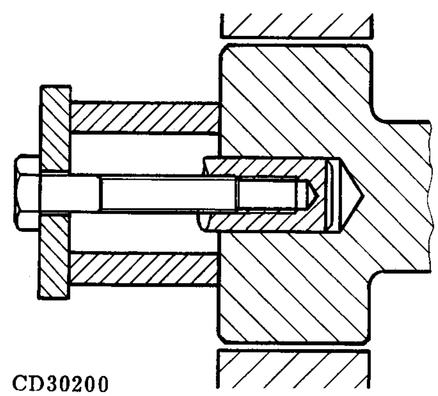


CD30595 –UN–19MAY98

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

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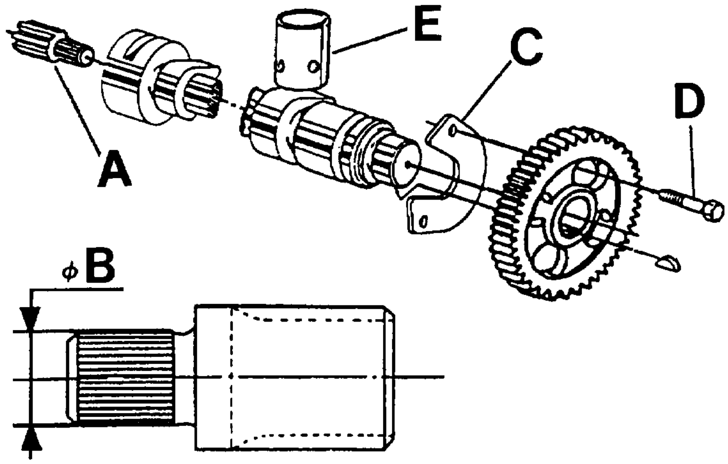
6

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


RG6324 –UN–23NOV97

Measure cam follower diameter and compare with specification.

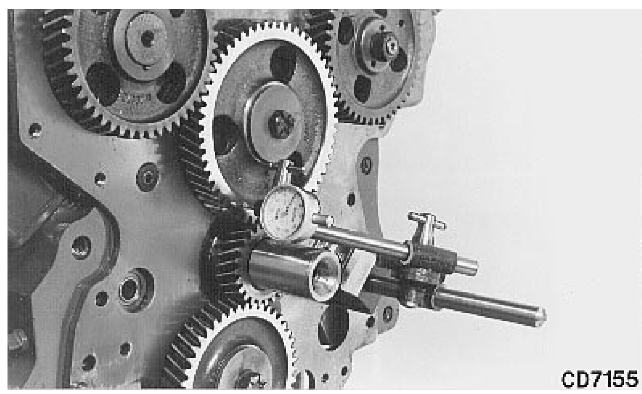
Specification

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.

CD,CTM125,117 –19–17JAN01–1/1

Idler Gear End Play Measure



CD7155 –UN–23MAY95

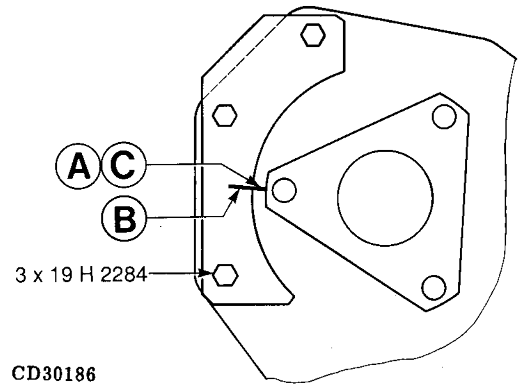
Using a dial indicator, check end play of upper and lower idler gears.

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.)

CD,3274,G20,20 –19–17JAN01–1/1

Remove Front Plate



CD30186 –UN–07MAR95

1. Proceed as follows in case of front plate replacement:

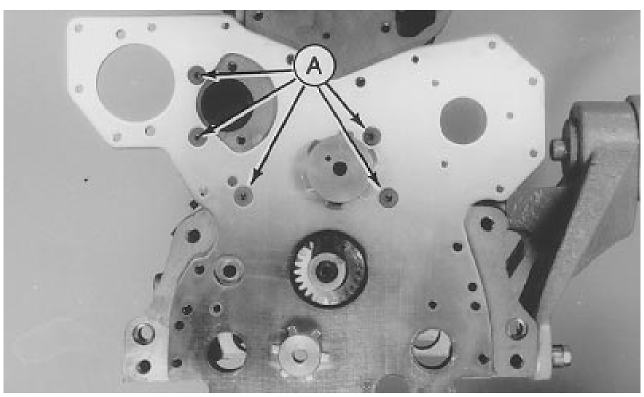
IMPORTANT: Replacement front plates do not have any injection pump timing marks. It is extremely important that the timing be accurately transferred from original front plate to the replacement plate in the exact location for proper injection pump timing.

   a. Build an aluminum template as shown under "Self-manufactured tool".

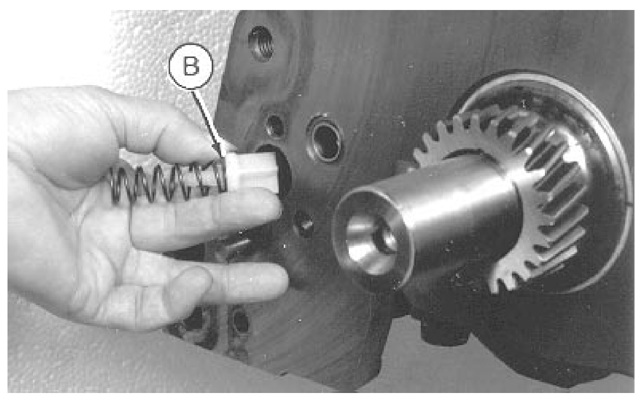
   b. Attach template to previous front plate using three 3/8 in. cap screws and transfer timing mark from previous front plate (A) to template (B) with a pencil.

   c. Attach template to new front plate and transfer timing mark to the new front plate (C) using a scriber.

CD,CTM125,118 –19–17JAN01–1/2



CD30597 –UN–19MAY98



CD30598 –UN–04MAY98

2. Remove upper and lower idler gears.

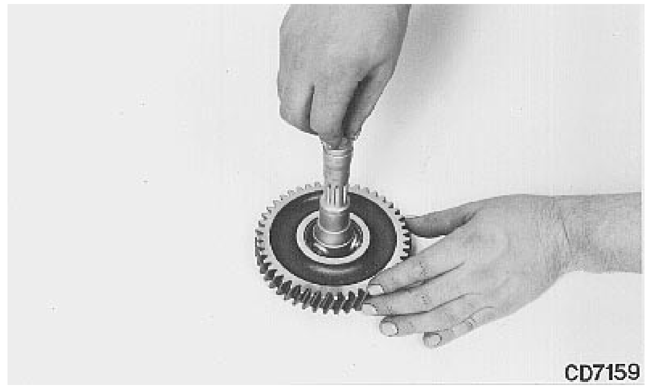
3. Remove camshaft, fuel injection pump and oil pump.

4. Remove countersunk screws (A) and lift off front plate.

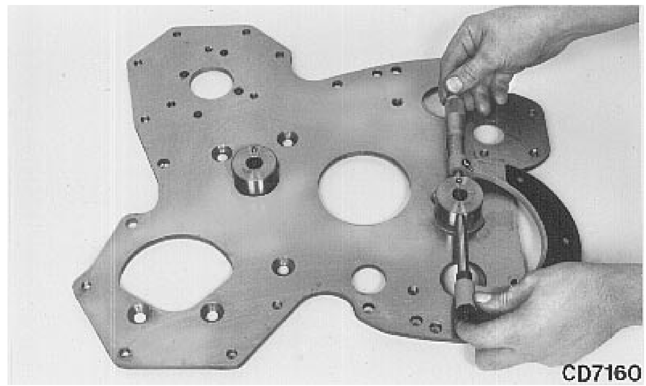
5. Remove oil by-pass valve and spring (B).

CD,CTM125,118 –19–17JAN01–2/2

Idler Gear Bushing and Shaft Measure



CD7159 –UN–07MAR95



CD7160 –UN–07MAR95

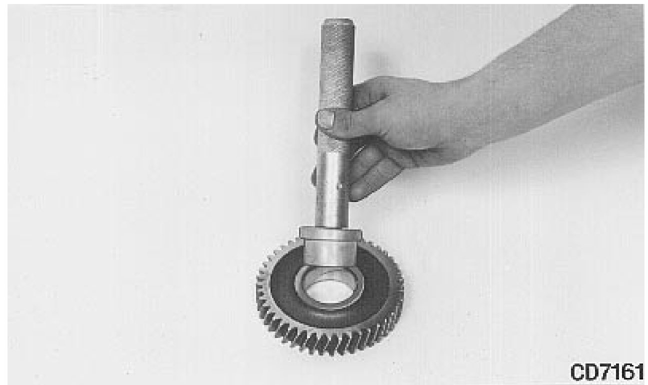
Specification

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.)

If clearance is more than specified, replace worn parts with new ones.

CD,3274,G20,22 –19–01FEB94–1/1

Idler Gear Bushing Replacement



CD7161 –UN–07MAR95

NOTE: Bushing for spur upper idler gear is not available separately. Install a new idler gear/bushing assembly.

1. Press worn idler gear bushing out of gear.

IMPORTANT: The upper and lower idler gears require different bushings.

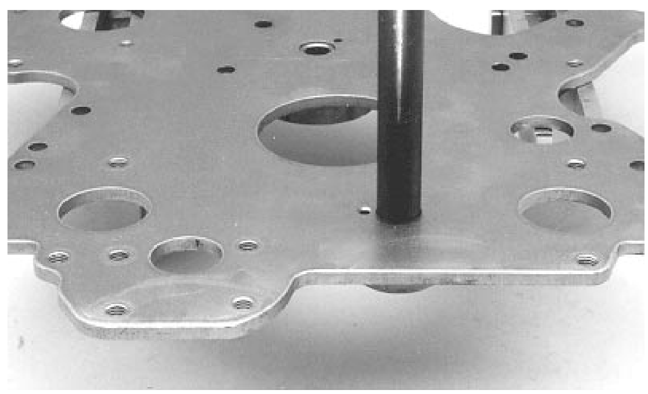
UPPER IDLER GEAR: Being pressure lubricated, this gear is specified with a smooth-bore bushing.

LOWER IDLER GEAR: Being splash lubricated, this gear is specified with a lube-groove fitted bushing.

2. Press in new bushing with JD-252 Driver and JDG537 Handle so that it is flush with one side of the gear.

CD,3274,G20,23 –19–17JAN01–1/1

Remove Idler Shaft

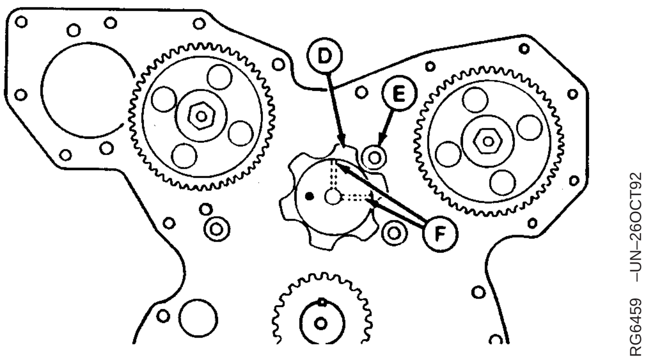


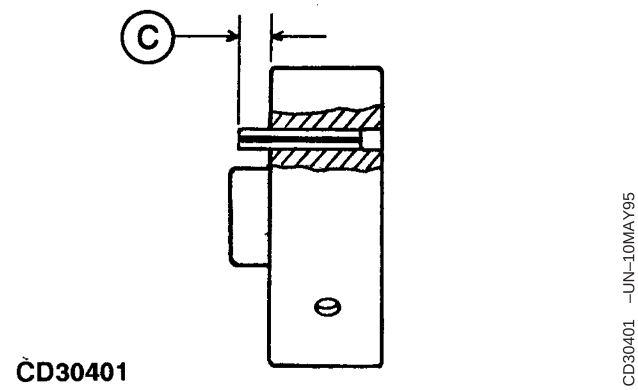
CD30599 –UN–04MAY98

Remove upper or lower idler shaft by driving shaft out of the front plate. Remove thrust washer.

CD,CTM125,119 –19–01DEC97–1/1

Install Idler Shaft Spring Pin





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).

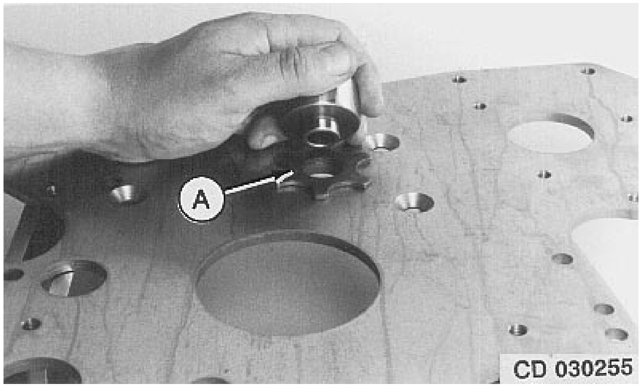
Press spring pin until protrusion (C) is obtained.

Specification

Upper shaft spring pin (spur gear)—Protrusion (C) .... 7.5—8.5 mm (0.295—0.335 in.)

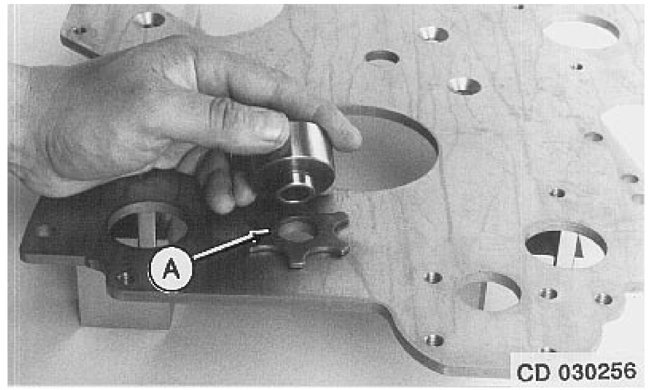
CD,CTM125,132 –19–17JAN01–1/1

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.

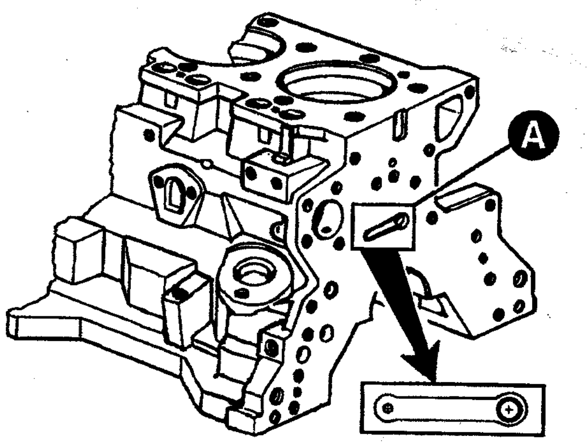
2. Place idler shaft in front plate bore with oil hole oriented between 10 and 11 o’clock position. On engine with auxiliary drive, make sure that spring pin of upper shaft is in line with thrust washer and front plate holes.

3. Press shaft into front plate until thrust washer is fully seated.

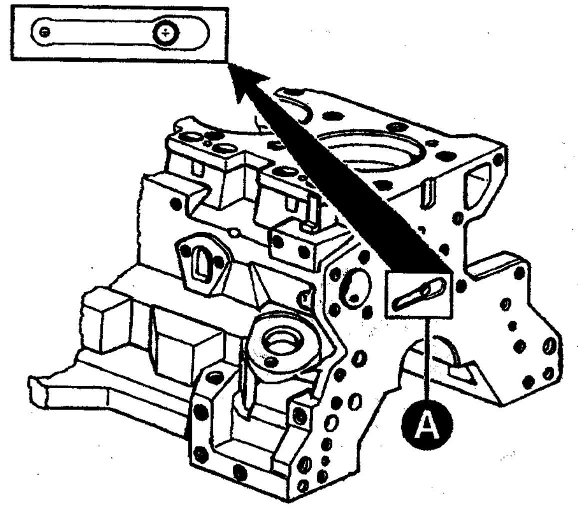
NOTE: Idler shaft is secured to front plate when gear bolt or nut are tightened.

CD,CTM125,133 –19–01DEC97–1/1

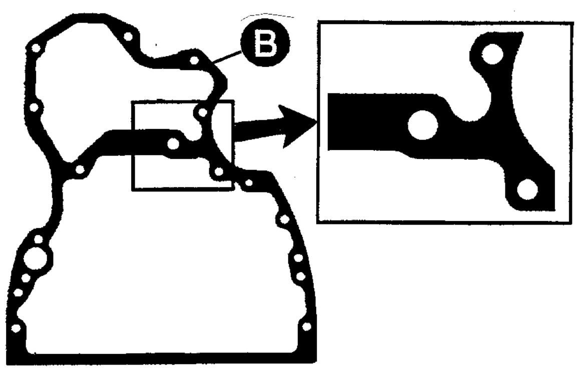
Front Plate Gasket



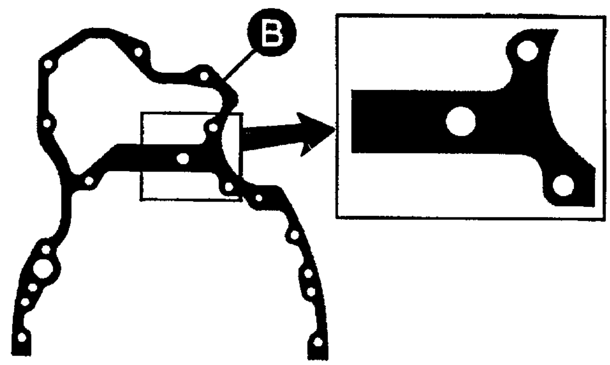
Earlier engines (-291260CD)



Later engines (291261CD-)



Gasket for engines (-291260CD)



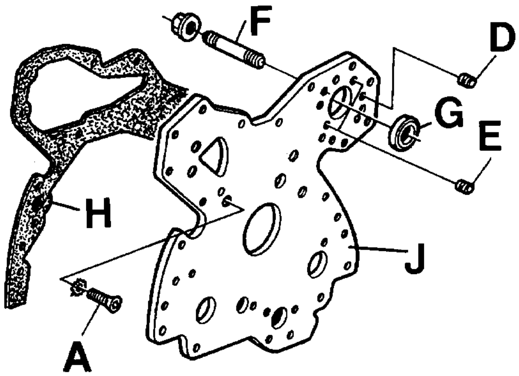
Gasket for ALL engines

The shape of the oil groove casting (A) used to lubricate the upper idler gear has been modified from engine serial number (291261CD-).

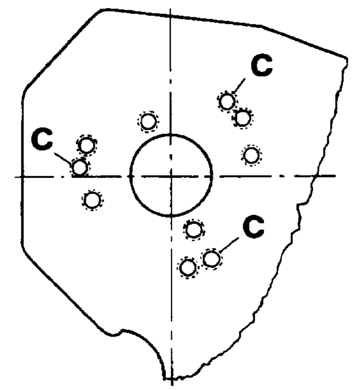
The front plate gasket designed for the new oil groove shape can be used on cylinder blocks with previous oil groove design while previous gasket cannot match the new cylinder block design.

CD03523,00000F9 –19–17JAN01–1/1

Install Front Plate



CD30600 –UN–16JUN98



CD30695 –UN–16JUN98

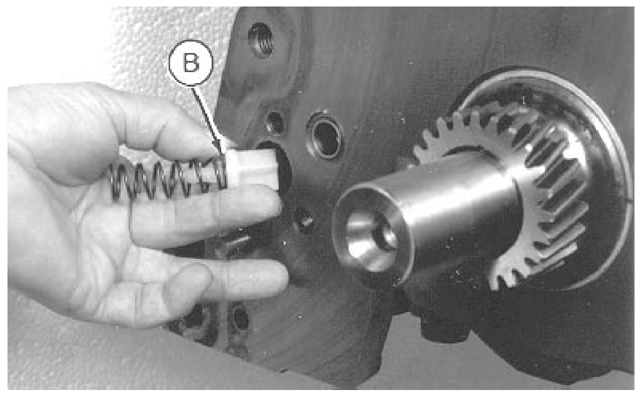
1. Install injection pump stud (F) on front plate using Loctite 271.

NOTE: Standard front plate (without auxiliary drive extension) have several injection pump stud locations. Use holes marked (C).

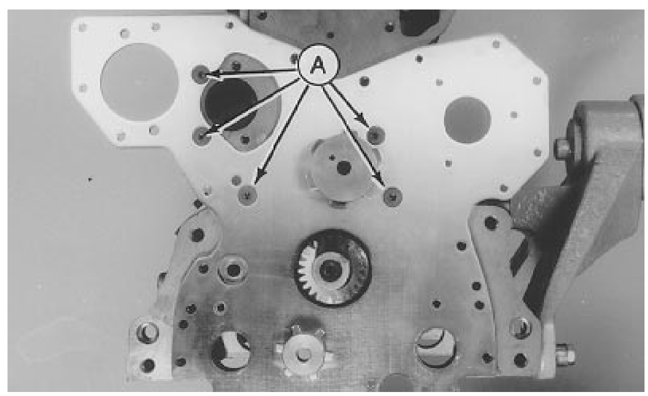
2. ON standard front plate only, install the 5/16“ plugs (D) and the 3/8” plugs (E) as shown. Bushing (G) is not required for this application.

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

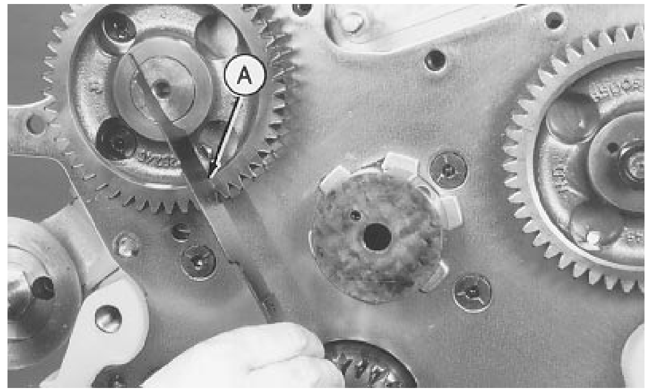
Specification

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

Install Upper Timing Gear Train



CD30601 –UN–19MAY98

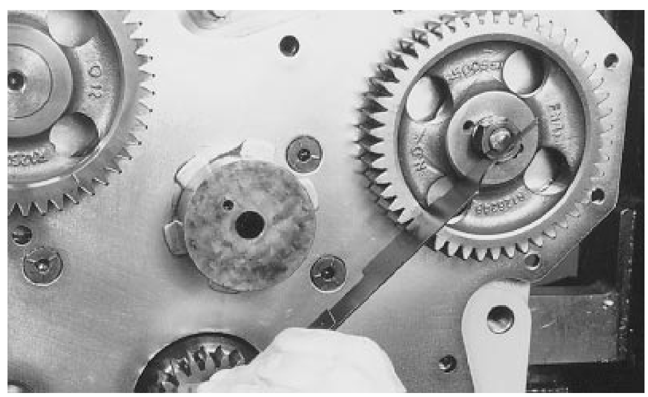
1. Adjust No. 1 piston to TDC using JDE83 or JDG820 (formerly JDE81-1) Flywheel Turning Tool and JDE81-4 Timing Pin.

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 JD-254A Timing Tool on crankshaft nose and directed toward center of camshaft, turn camshaft until gear timing mark (A) aligns with timing tool.

CD,CTM125,123 –19–01DEC97–1/3



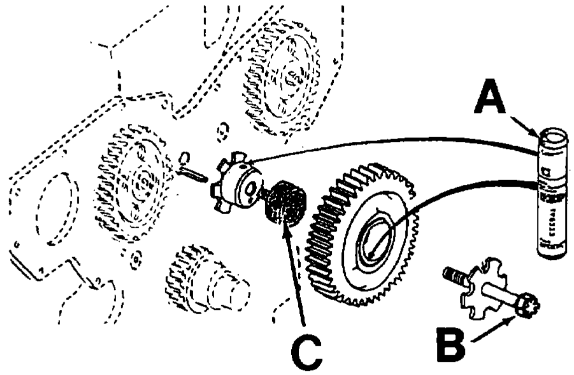
CD30602 –UN–19MAY98

3. Install fuel injection pump.

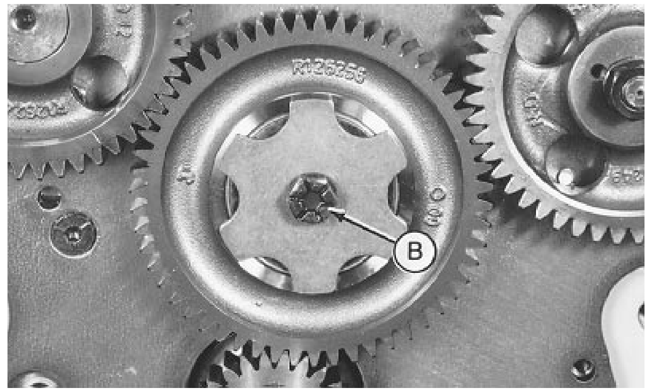
4. Using JD-254A Timing Tool, align the timing mark “3” (for 3 cyl. engines) with the timing tool.

Continued on next page

CD,CTM125,123 –19–01DEC97–2/3



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.

7. Install washer, with sharp edge toward timing cover, and bolt (B) then tighten to specification.

Specification

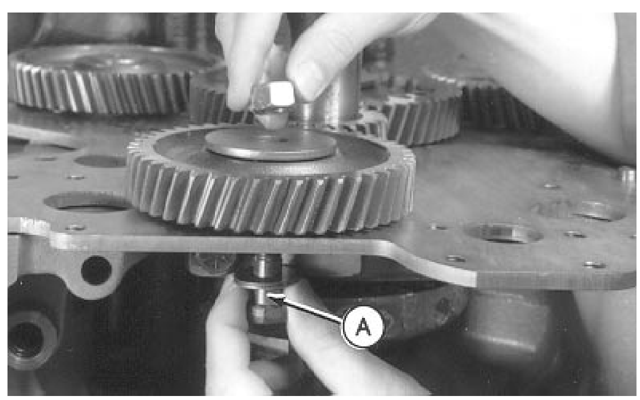
Upper idler gear cap screw—
Torque.. 110 N•m (80 lb-ft).

8. Recheck gear timing to make sure it is correct.

[1]*Available as service part.*

CD,CTM125,123 –19–01DEC97–3/3

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.

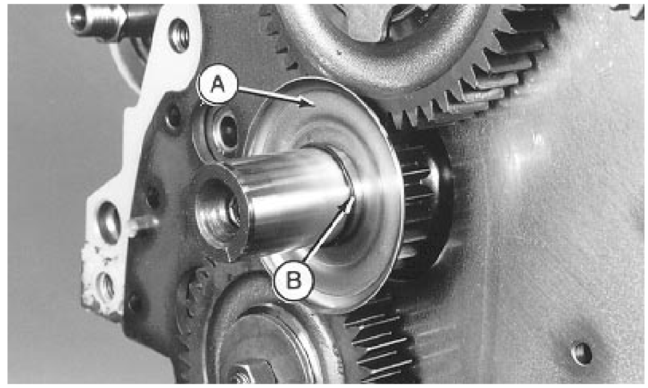
Specification

Oil pump drive gear nut—Torque .... 75 N•m (55 lb-ft)

CD,CTM125,124 –19–17JAN01–1/1

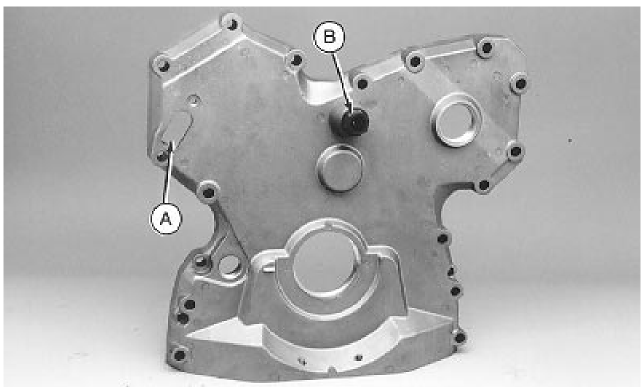
Install Oil Deflector

Install oil deflector (A) and O-ring (B) when equipped, on crankshaft nose.

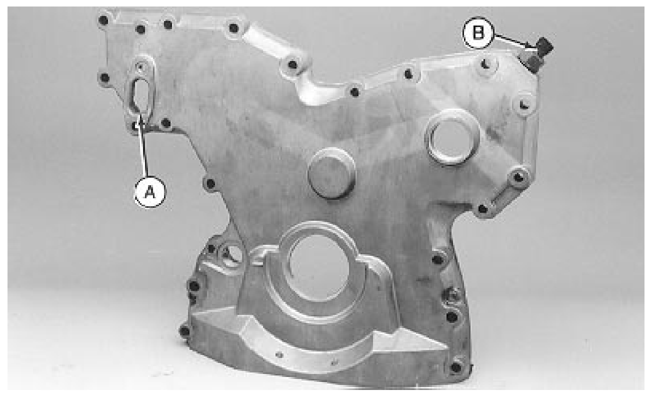


CD,CTM125,126 –19–01DEC97–1/1

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

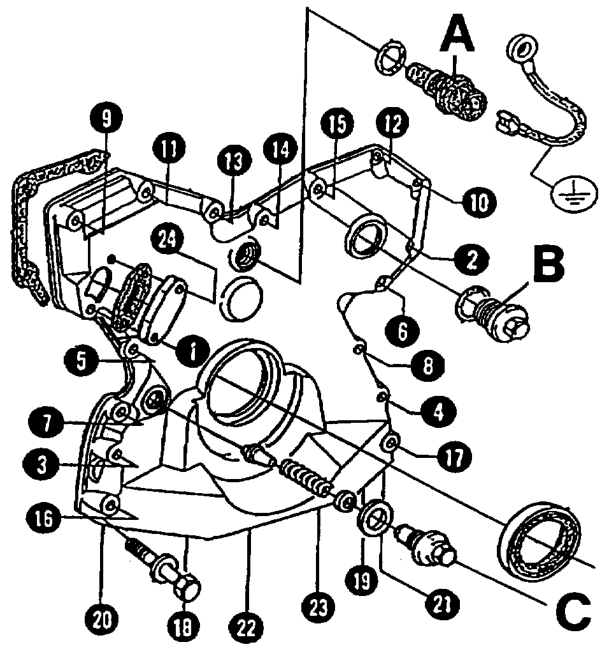
Install Timing Gear Cover

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	30 N•m (22 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)



CD30609 –UN–16JUN98

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

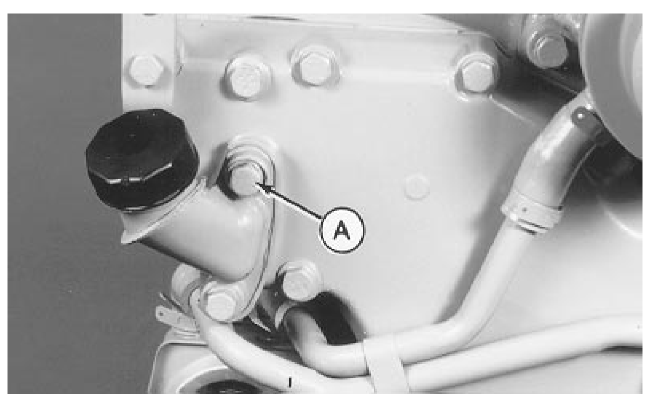
CD,CTM125,128 –19–17JAN01–1/2

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)

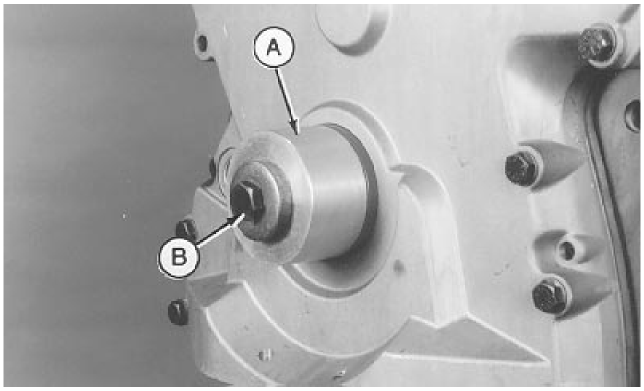
4. Cut off protruding edge of gasket.



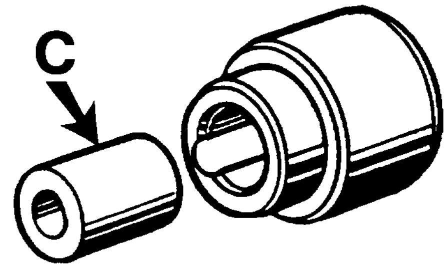
CD30610 –UN–04MAY98

CD,CTM125,128 –19–17JAN01–2/2

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.

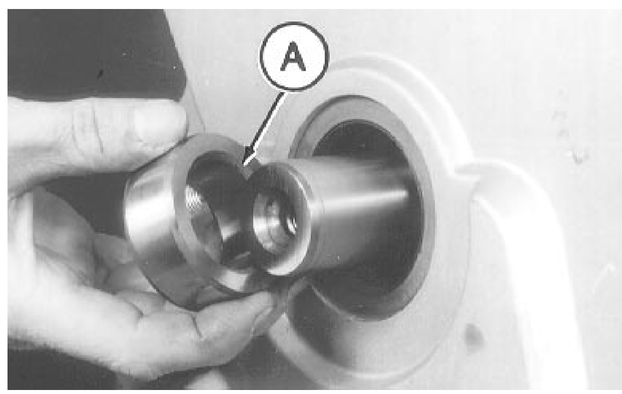
NOTE: KJD10164 tool set contains also a spacer (C) to be used only on old applications with short nose crankshaft (35 mm length).

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.

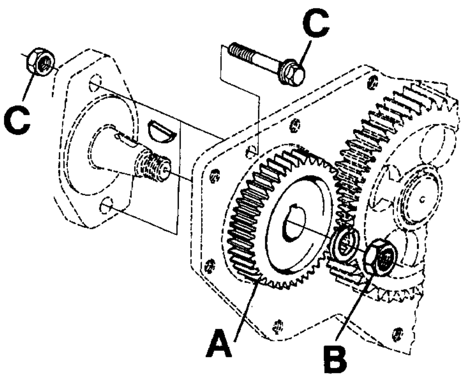


CD30612 –UN–04MAY98

CD,CTM125,130 –19–01DEC97–1/1

20
20

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).

3. Tighten the two fastening cap screws or nuts (C) to specification.

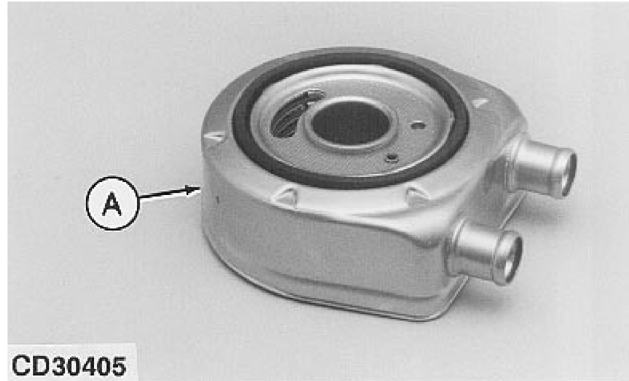
Auxiliary Equipment driven by camshaft gear —Specification

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 –19–17JAN01–1/1

Oil Cooler Identification

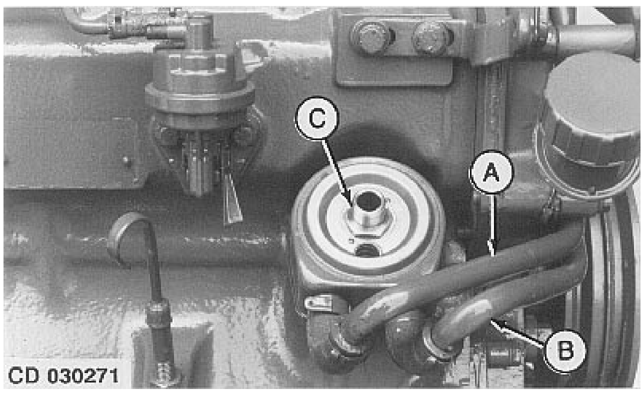
The 6-plates oil cooler (A) is clamped between oil filter and cylinder block or adaptation housing.



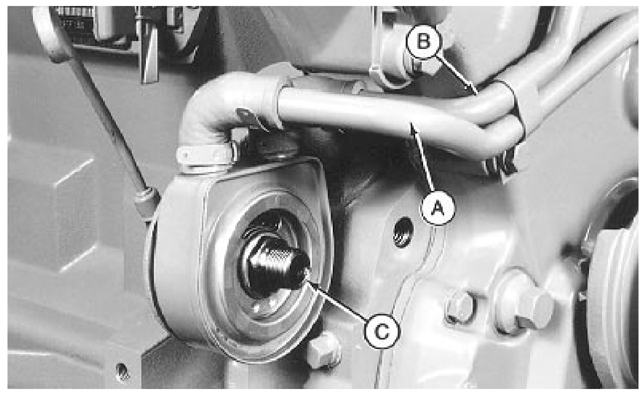
CD30405 –UN–10MAY95

CD,CTM125,152 –19–01DEC97–1/1

Remove Oil Cooler

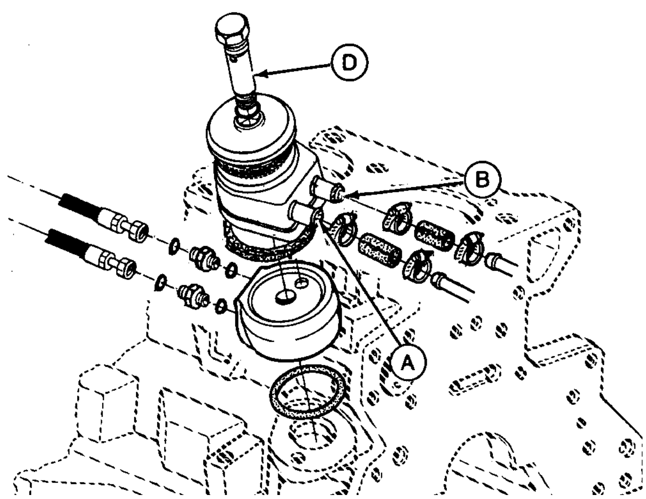


CD30271 –UN–06MAR95



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.



CD30616 –UN–24JUN98

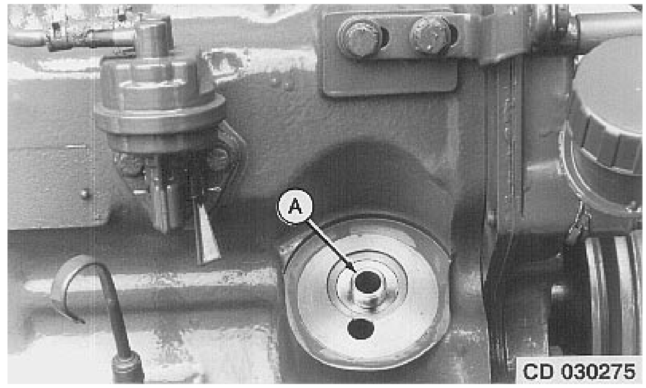
A—Inlet line from water pump
B—Outlet line to water pump
C—Nipple
D—Holding screw

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.

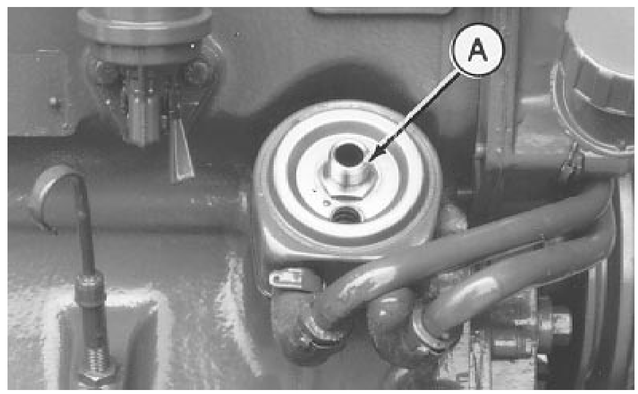
2. Attach oil cooler with nipple (A). Tighten to specification.

Specification

Oil cooler nipple—Torque .... 35 N•m (25 lb-ft)

3. Connect coolant lines to oil cooler.

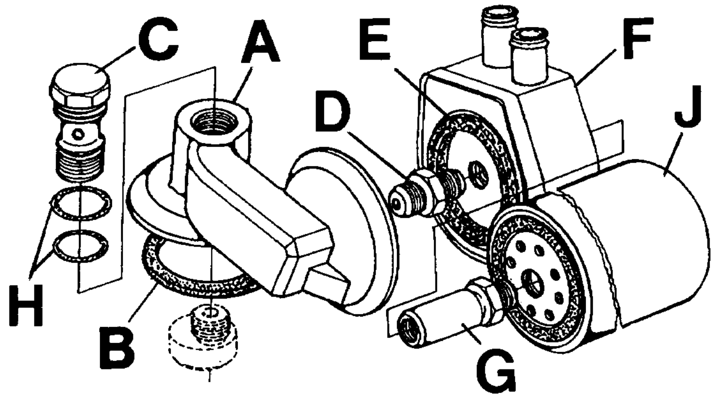
4. Install oil filter.



CD30617 –UN–04MAY98

CD,CTM125,139 –19–24JAN01–1/1

Replace Oil Cooler/Filter Bracket on Engine with Auxiliary Drive



CD30618 –UN–16JUN98

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

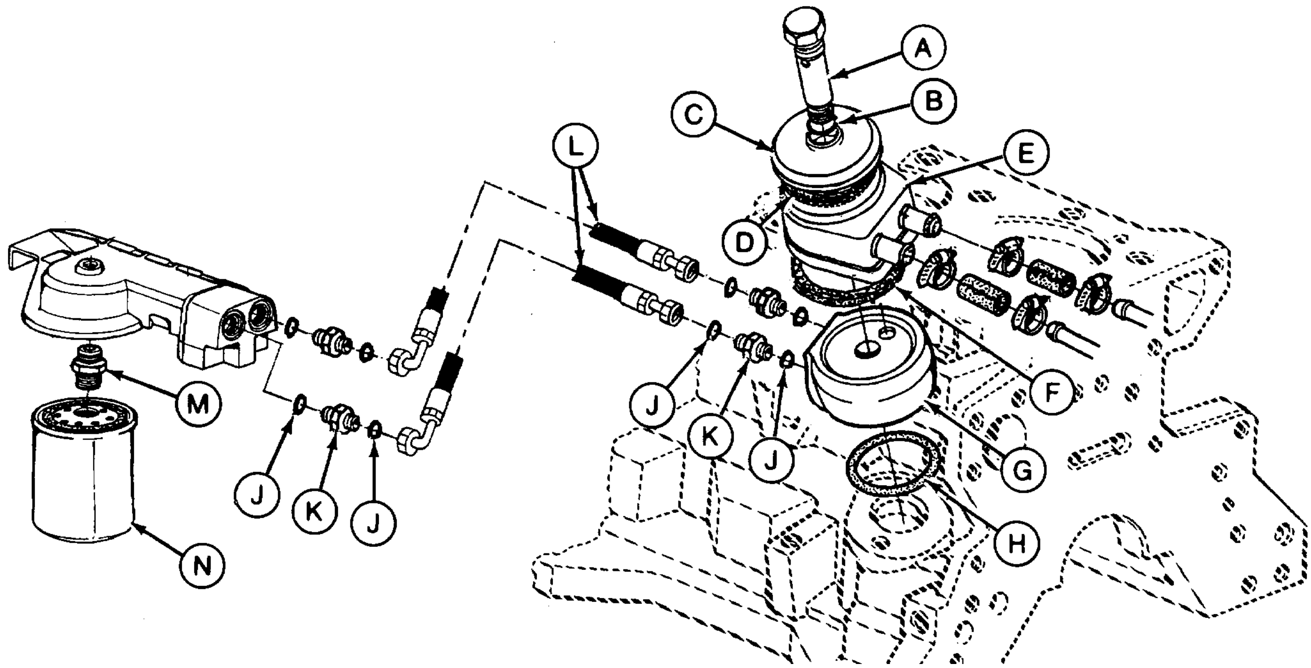
1. Remove oil cooler/filter bracket (A).
2. Clean and check parts.
3. Install bracket (A) with a new packing (B). Tighten holding screw (C) to specification.
4. Install fitting (D) onto bracket. Tighten to specification.
5. Install a new packing (E) between oil cooler (F) and bracket.
6. Attach oil cooler 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



CD30619 –UN–24JUN98

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.

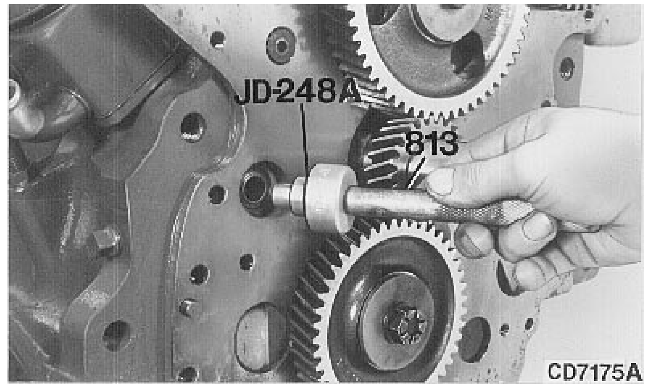
Specification

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.)

CD30620 –UN–04MAY98

CD,CTM125,142 –19–24JAN01–1/1

Replace Oil Pressure Regulating Valve Seat



CD7175A –UN–07MAR95

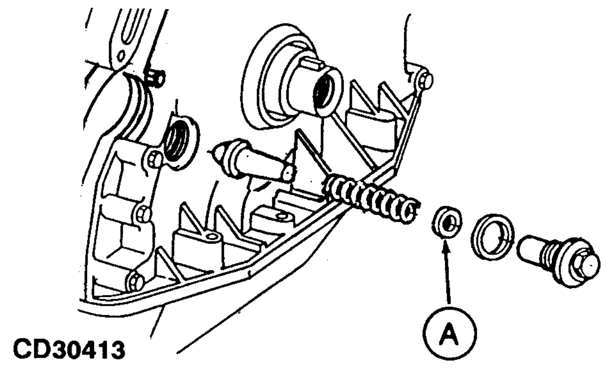
1. Remove valve seat bushing, using a suitable puller.

2. Drive in new bushing, using special tools JD-248A 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.

CD,CTM125,143 –19–24JAN01–1/1

Install Oil Pressure Regulating Valve



CD30413 –UN–10MAY95

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)

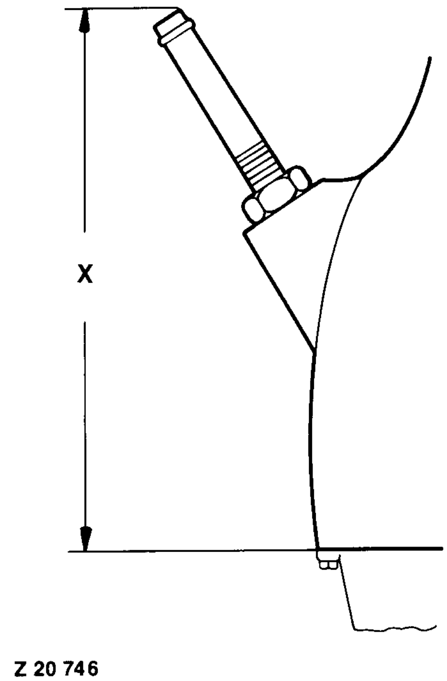
CD,CTM125,144 –19–24JAN01–1/1

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

1. Remove timing gear cover and front plate.

2. Remove oil by-pass valve and spring (A). Inspect valve and spring for damage.

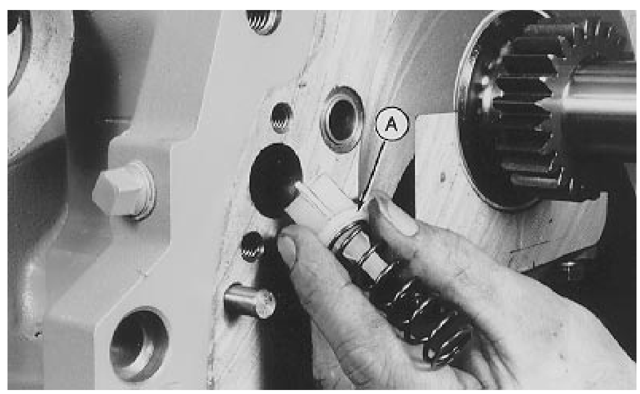
3. Check spring load and compare with specification.

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.



CD30622 –UN–04MAY98

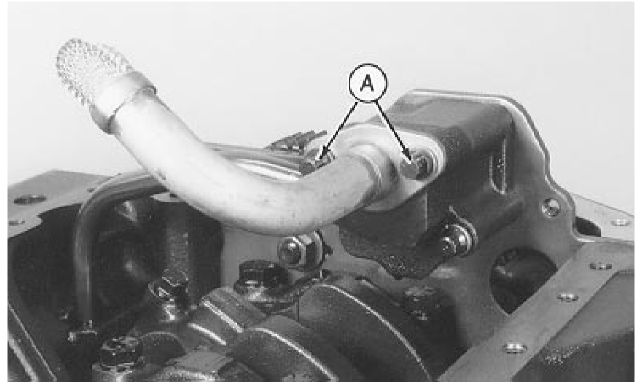
CD,CTM125,146 –19–24JAN01–1/1

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.

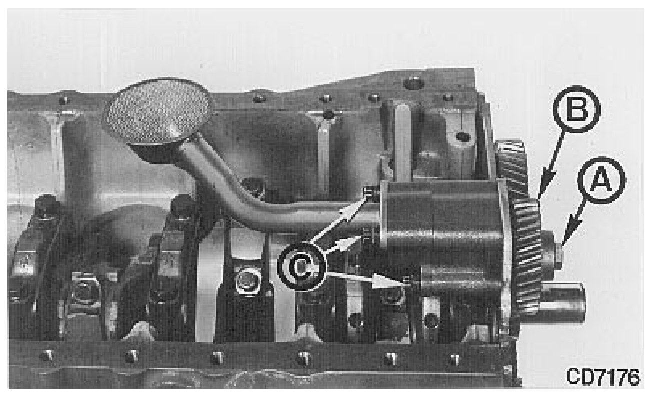


CD30623 –UN–04MAY98

CD,CTM125,147 –19–24JAN01–1/1

Remove Oil Pump

1. Remove oil pan and timing gear cover.
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.



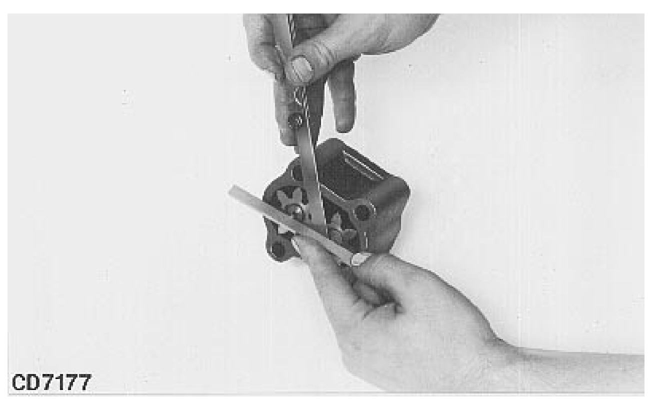
CD7176 –UN–07MAR95

A—Oil pump drive gear nut
B—Oil pump drive gear
C—Screw

CD,CTM125,148 –19–24JAN01–1/1

Oil Pump Gear Axial Clearance

Oil pump gear axial clearance—Specification
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.)



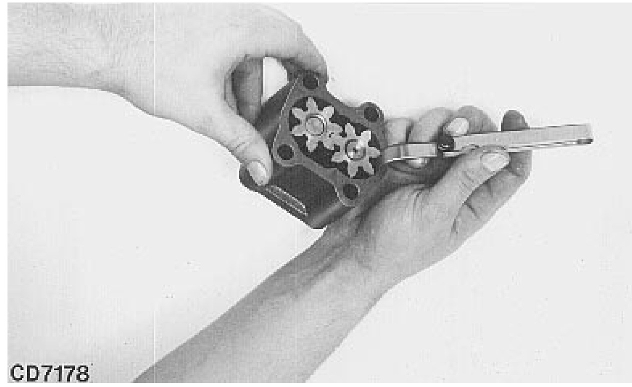
CD7177 –UN–07MAR95

CD,3274,G25,26 –19–24JAN01–1/1

Oil Pump Gear Radial Clearance

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.)



CD7178 –UN–07MAR95

CD,3274,G25,27 –19–24JAN01–1/1

Oil Pump Specifications

T81953 –UN–09NOV88

T81781 –UN–09NOV88

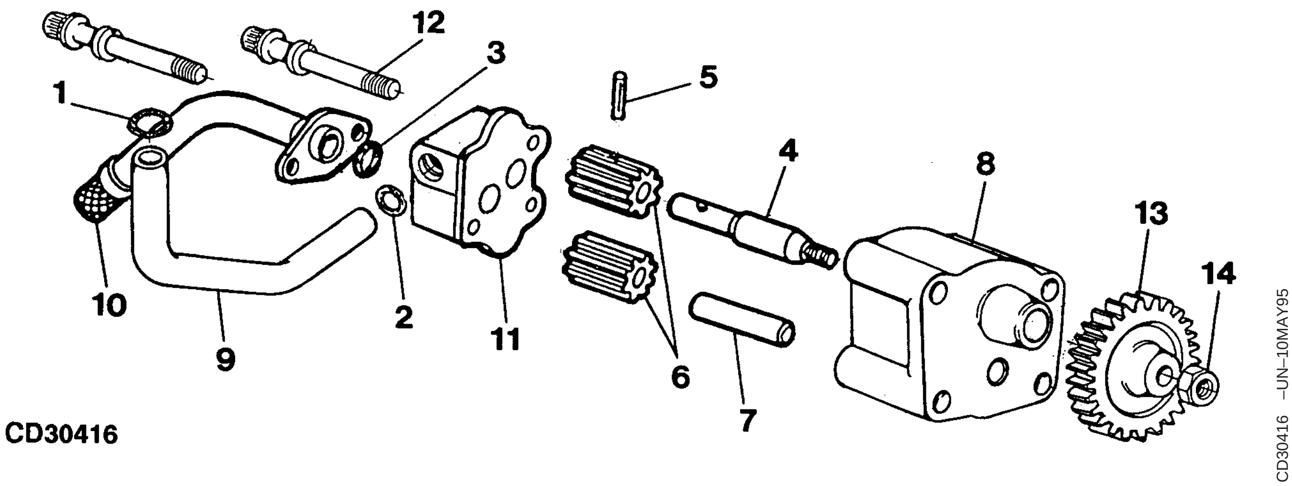
Oil pump—Specification

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.)

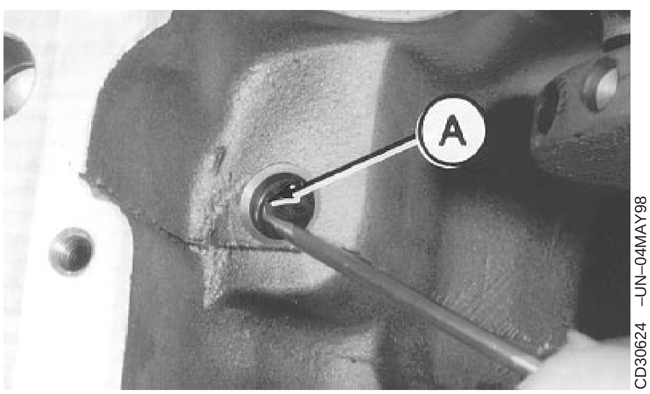
CD,CTM125,153 –19–24JAN01–1/1

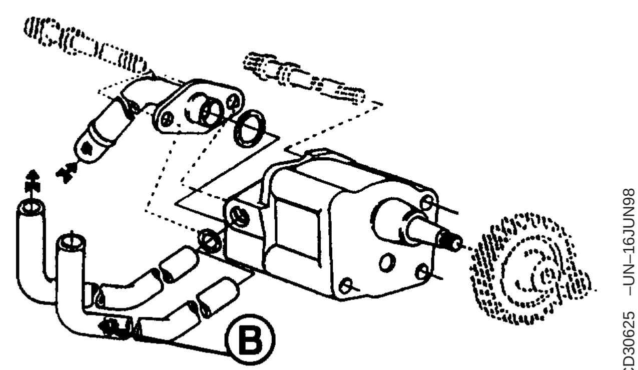
Oil Pump Installation



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

CD,CTM125,150 –19–24JAN01–1/3





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.

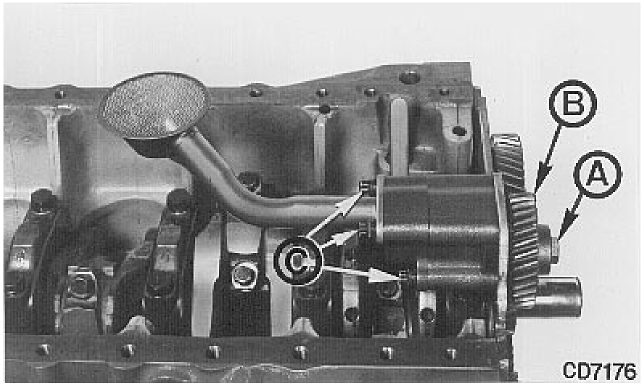
3. Install drive shaft with gear and idler gear in pump housing. Both gears must turn freely.

4. Install outlet tube, strainer and pump cover.

NOTE: Service oil pump kit has two outlet tube. Install tube without paint mark (B).

Continued on next page

CD,CTM125,150 –19–24JAN01–2/3



CD7176 –UN–07MAR95

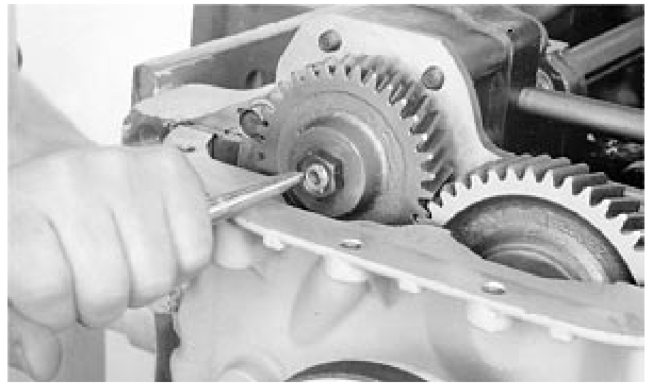
5. Attach oil pump assembly to front plate, tightening cap screws (C) to specification.

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.



T81782 –UN–09NOV88

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 –19–24JAN01–3/3

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:

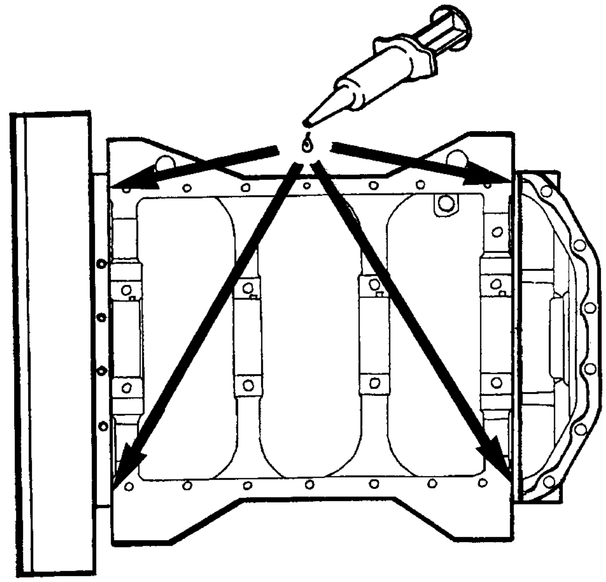
Specification

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)



CD30626 –UN–16JUN98

CD30627 –UN–04MAY98

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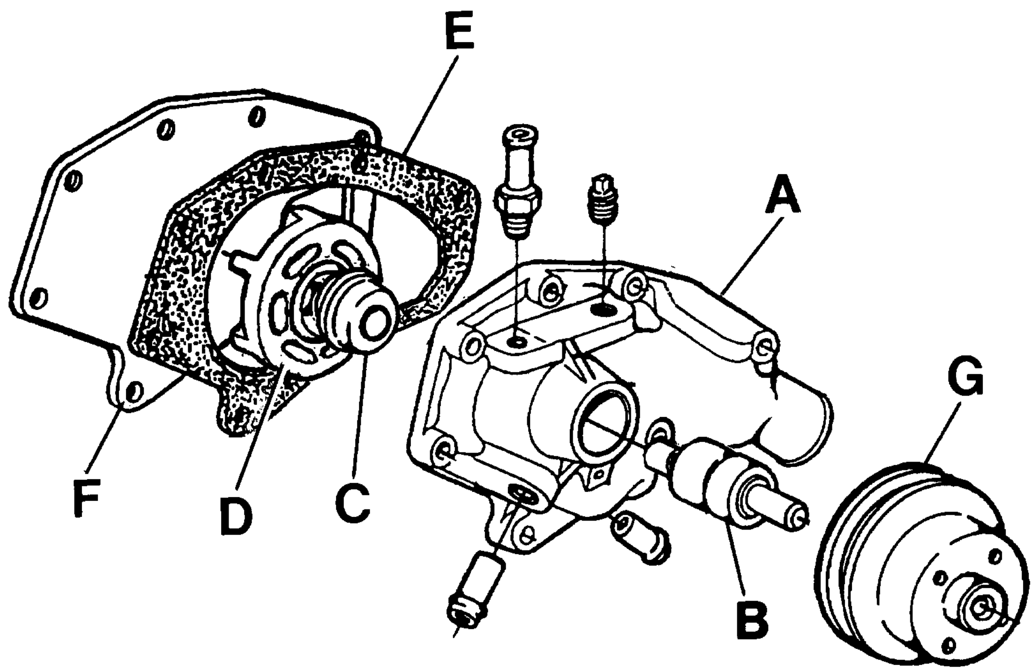
CD,CTM125,151 –19–24JAN01–1/1

Water Pump — Exploded View



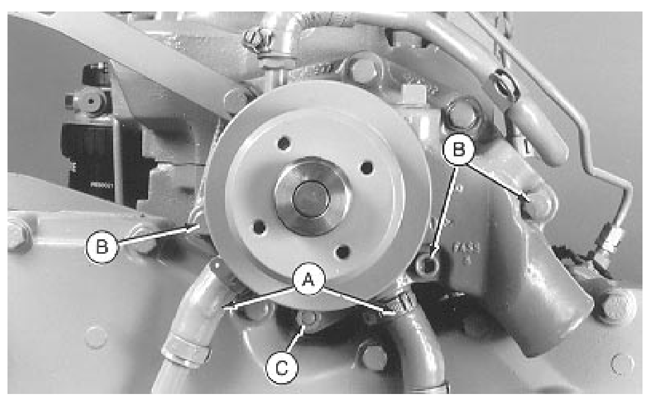
CD30628 –UN–17JUN98

A—Housing
B—Bearing shaft
C—Seal
D—Impeller
E—Gasket
F—Rear cover
G—Hub (or pulley)

CD,CTM125,156 –19–01DEC97–1/1

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.



CD30629 –UN–04MAY98

CD,CTM125,157 –19–01DEC97–1/1

Disassemble Water Pump

NOTE: When water pump operation is abnormal or when coolant drains from 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).

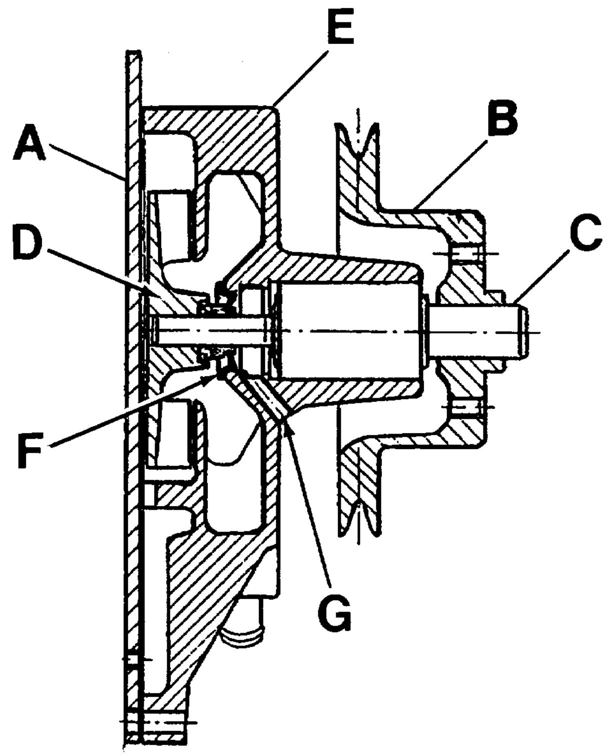
3. Support pulley end of housing, then using a 13 mm (0.5 in.) driver, simultaneously remove impeller (D) from bearing shaft and bearing shaft from pump housing (E). Discard bearing and impeller.

4. Using a suitable driver, remove seal (F) from pump housing and discard.

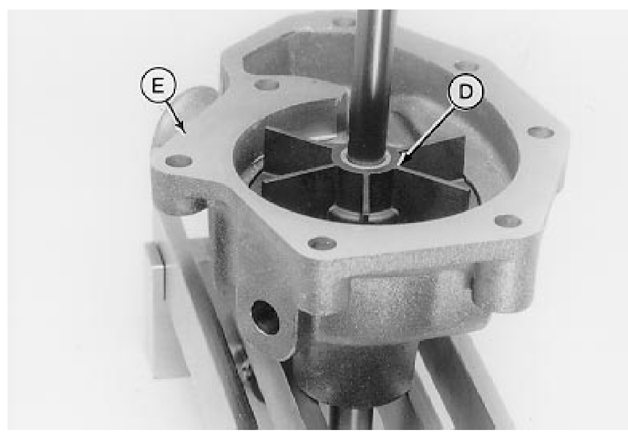
5. Inspect water pump housing, cover and pulley for wear, debris, cracks or other damage. Replace as necessary.

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.

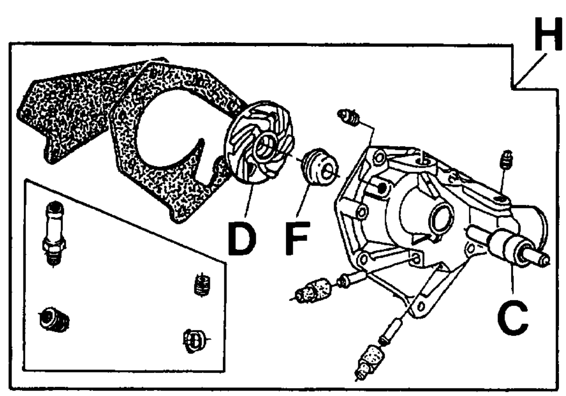
A—Rear cover
B—Pulley
C—Bearing shaft
D—Impeller
E—Housing
F—Seal
G—Weep hole
H—Pre-assembled water pump



CD30630 –UN–16JUN98



CD30631 –UN–04MAY98

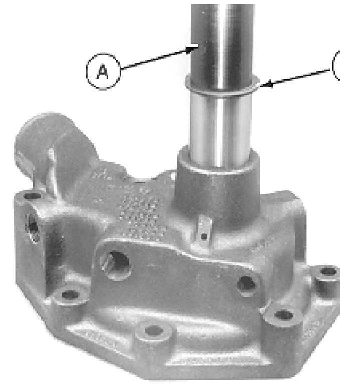


CD30632 –UN–16JUN98

Pre-assembled water pump

CD,CTM125,158 –19–25JAN01–1/1

Assemble Water Pump

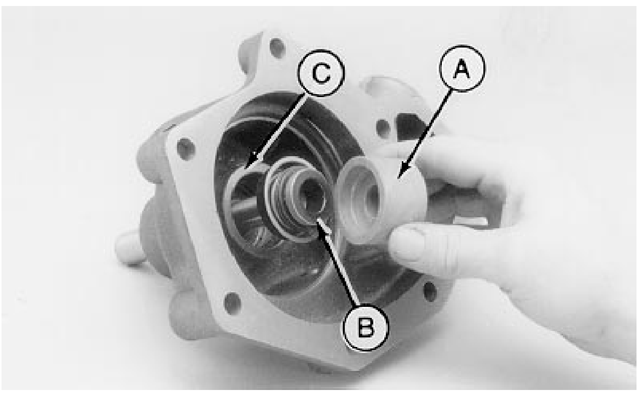


CD30633 –UN–04MAY98

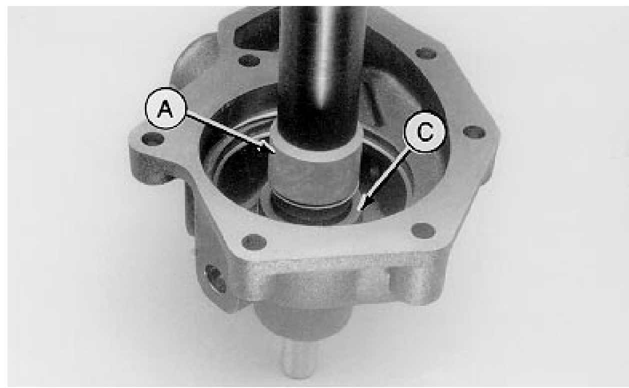
1. Use JD-262A (JD262A) (A) to install bearing shaft.

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 a proper installation.

CD,CTM125,162 –19–25JAN01–1/4



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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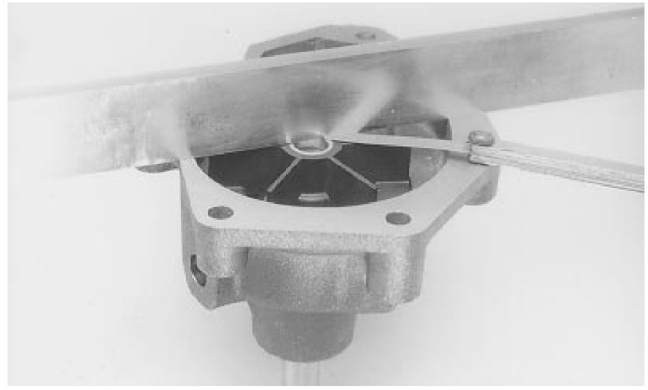
CD,CTM125,162 –19–25JAN01–2/4



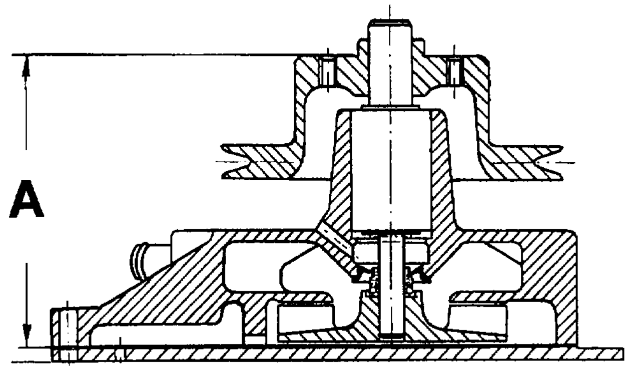
4. Place pump housing under a press and support on pulley end of shaft.

5. Using special tool JD-262A (JD262A), press impeller onto pump shaft until flush with pump housing face within clearance specification.

Specification

Impeller-to-water pump housing—Clearance .... 0 to -0.25 mm (0 to -0.01 in.)

CD,CTM125,162 –19–25JAN01–3/4



6. Place pump housing under a press and support on impeller end of shaft.

7. Install pulley or hub to the specified dimension “A” (see specifications).

CD,CTM125,162 –19–25JAN01–4/4

Install Water Pump

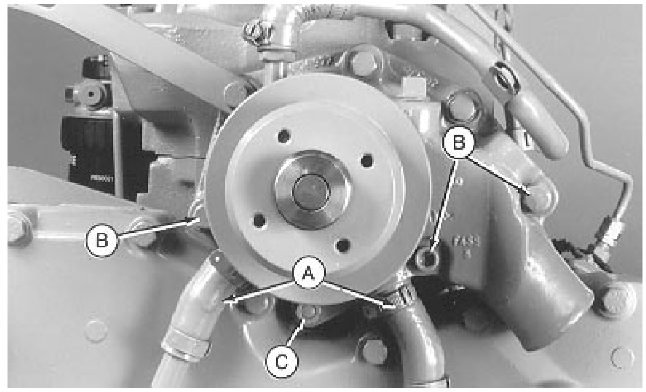
1. Attach pump cover to pump housing using a new gasket and tighten cap screws to specification.

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).

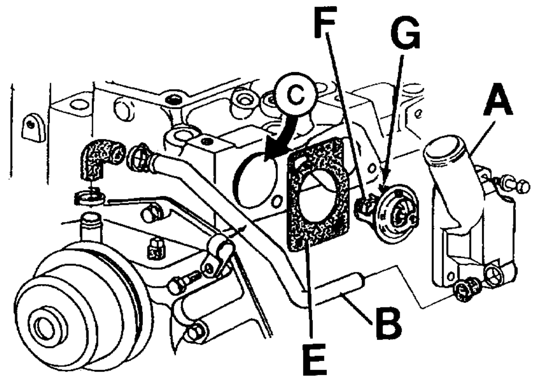


CD30629 –UN–04MAY98

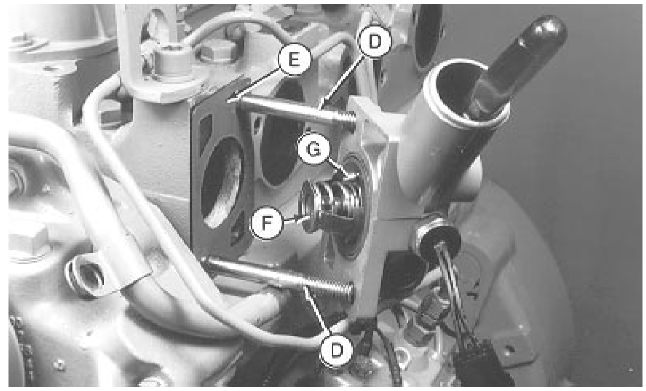
A—Coolant hose
B—Cap screw
C—Nut

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.

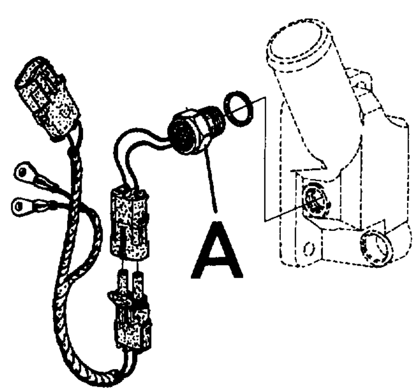
CD,CTM125,205 –19–25JAN01–1/1

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

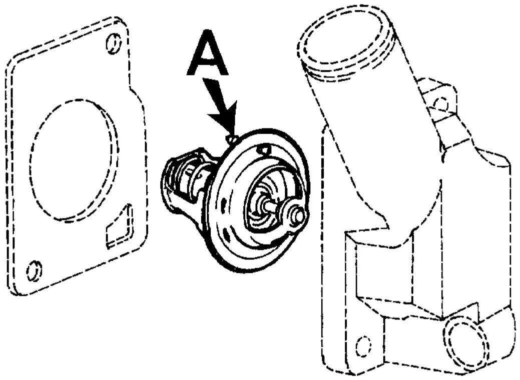
Cold Start Advance Switch—
Torque .... 5 N•m (3.5 lb-ft)



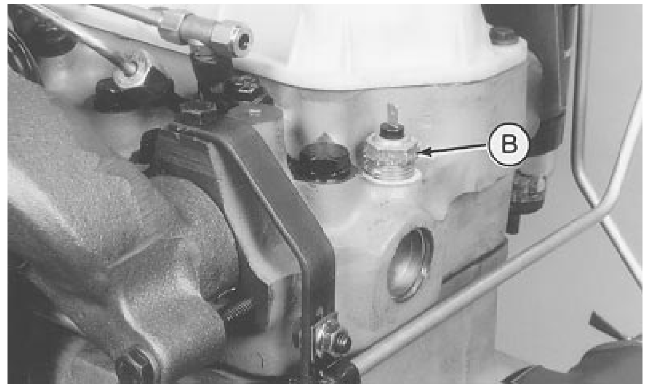
CD30682 –UN–16JUN98

CD03523,0000100 –19–26JAN01–1/1

Cooling System Deaeration



CD30642 –UN–16JUN98

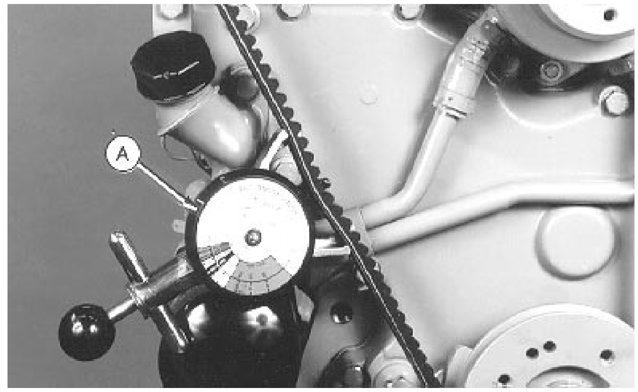


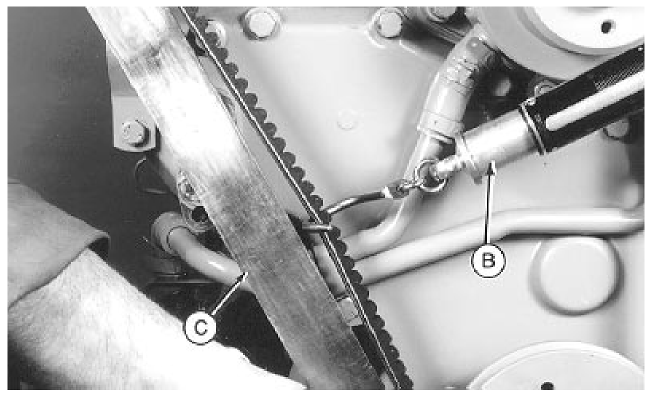
CD30643 –UN–04MAY98

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





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)**

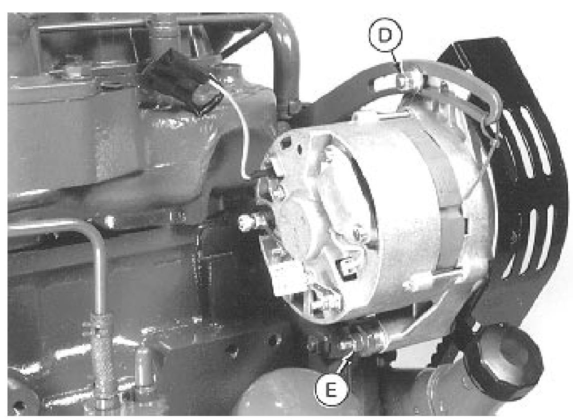
Specification

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.

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.

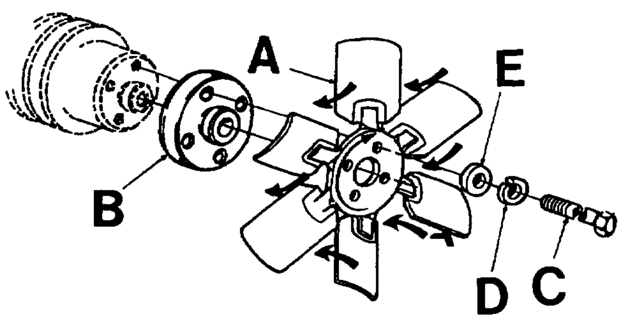
IMPORTANT: Do not pry against the alternator rear frame. Do not tighten or loosen belts while they are hot.

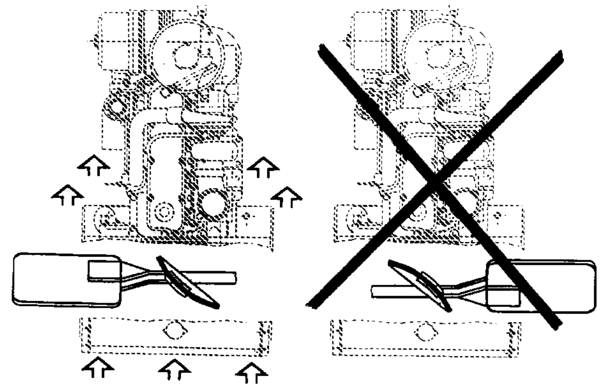
3. Tighten alternator bracket nuts firmly.

4. Run engine for 10 minutes then recheck belt tension.

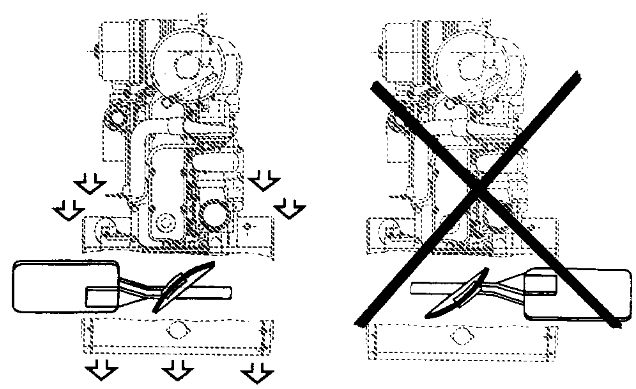
CD,CTM125,166 –19–26JAN01–2/2

Install Fan





Suction fan (top view)



Blower fan (top view)

A—Fan
B—Spacer
C—Cap screw
D—Lock washer
E—Flat washer

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.

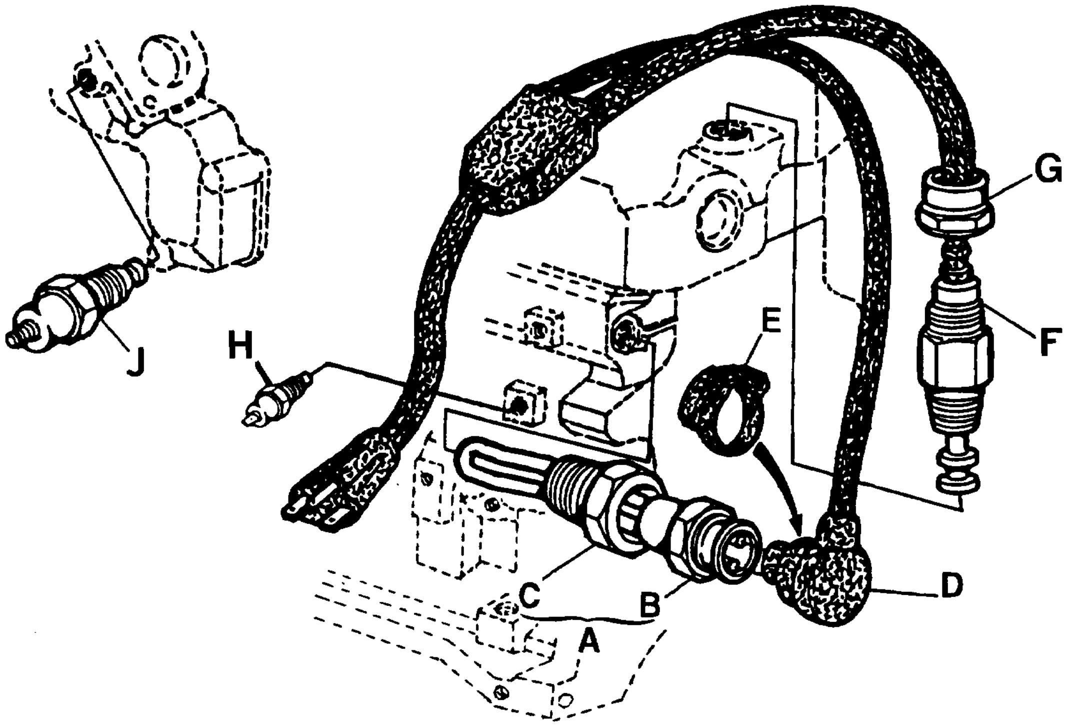
4. Install cap screws (C) with new lock washers (D) and, when required, flat washers (E). Tighten as specified.

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



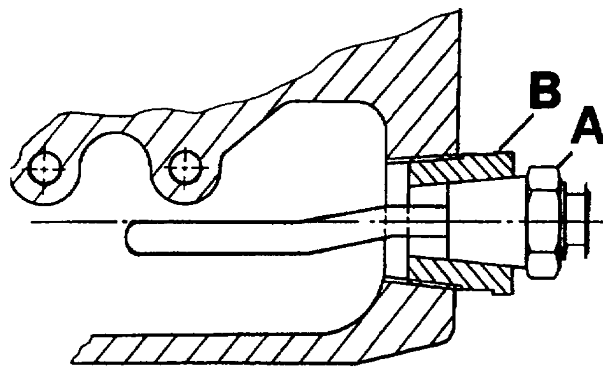
A—Coolant heater
B—Heater element: RE64803 (240 V, 1000 W)
C—Adapter
D—Electrical cord
E—Clamp
F—Coolant temperature sensor for heater regulation
G—Hexagonal cap
H—Engine coolant temperature sensor in cyl. block
J—Engine coolant temperature sensor in thermostat housing

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.

Continued on next page CD,CTM125,169 –19–26JAN01–1/3

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).



CD30651 –UN–16JUN98

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.

CD,CTM125,169 –19–26JAN01–2/3

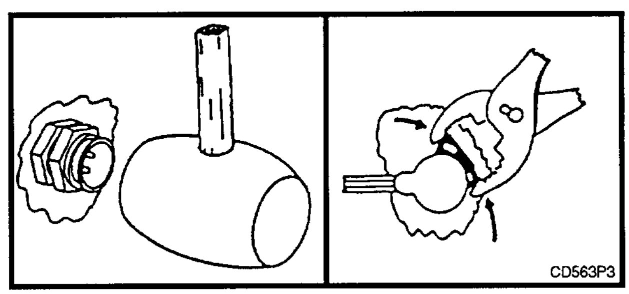
Installation

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.

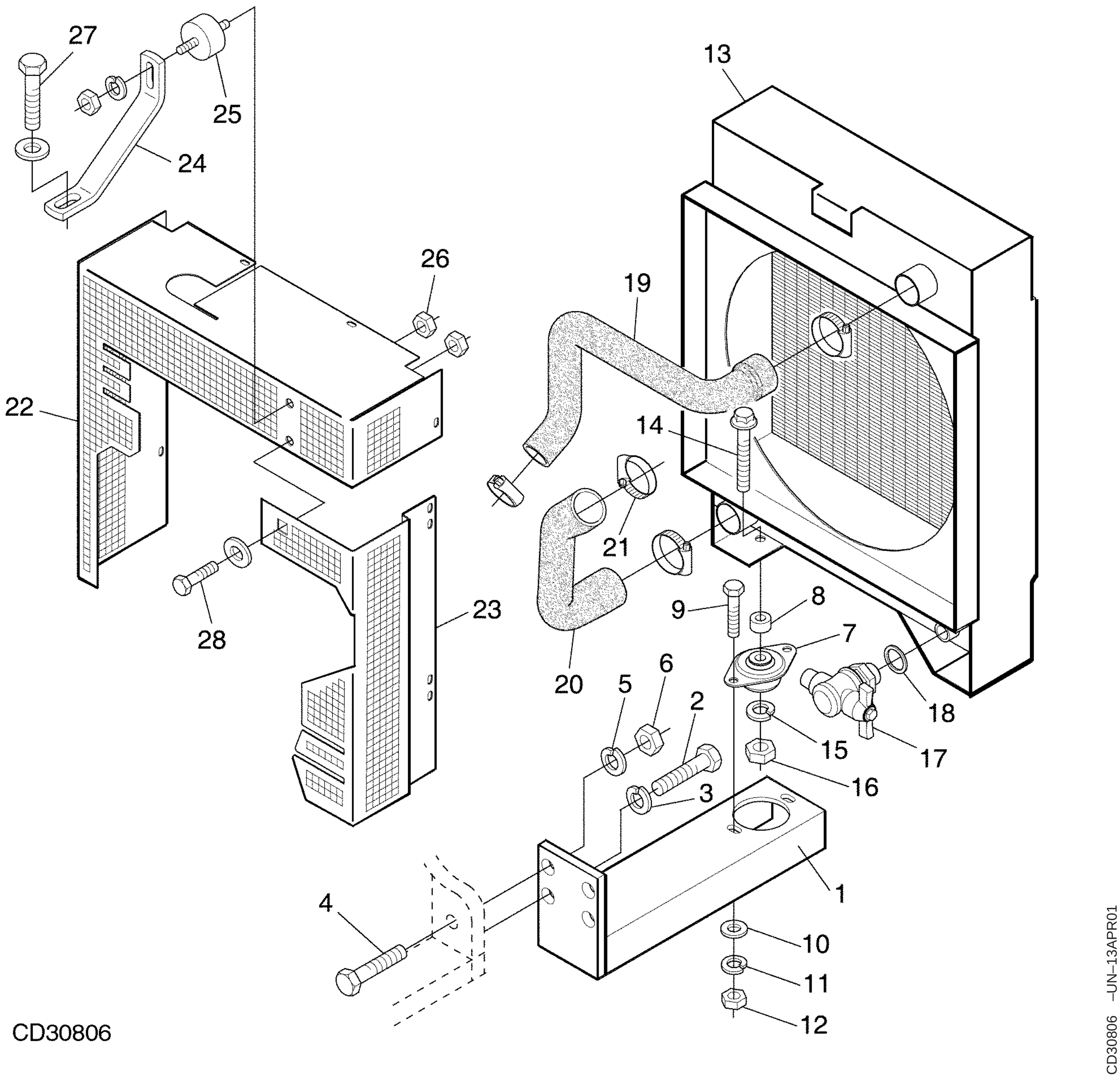


CD563P3 –UN–31OCT96

LOCTITE is a trademark of Loctite Corp.

CD,CTM125,169 –19–26JAN01–3/3

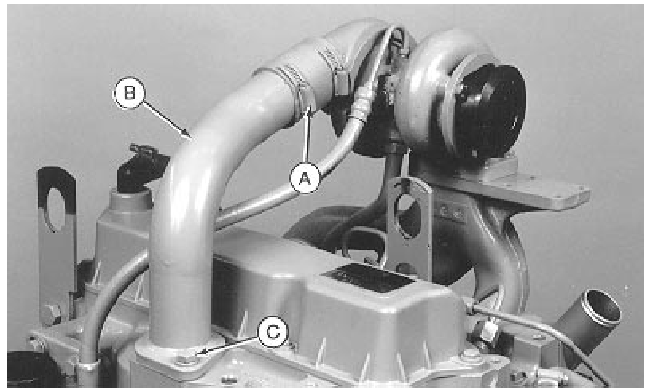
Radiator Exploded view (CD3209DF128)



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 –19–26JAN01–1/1

Check Air Inlet Pipe



CD30653 –UN–04MAY98

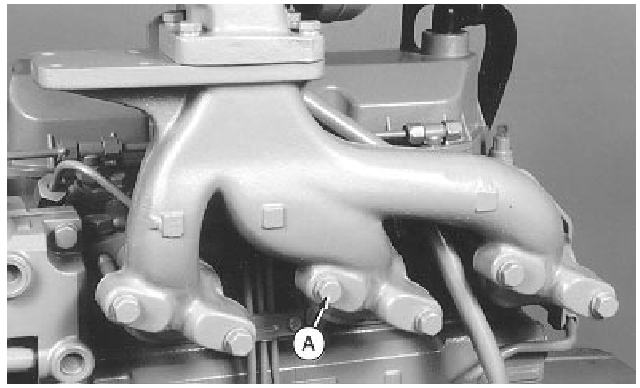
1. Loosen hose clamps (A) holding air inlet hose.
2. Remove air inlet pipe (B).
3. Inspect inlet pipe for serviceability and repair or replace, if it is cracked or otherwise damaged.
4. Inspect machined mating surfaces of cylinder head and inlet pipe. Clean as required, using a scraper and/or wire brush 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.

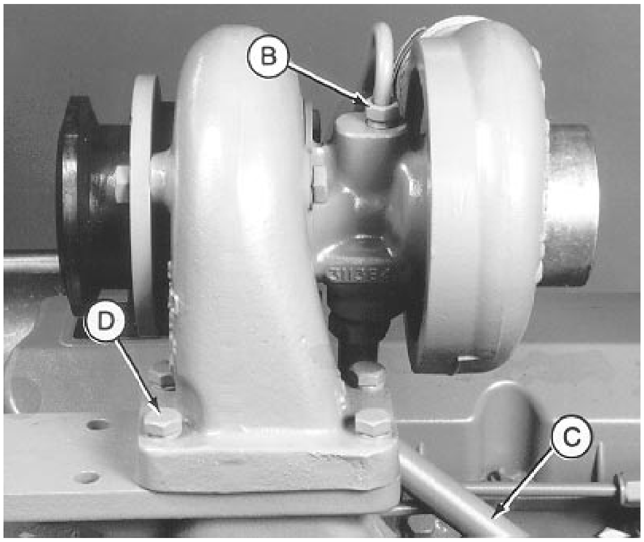
4. To install exhaust manifold, reverse removal procedure and use new gaskets.
5. Tighten exhaust manifold attaching cap screws to specification.

Specification

Exhaust manifold-to-cylinder
head, cap screws—Torque .... 50 N•m (35 lb-ft)

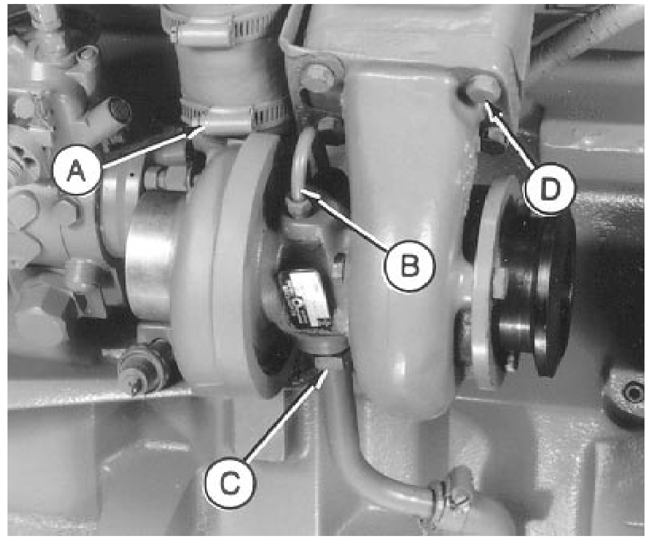
CD,CTM125,173 –19–01DEC97–1/1

Remove Turbocharger



CD30655 –UN–20MAY98

High mount



CD30656 –UN–20MAY98

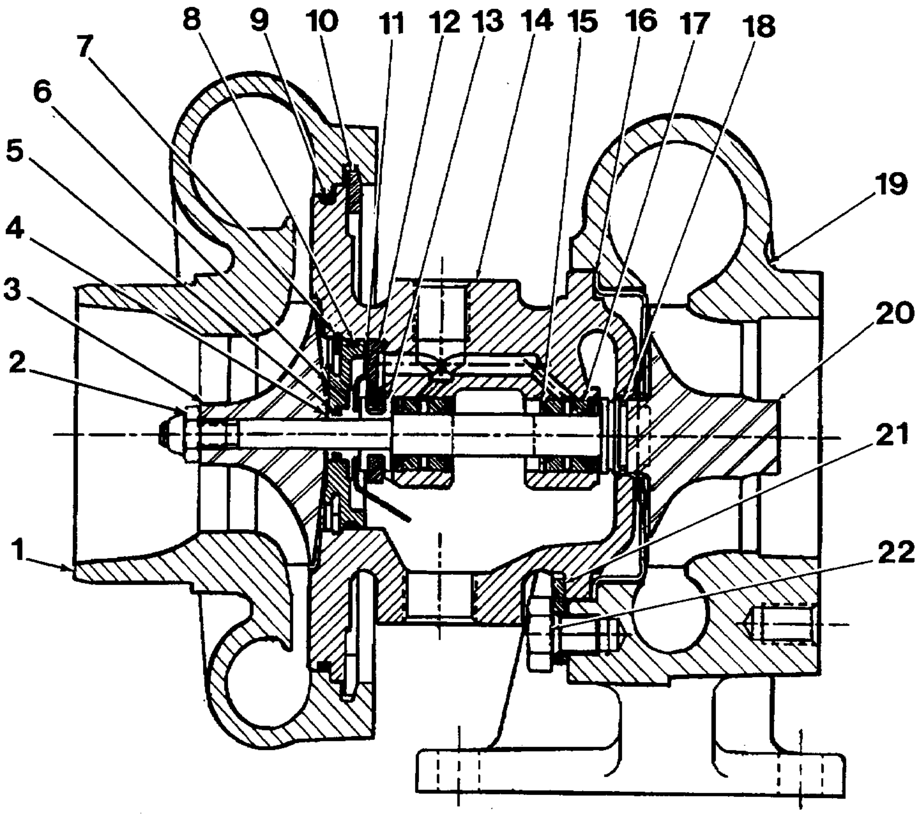
Side mount

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

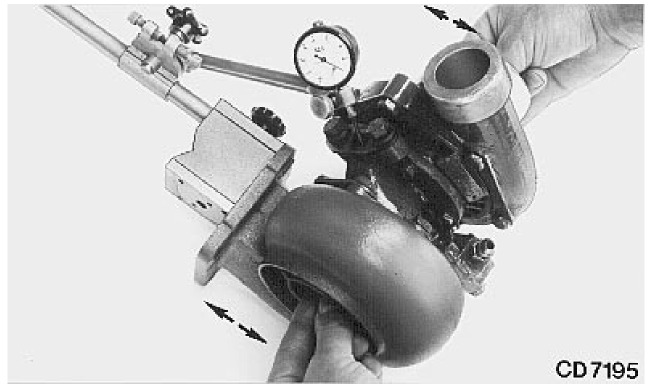
Turbocharger Cut-Away View (SCHWITZER)



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 –19–31JAN01–1/1

Check Radial Clearance



CD7195 –UN–23MAY95

GARRETT Turbocharger

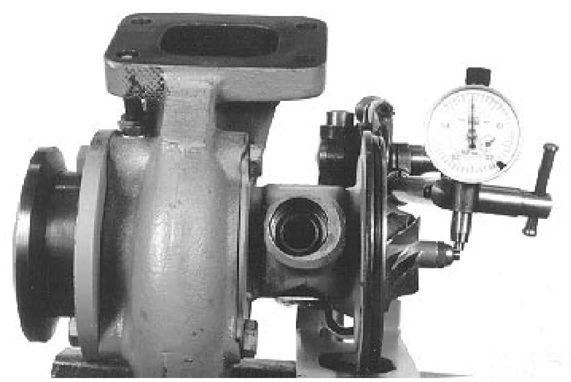
1. Using an adapter with indicator extension rod, fasten a dial indicator to the turbocharger and place indicator rod against compressor shaft through lube hole.
2. Move shaft alternately toward and away from indicator.
3. Applying equal pressure to both ends of shaft, compare the radial bearing end 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.

CD,CTM125,176 –19–31JAN01–1/2

SCHWITZER Turbocharger



CD30658 –UN–04MAY98

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.

SCHWITZER Turbocharger—Specification
S1B model—Radial clearance .... 0.51 mm (0.20 in.) Maxi

If radial clearance is exceeds specifications, replace turbocharger.

CD,CTM125,176 –19–31JAN01–2/2

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.

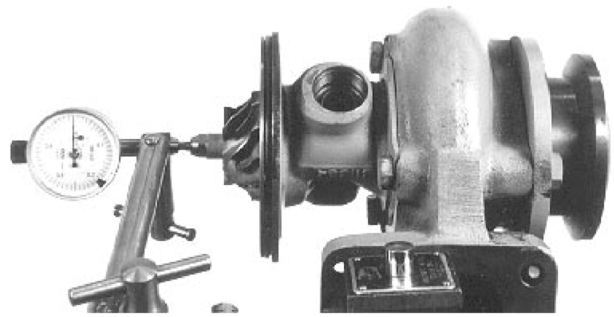
GARRETT Turbocharger—Specification

TA25 model—Axial clearance .... 0.025—0.09 mm (0.001—0.0035 in.)

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 –19–31JAN01–1/1

Repair Turbocharger

Due to special tooling and highly specialized personnel required, turbochargers can be serviced only by an authorized workshop.

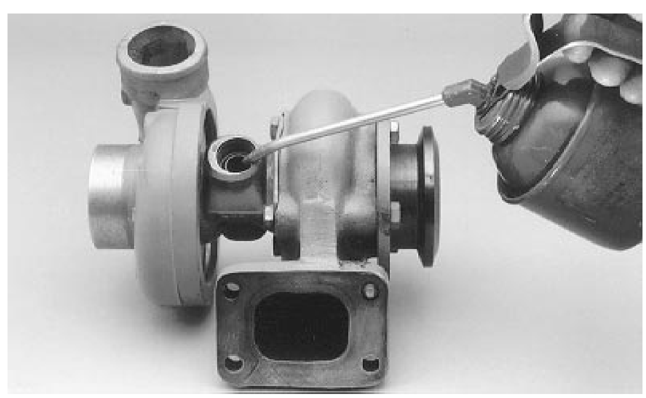
Only complete turbochargers are available through service parts channel. Individual components for repair are not available.

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.

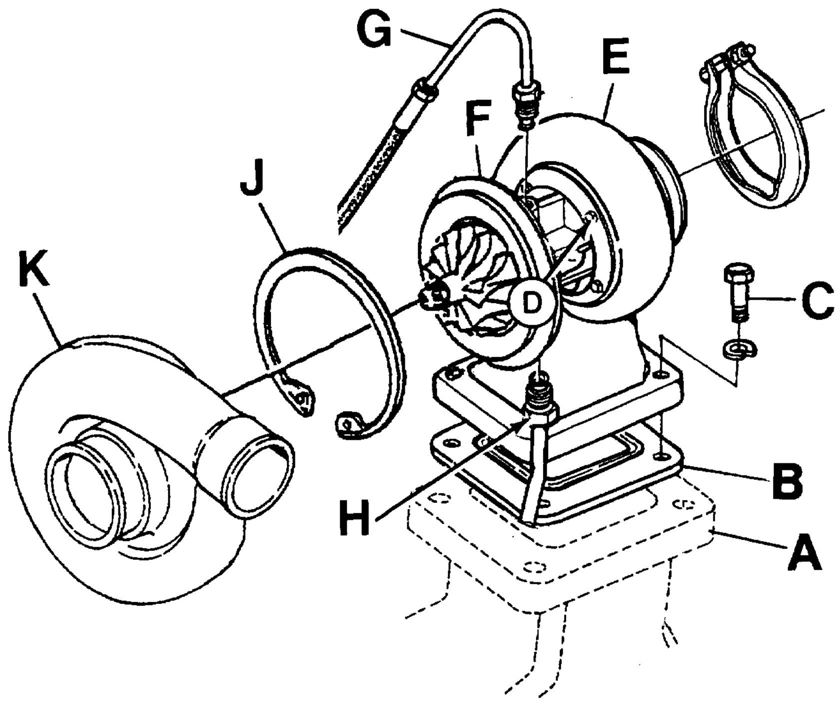
Fill oil inlet or drain port with clean engine oil and spin rotating assembly **(by hand)** to properly lubricate bearings.



CD30660 –UN–04MAY98

CD,CTM125,179 –19–01DEC97–1/1

Install Turbocharger



CD30661 –UN–17JUN98

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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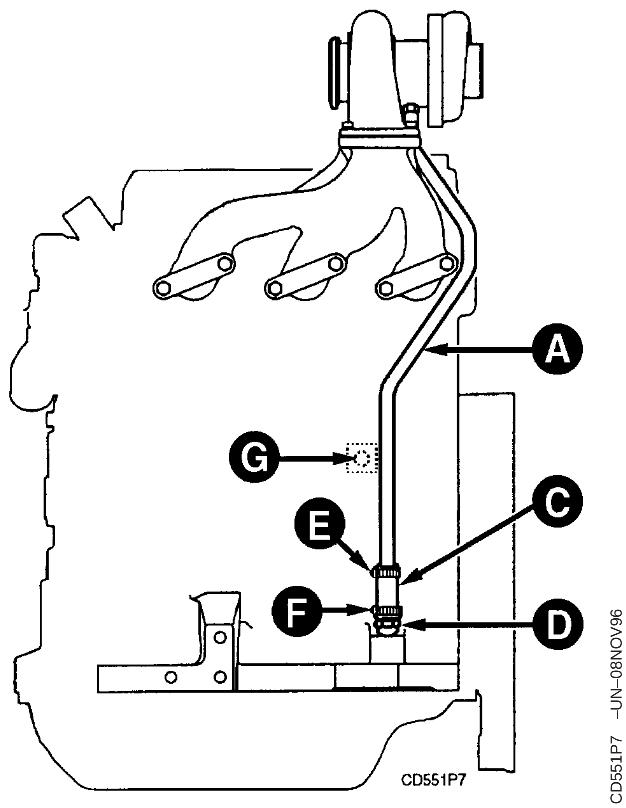
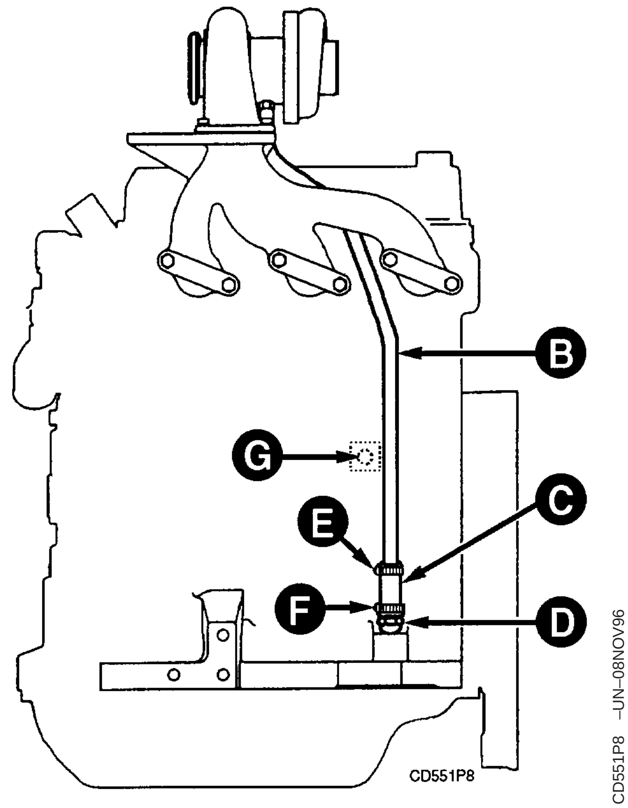
CD,CTM125,180 –19–31JAN01–1/2



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	80 N•m (60 lb-ft)

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	80 N•m (60 lb-ft)

CD,CTM125,180 –19–31JAN01–2/2

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

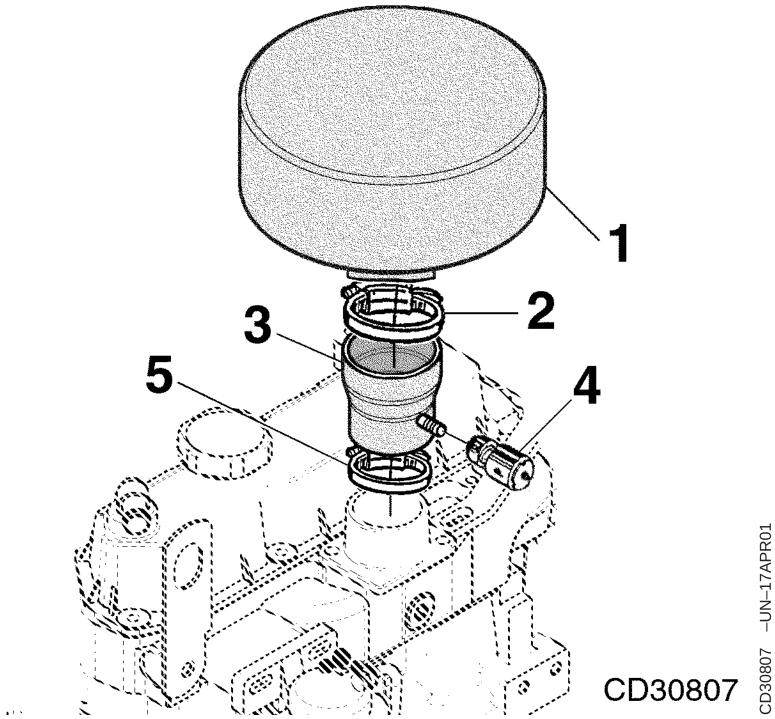
Recommendations for Turbocharger Use

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

Air Filter Exploded View

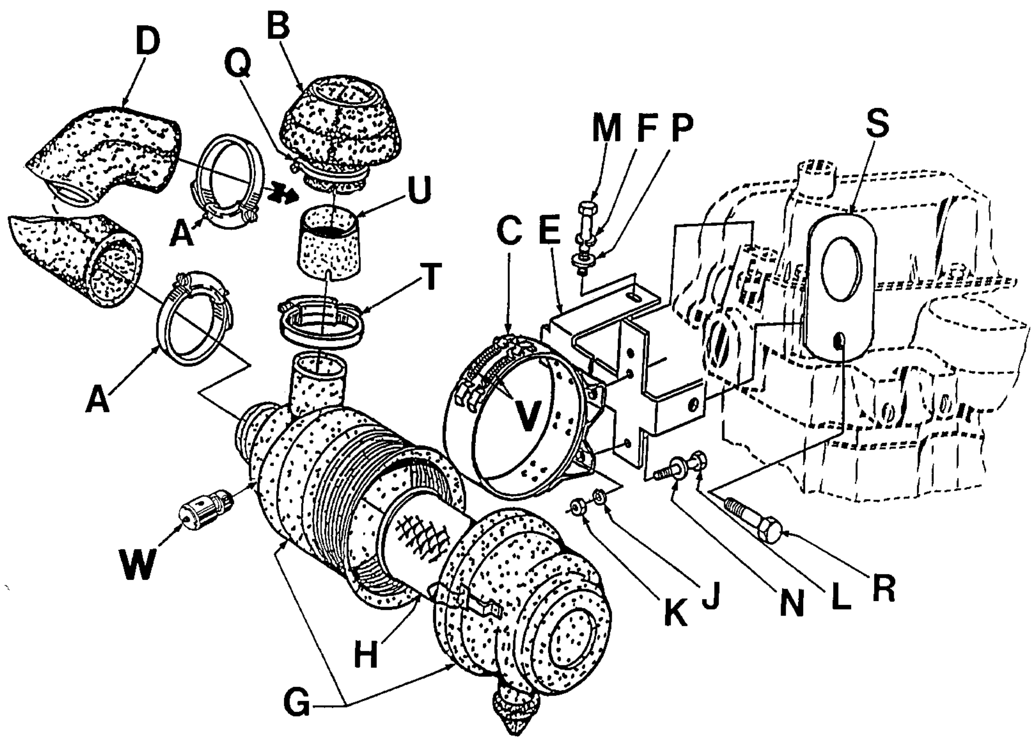


Light duty configuration

1—Air filter
2—Clamp
3—Hose
4—Air restriction indicator
5—Clamp

NOTE: Applies only to air filters installed by John Deere.

Continued on next page CD03523,0000107 –19–31JAN01–1/2

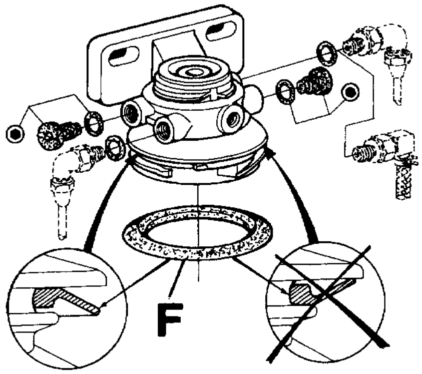


Medium duty configuration

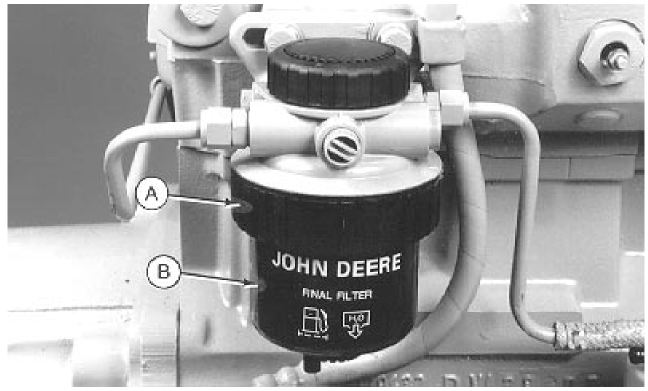
A—Clamp
B—Rain cap
C—Clamp
D—Hose
E—Bracket
F—Lock washer
G—Air cleaner assembly
H—Filter element
J—Lock washer
K—Nut
L—Cap screw
M—Cap screw
N—Washer
P—Washer
Q—Clamp
R—Cap screw
S—Lifting strap
T—Clamp
U—Sleeve
V—Spring
W—Air restriction indicator

CD03523,0000107 –19–31JAN01–2/2

Replace Fuel Filter Element



CD30667 –UN–17JUN98



CD30664 –UN–04MAY98

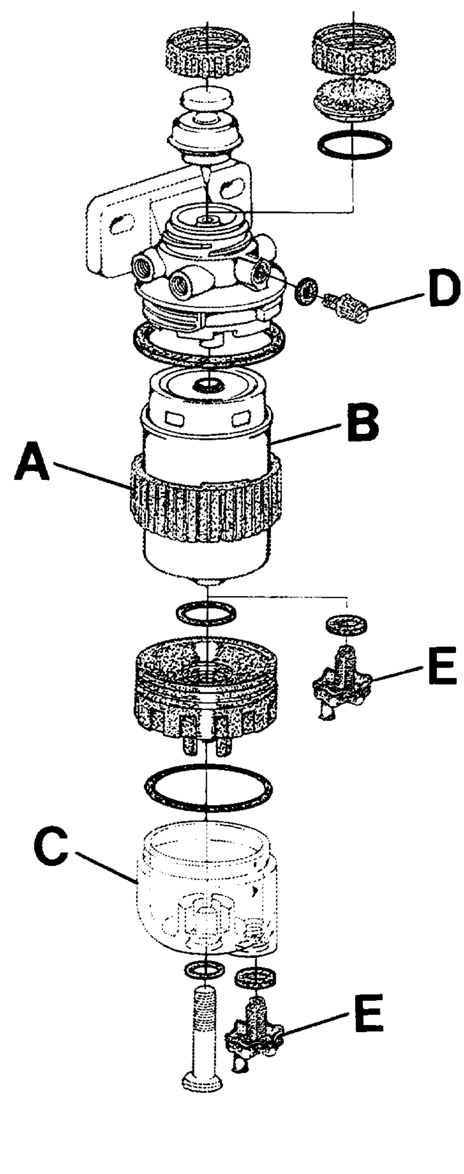
NOTE: For proper filter servicing and replacement, see Operator's Manual.

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.

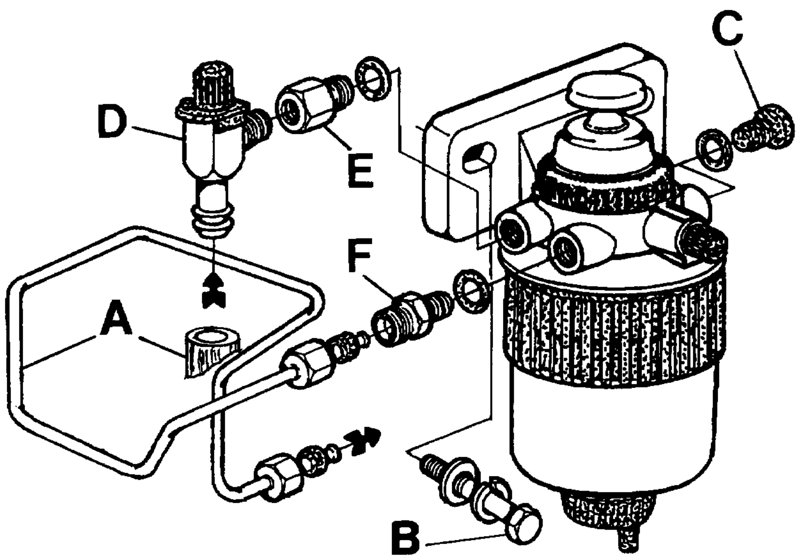
A—Retaining ring
B—Filter element
C—Sediment glass bowl
D—Bleed screw
E—Drain screw



CD30665 –UN–16JUN98

40
2

Replace Fuel Filter Assembly



CD30666 –UN–16JUN98

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.

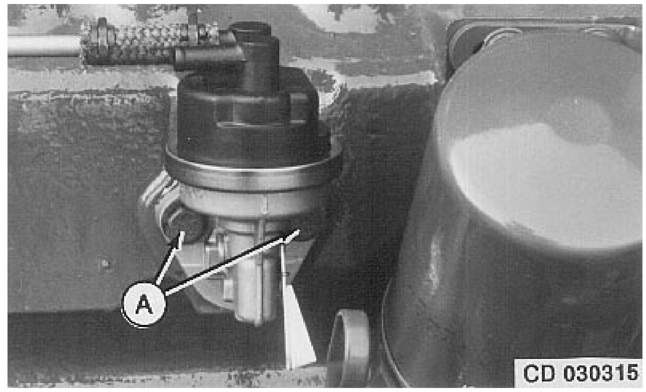
7. Install fuel lines then tighten to specification.

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 –19–05FEB01–1/1

Replace Fuel Supply Pump



CD30315 –UN–17FEB95

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.

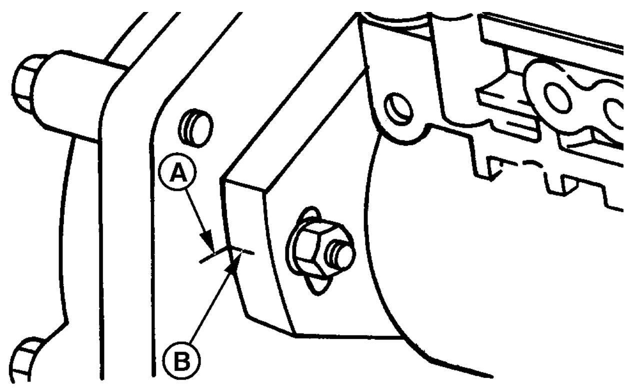
4. Apply sealing compound on thread of cap screws and attach the fuel pump to cylinder block. Tighten to specification.

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 –19–05FEB01–1/1

Remove STANADYNE DB2 or DB4 Fuel Injection Pump



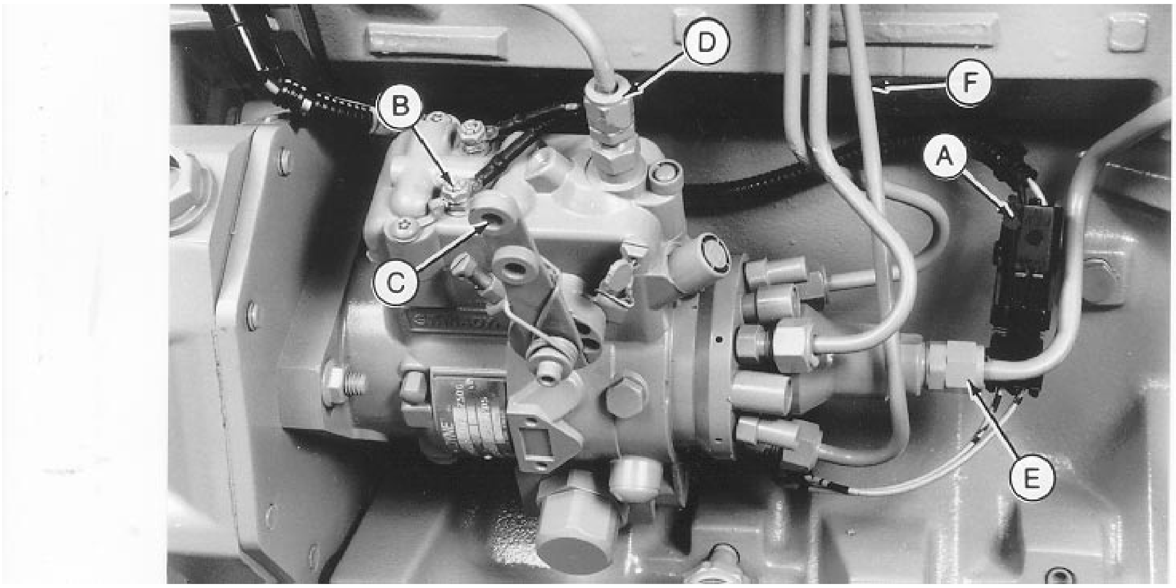
RG6293 –UN–03NOV97

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.

Continued on next page CD,CTM125,192 –19–05FEB01–1/4



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)

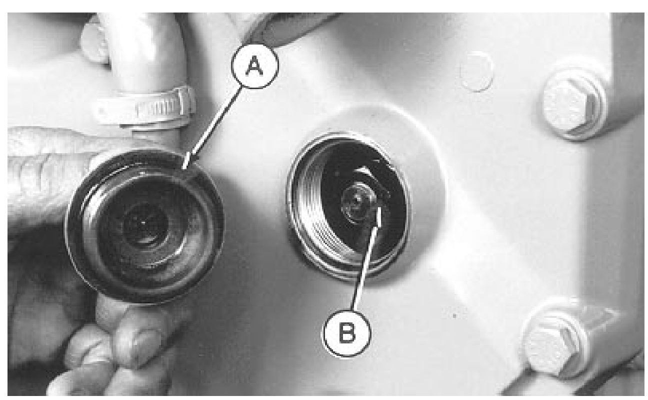
IMPORTANT: Always use a backup wrench when loosening or tightening fuel injection lines at injection pump to prevent rotation of the discharge fitting.

4. Plug all open connections on pump and fuel lines. Do not use fibrous material.

CD,CTM125,192 –19–05FEB01–2/4

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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CD,CTM125,192 –19–05FEB01–3/4

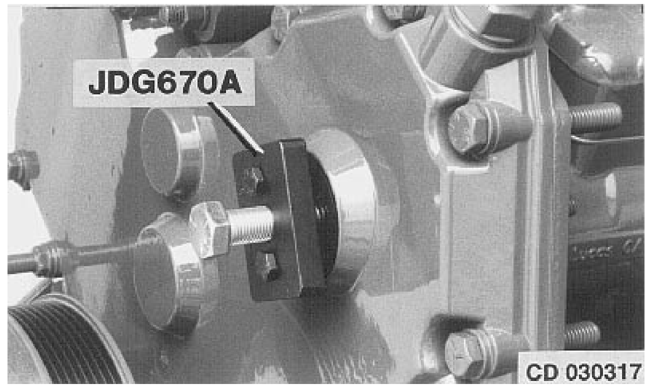
7. Attach special tool JDG670A to gear. Remove the three nuts holding fuel injection pump to engine front plate.

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 JDG670A 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

CD,CTM125,192 –19–05FEB01–4/4

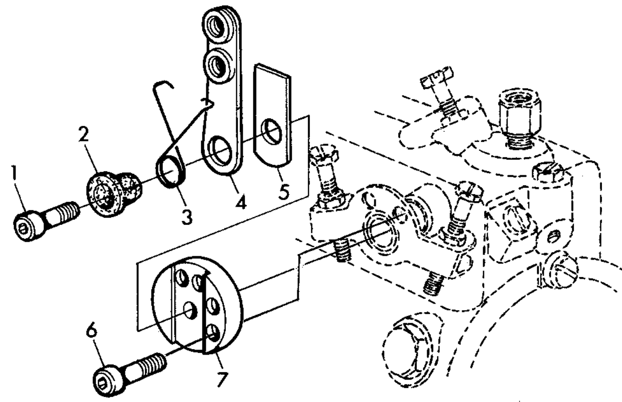
Repairs to STANADYNE Fuel Injection Pump

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 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.

CD,CTM125,193 –19–05FEB01–1/1

Replace Throttle Lever (STANADYNE)



1. Remove parts.

2. Inspect parts. Replace as necessary.

3. Tighten position screw (6) and spring screw (1) to specification.

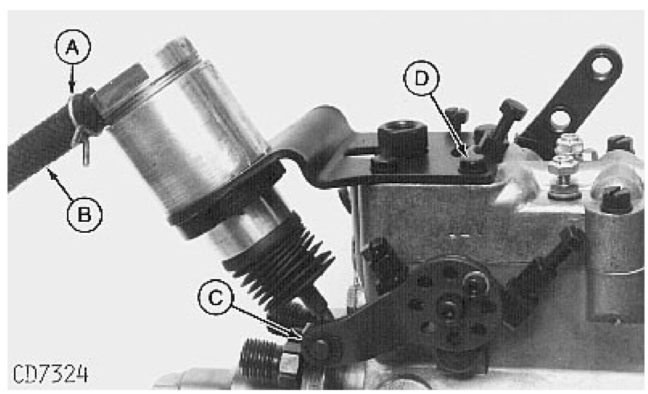
Throttle lever (Stanadyne)—Specification

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)

1—Spring screw
2—Spring retainer
3—Spring
4—Lever
5—Arm
6—Throttle lever position screw
7—Throttle lever adjustment spacer

CD03523,000010E –19–05FEB01–1/1

Aneroid Replacement (STANADYNE)



A—Clamp
B—Hose
C—Retaining ring
D—Attaching screw

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 (45 lb-in.)

5. Connect hose (B) to aneroid inlet with clamp (A).

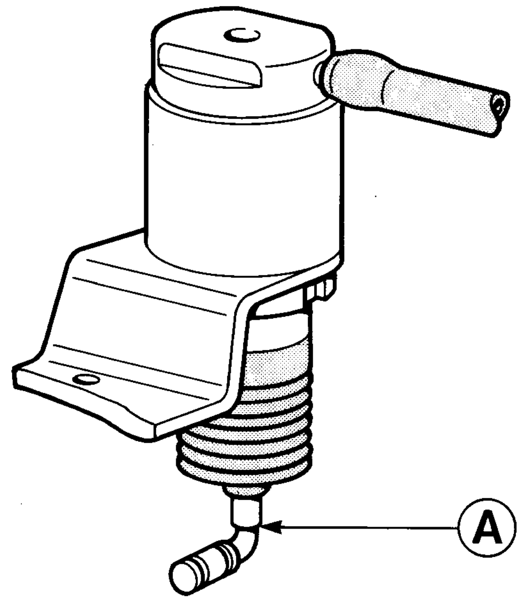
CD03523,0000112 –19–06FEB01–1/1

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.

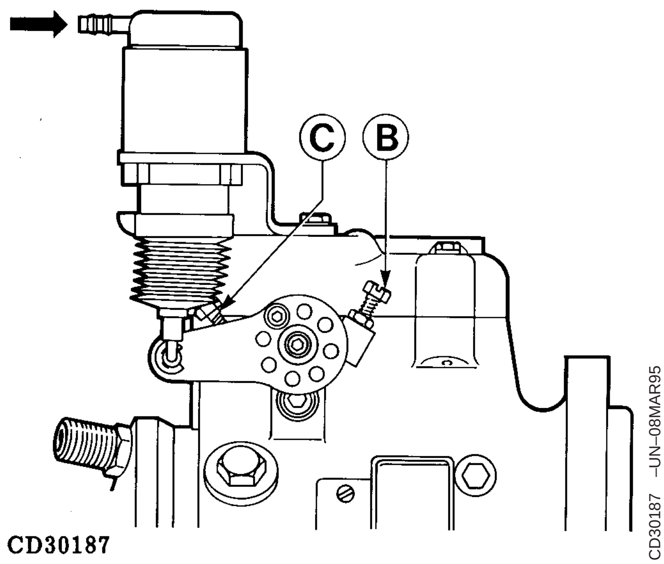
3. Install adjusted aneroid on injection pump.



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.

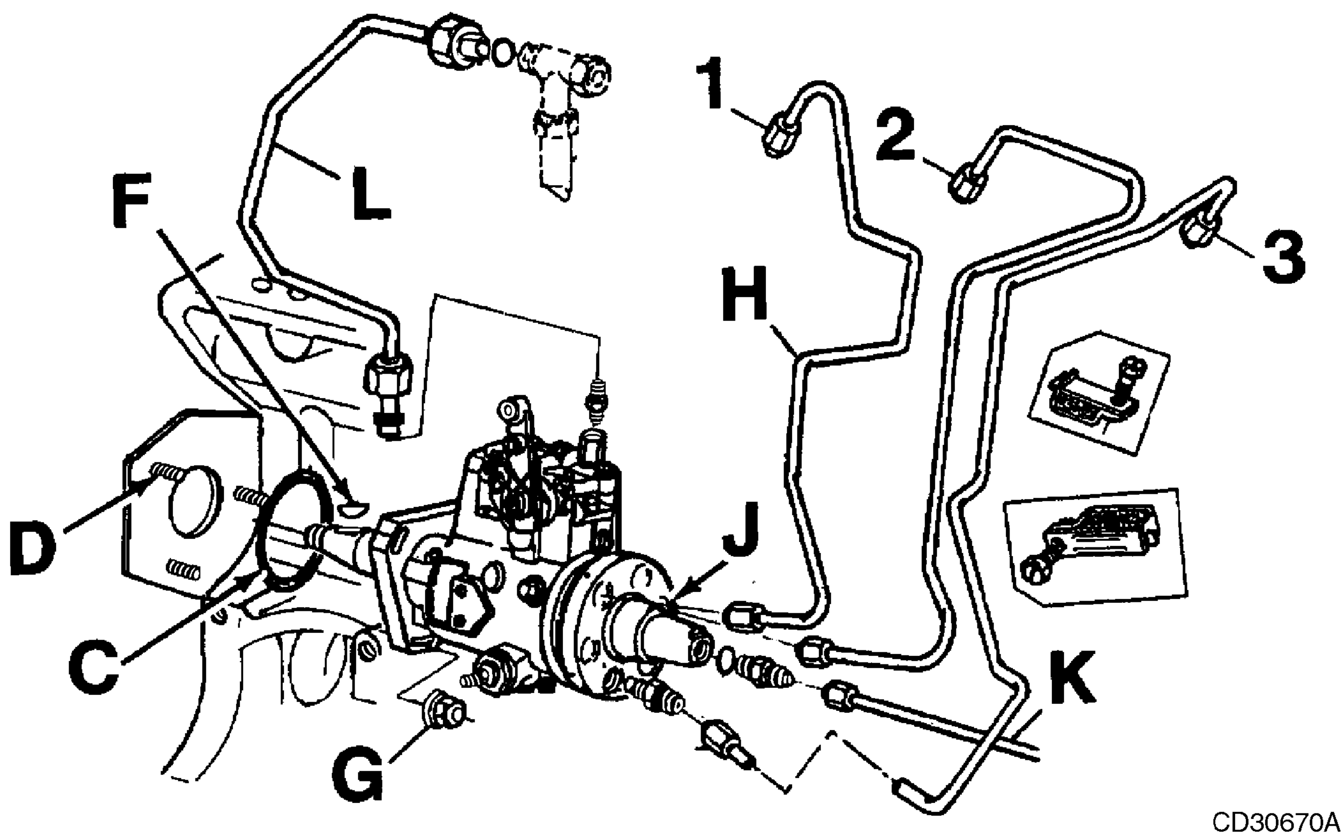
IMPORTANT: During aneroid adjustment, do not touch the forward/rear screw, as these devices have been adjusted on the test stand.

5. Once aneroid is set, repeat test to check adjustment.

6. Install injection pump on engine.

CD03523,0000114 –19–06FEB01–1/1

Install STANADYNE DB2 or DB4 Fuel Injection Pump



CD30670A –UN–19MAR01

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.

Continued on next page

CD,CTM125,195 –19–01DEC97–1/2

3. Push drive gear firmly onto shaft taper. Install washer and nut (E) then tighten to specification. Install mounting plug onto timing gear cover.

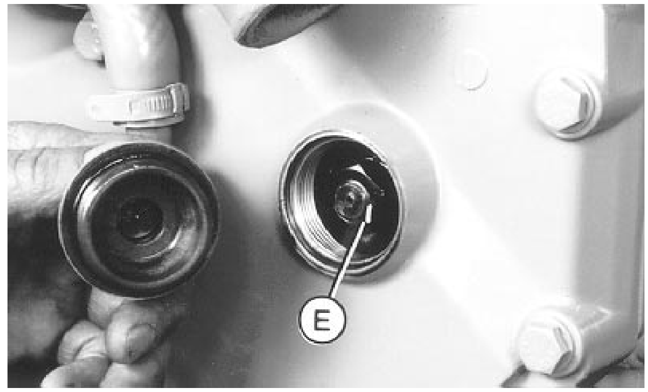
4. Align timing mark on pump flange (B) with timing mark on front plate (A) then tighten nuts (G) to specification.

NOTE: In case of replacement of injection pump, install injection pump with studs in middle of flange slots. Then perform a dynamic timing.

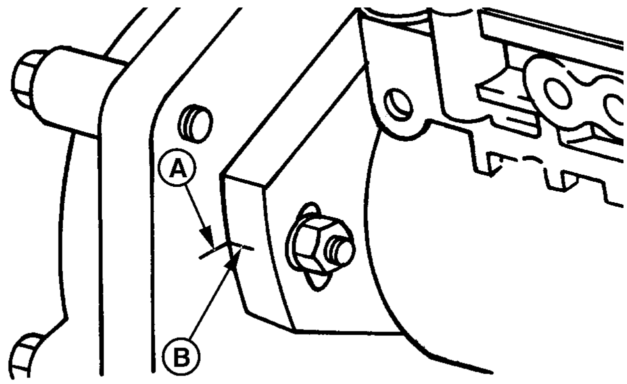
5. Connect injection line No. 1 (H) to outlet (J) and continue counter-clockwise with injection line No. 2. Using JDF22 socket and a backup wrench, tighten to specification.

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



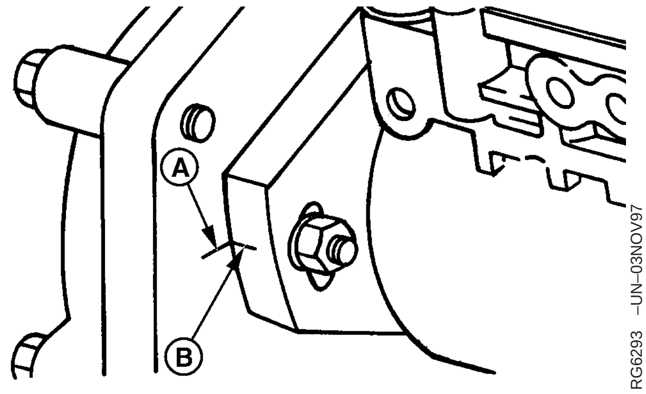
RG6293 –UN–03NOV97

STANADYNE DB2 or DB4 Fuel Injection Pump—Specification

Drive gear nut—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

CD,CTM125,195 –19–01DEC97–2/2

Remove DELPHI/LUCAS Fuel Injection Pump

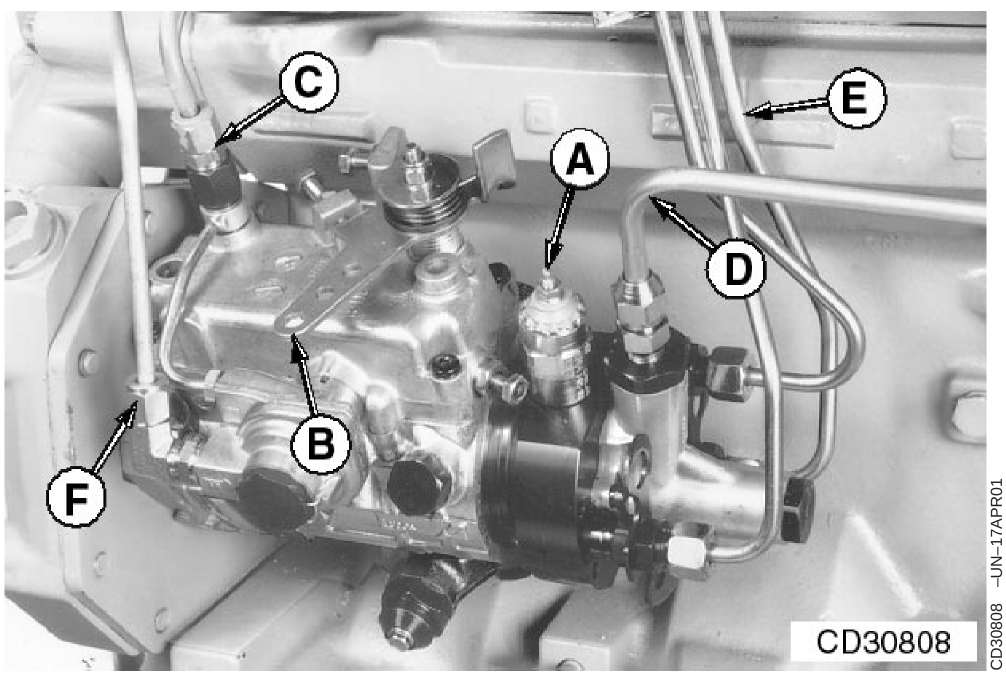


IMPORTANT: Never steam clean or pour cold water on a fuel injection pump while the pump is running or while it is warm. Seizure of internal component can occur.

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.

CD03523,000010F –19–05FEB01–1/4



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.

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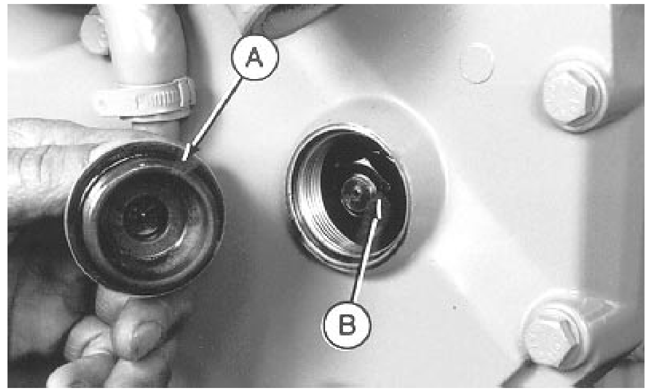
CD03523,000010F –19–05FEB01–2/4

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

CD03523,000010F –19–05FEB01–3/4

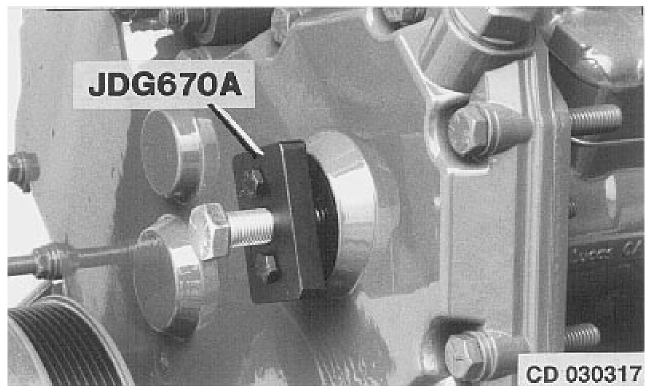
7. Attach special tool JDG670A to gear. Remove the three nuts holding fuel injection pump to engine front plate.

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 JDG670A 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

CD03523,000010F –19–05FEB01–4/4

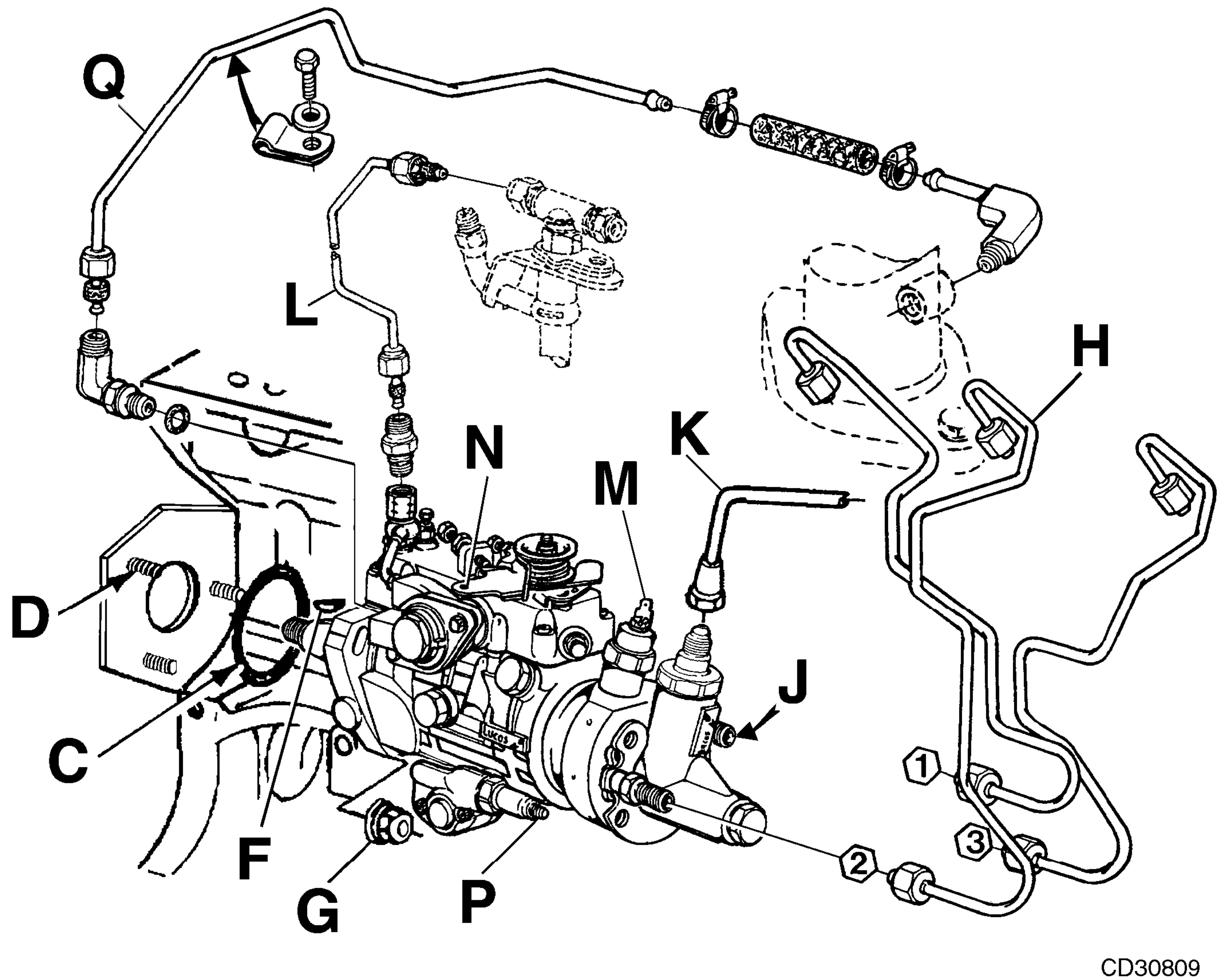
Repairs to DELPHI/LUCAS Fuel Injection Pump

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



CD30809 –UN–19MAR01

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

CD03523,0000111 –19–05FEB01–1/2

3. Push drive gear firmly onto shaft taper. Install washer and nut (E) then tighten to specification. Install mounting plug onto timing gear cover.

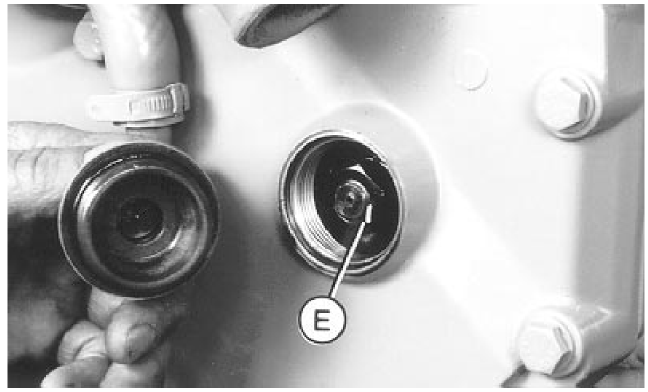
4. Align timing mark on pump flange (B) with timing mark on front plate (A) then tighten nuts (G) to specification.

NOTE: In case of replacement of injection pump, install injection pump with studs in middle of flange slots. Then perform a dynamic timing.

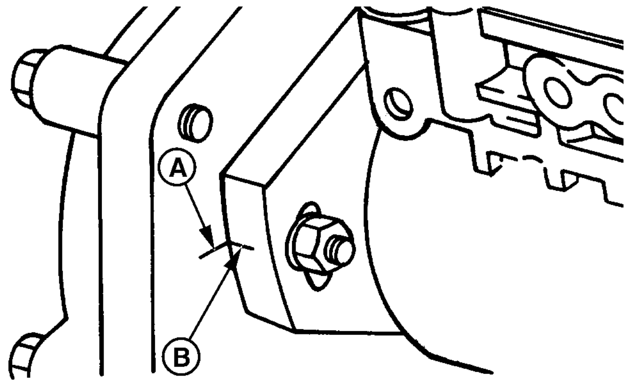
5. Connect injection line No. 1 (H) to outlet (J) and continue counter-clockwise with injection line No. 2. Using JDF22 socket and a backup wrench, tighten to specification.

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)
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

CD03523,0000111 –19–05FEB01–2/2

Dynamic Timing

FKM10429A (or JT07158) TIME-TRAC electronically indicates the start of injection with respect to the piston top dead center (TDC), and allows accurate setting of injection pump timing to provide optimum engine performances while complying with exhaust emission regulations.

NOTE: FKM10429A contains the following components:

- *A-FKM10429-1 Meter*
- *B-FKM10429-4 Sensor clamp*
- *C-FKM10429-5 6 mm clamp-on transducer*
- *D-FKM10429-8 Instruction manual*
- *E-FKM10429-6 Timing sensor*
- *F-JDE81-4 Timing pin*
- *G-FKM10465-1 Magnetic probe*
- *H-FKM10465-2 Transducer cable*
- *J-FKM10465-3 1/4“ clamp-on transducer*
- *K-JDG793 Magnetic probe adapter*
- *L-JDG821 Magnetic probe adapter*

CD30441 –UN–10MAY96

FKM10465 kit is also available to convert the previous FKM10429 “TIME-TRAC”. Keys G, H, J, K, and L are the components of FKM10465 conversion kit.

Timing light is not requested for recent engines. However timing light is still available under part number FKM10429-2.

CD,CTM125,196 –19–06FEB01–1/1

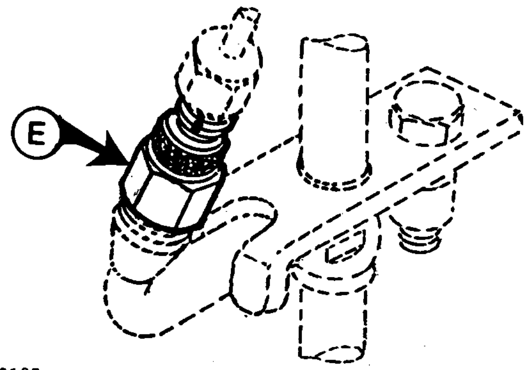
Install Timing Sensor

Install FKM10429-6 timing sensor (E) between No. 1 nozzle and high pressure fuel line.

Using two wrenches, tighten sensor and fuel pressure line to 30 N•m (22 lb-ft).

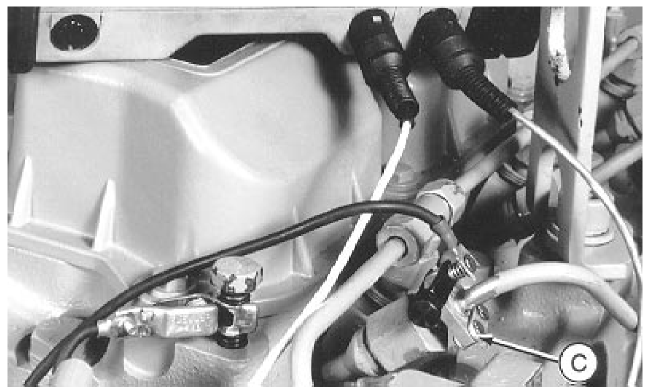
IMPORTANT: Timing sensor must be installed at nozzle end of N°.1 fuel injection line. If access to N°.1 line is restricted, sensor can be installed on N°.4 injection line (4-cylinder engines) and N°.6 injection line (6-cylinder engines). Sensor MUST BE installed on N°.1 injection line of all 3-cylinder engines.

NOTE: If clearance does not allow proper installation of the timing sensor (E), FKM10429-5 or FKM10465-3 clamp-on transducer (C) can be installed close to injection nozzle. Remove paint on injection line before installation.



CD30195

CD30195 –UN–07MAR95



CD30673 –UN–20MAY98

CD,FKM10429A,2 –19–23FEB98–1/1

Install Magnetic Probe

IMPORTANT: Use 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 probe (D) when engine is started.

Installation of Flywheel Housing with Tapped Timing Hole

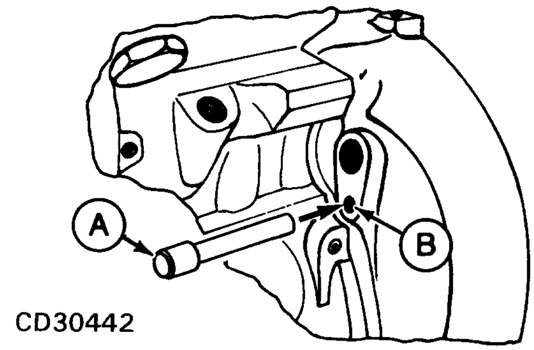
1. Install JDG793 magnetic probe adapter (C) into flywheel housing tapped hole (B) until it bottoms.

2. Insert magnetic probe (D) into adapter until contacts flywheel. Back out hex head of adapter two flats and tighten lock nut (E), this will provide the 0,65 mm (0.025") recommended air gap.

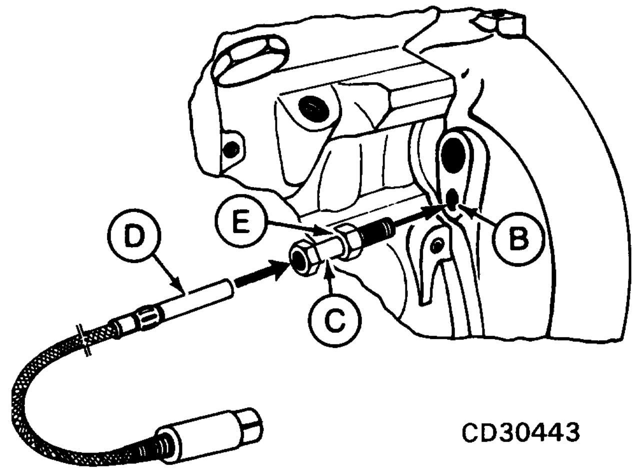
Installation of Flywheel Housing with Smooth Timing Hole

1. Install JDG821 magnetic probe adapter (F) into flywheel housing smooth hole (B). Lightly tap adapter to lock into position.

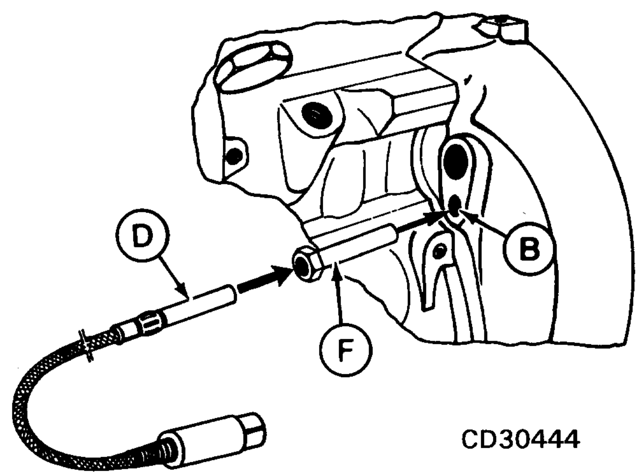
2. Insert magnetic probe (D) into adapter until contacts flywheel. Pull magnetic probe back out to provide 0,65 mm (0.025") recommended air gap.



CD30442 –UN–10MAY96



CD30443 –UN–10MAY96



CD30444 –UN–10MAY96

CD,FKM10429A,3 –19–02MAY96–1/1

Timing Sensor and Magnetic Probe Connection

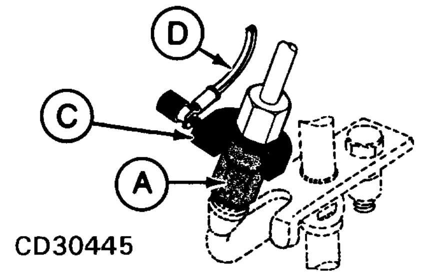
1. Connect timing sensor (A) or clamp-on tranducer to meter socket “SR” (B) with FKM10429-4 sensor clamp (C) and FKM10429-2 transducer cable (D).

   Also connect ground cable wire.

IMPORTANT: Observe correct polarity to avoid possible damage to meter.

2. Connect magnetic probe (E) to meter socket “MP” (F).

A—Timing sensor
B—Meter socket for timing sensor (marked “SR”)
C—Sensor clamp
D—Transducer cable
E—Magnetic probe
F—Meter socket for magnetic probe (marked “MP”)



CD30445 –UN–10MAY96

CD30446 –UN–10MAY96

CD,FKM10429A,4 –19–23FEB98–1/1

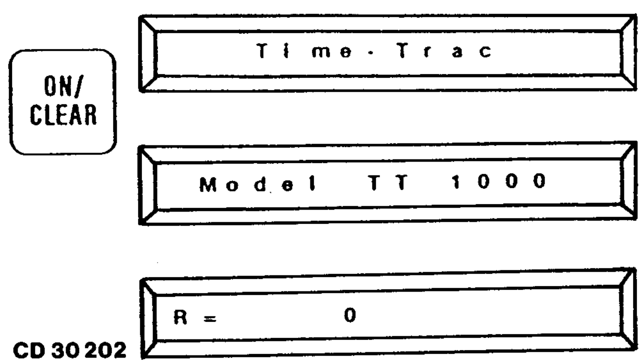
Check Fuel Injection Pump Timing

NOTE: If not yet done, install timing sensor, magnetic probe and connect.

1. Switch-on meter by pressing the “ON/CLEAR” key. The display will show “Time-Trac”, then “Model TT1000”, then “R = 0”.

NOTE: At this point, meter can be used as tachometer.

2. Start the engine and run for 10 minutes to bring to operating temperature.



CD30202 –UN–07MAR95

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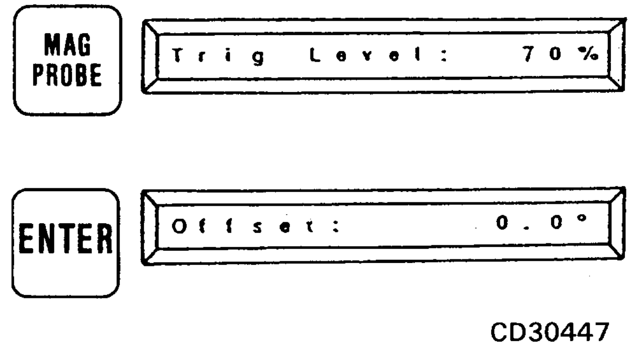
CD,FKM10429A,10 –19–03MAY01–1/6

3. Press “MAG PROBE” key. A default “trig level” value of 30% will appear. Then type in 70 to enter a 70% “trig level” and press the “ENTER” key.

4. A default “Offset” value of 20.0° will now appear. Type in 0.0 to enter a 0.0° “Offset” value and press the “ENTER” key.

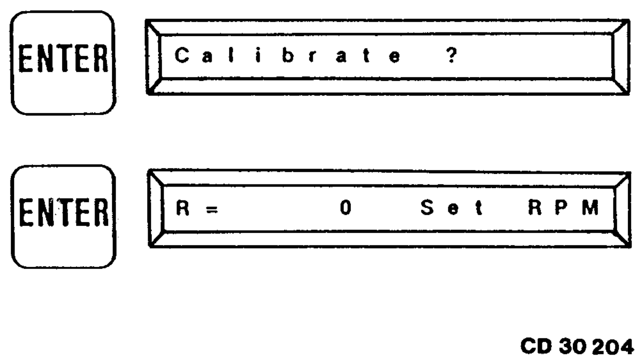


CD30447 –UN–10MAY96

CD,FKM10429A,10 –19–03MAY01–2/6

5. The display will now show “Calibrate?”. The meter is now ready to accept a timing sensor signal for calibration.

6. Press “ENTER” to perform calibration. Run engine at 1300 rpm. The display will automatically show the engine speed.

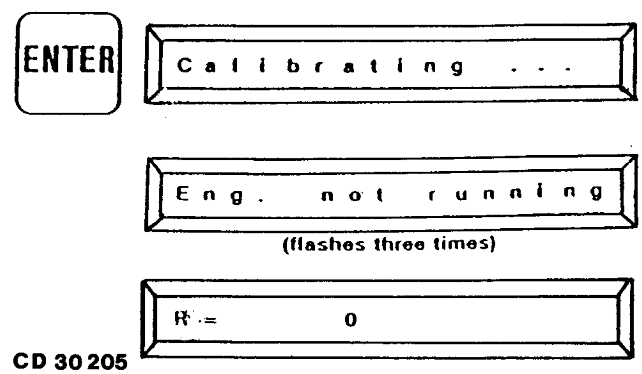


CD30204 –UN–07MAR95

CD,FKM10429A,10 –19–03MAY01–3/6

7. Once 1300 rpm is displayed, press “ENTER” key. “Calibrating ...” will then appear on the display for a short period of time.

NOTE: If the meter loses the engine speed signal or the engine is not running, the display will show “Eng. not running”. This message flashes three times before the meter returns to tachometer mode. To restart the procedure, press “MAG PROBE” key (step 3).



CD30205 –UN–07MAR95

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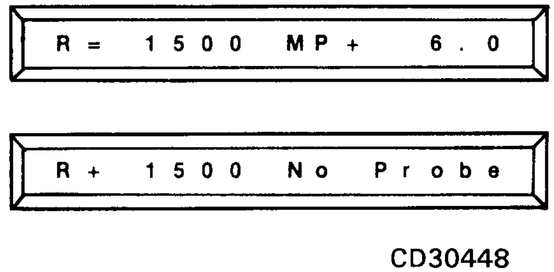
8. Run engine at fast idle speed then load engine down gradually to rated speed ("see specifications") using dynamometer or any other system allowing to load engine.

9. Record engine speed rpm and timing degrees.

NOTE: If display shows "R + 1500 No Probe", the magnetic probe has not been installed properly [air gap exceeds 0.65 mm (0.025")] or there is debris on the back of the flywheel. Check for proper air gap or to clean the back side of the flywheel.



CD30448 –UN–10MAY96

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CD,FKM10429A,10 –19–03MAY01–5/6

10.Stop engine and, if necessary, rotate injection pump as follows:

- If below specification, rotate pump towards engine block.
- If above specification, rotate pump away from engine block.

IMPORTANT: Stop engine prior to making timing adjustments. Injection pump can seize if adjustment is made with engine running.

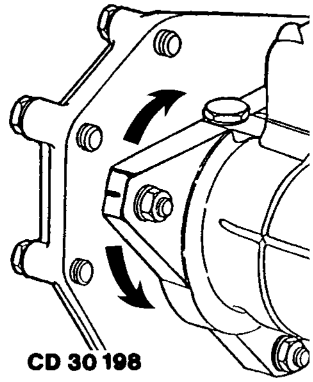
NOTE: 1 mm offset on the injection pump flange corresponds approximately to 2° on the meter display.

11. Recheck timing until specified timing is obtained.

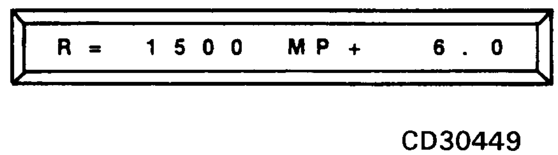
12. After adjustment, grind the engine front plate mark to avoid any confusion with the original timing adjustment.

NOTE: If the injection pump has to be removed from engine and reinstalled without any change, mark both the front plate and the injection pump flange to allow the reinstallation of injection pump at the same location.

In case of repair or replacement of injection pump, perform again a dynamic timing.



CD30198 –UN–05MAY95



CD30449 –UN–10MAY96

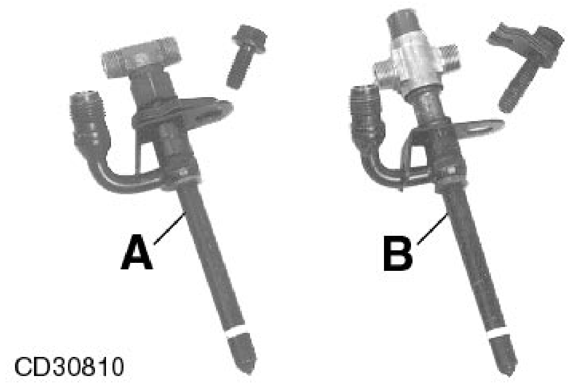
CD,FKM10429A,10 –19–03MAY01–6/6

Fuel Injection Nozzle Identification

Two types of fuel injection nozzles can be found on POWERTech 2.9 L engines.

- Conventional nozzle (A)
- Rate Shaping Nozzle (B)

The Rate Shaping Nozzle (RSN) gives to engines more aptitude to comply with exhaust emissions regulations

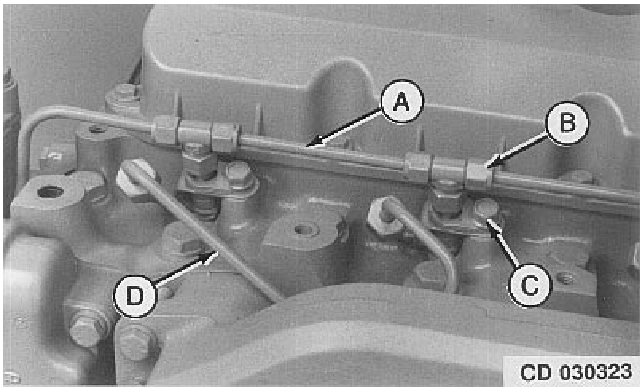


CD30810 –UN–17APR01

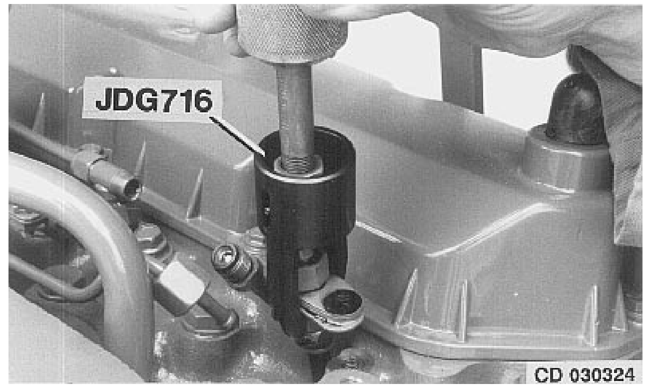
A—Conventional Nozzle
B—Rate Shaping Nozzle (RSN)

CD03523,0000115 –19–06FEB01–1/1

Remove Fuel Injection Nozzle



CD30323 –UN–17FEB95



CD30324 –UN–17FEB95

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.

IMPORTANT: Do not use screwdrivers or similar tools for this, as they may cause irreparable damage to the injection nozzles.

CD,CTM125,197 –19–06FEB01–1/1

Clean Fuel Injection Nozzle

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.

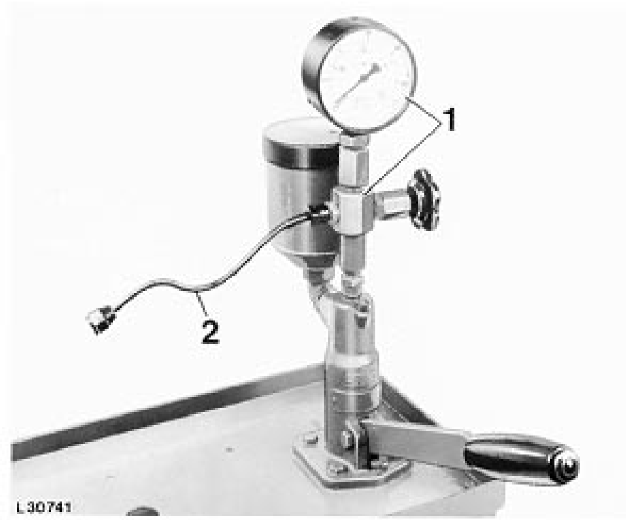
Remove the carbon stop seal from groove in nozzle body using suitable pliers. Pull seal washer from the nozzle body and discard carbon stop seal and seal washer.

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.

TEFLON is a trademark of Du Pont Co.

CD,CTM125,198 –19–06FEB01–1/1

Fuel Injection Nozzle Test



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.

Continued on next page CD,3274,G40,45 –19–06FEB01–1/4

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.

Continued on next page

CD,3274,G40,45 –19–06FEB01–2/4

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.

Fuel Injection Nozzle—Specification

Conventional nozzle (3029D - Non Certified Engines)—Opening pressure for setting (New or reconditioned)	22600—23200 kPa (226—232 bar; 3277—3364 psi)
Opening pressure for checking (New or reconditioned)	22300 kPa (223 bar; 3233 psi) Mini
Opening pressure for setting (Used)	21500—22100 kPa (215—221 bar; 3118—3205 psi)
Opening pressure for checking (Used)	20400 kPa (204 bar; 2958 psi) Mini
Conventional nozzle (3029D - Certified Engines)—Opening pressure for setting (New or reconditioned)	24400—24900 kPa (244—249 bar; 3540—3620 psi)
Opening pressure for checking (New or reconditioned)	24100 kPa (241 bar; 3500 psi) Mini
Opening pressure for setting (Used)	23000—23600 kPa (230—236 bar; 3340—3420 psi)
Opening pressure for checking (Used)	21800 kPa (218 bar; 3170 psi) Mini
Conventional nozzle (3029T Engines)—Opening pressure for setting (New or reconditioned)	26100—26600 kPa (261—266 bar; 3780—3857 psi)
Opening pressure for checking (New or reconditioned)	25700 kPa (257 bar; 3727 psi) Mini
Opening pressure for setting (Used)	24700—25200 kPa (247—252 bar; 3580—3654 psi)
Opening pressure for checking (Used)	23500 kPa (235 bar; 3407 psi) Mini

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CD,3274,G40,45 –19–06FEB01–3/4

Rate Shaping Nozzle (3029D - Certified Engines)—Opening pressure for setting (New or reconditioned) .... 24400—24900 kPa (244—249 bar; 3540—3620 psi)
Opening pressure for checking (New or reconditioned) .... 24100 kPa (241 bar; 3500 psi) Mini
Opening pressure for setting (Used) .... 23000—23600 kPa (230—236 bar; 3340—3420 psi)
Opening pressure for checking (Used) .... 21800 kPa (218 bar; 3170 psi) Mini
Nozzle (All types)—Opening pressure difference between cylinders .... 700 kPa (7 bar; 100 psi) Maxi

If spray pattern, leakage test, and valve wear test are good but the opening pressure test is unsatisfactory, adjust opening pressure.

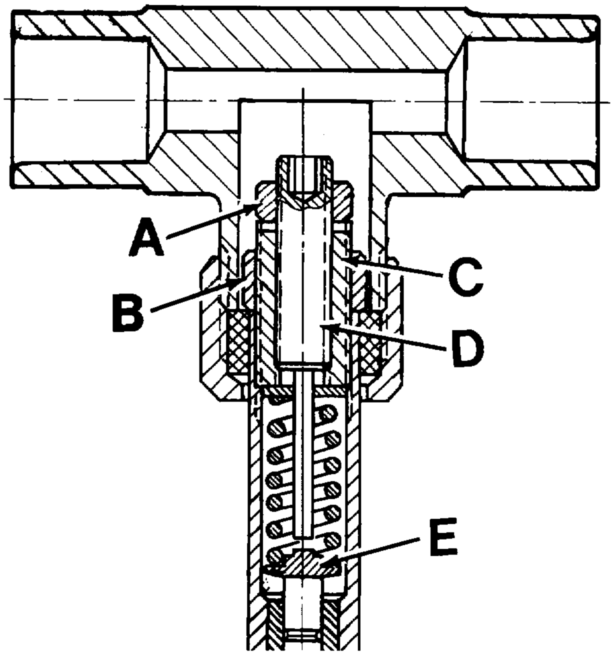
CD,3274,G40,45 –19–06FEB01–4/4

Fuel Injection Nozzle Disassembly

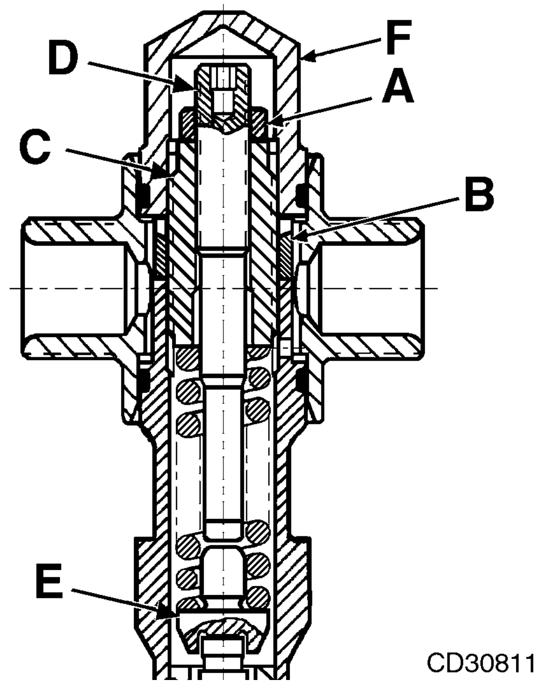
NOTE: If all tests prove that the nozzle performs properly, no further service is necessary and the nozzle can be reinstalled. If an injection nozzle is not operating properly and must be disassembled for cleaning and/or reconditioning, see your “Stanadyne” dealer.

CD,3274,G40,46 –19–01FEB94–1/1

Adjust Fuel Injection Nozzle



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.

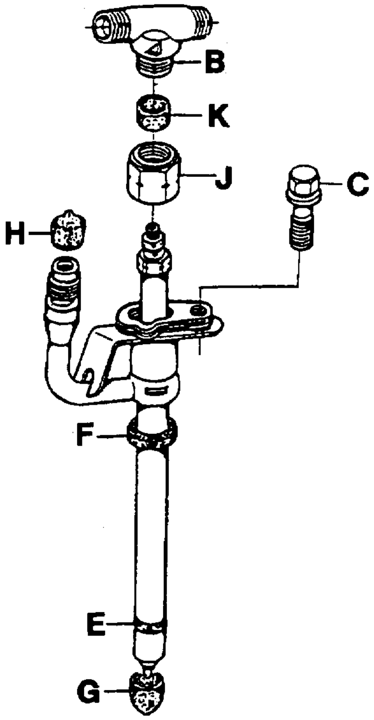
9. Recheck opening pressure.

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

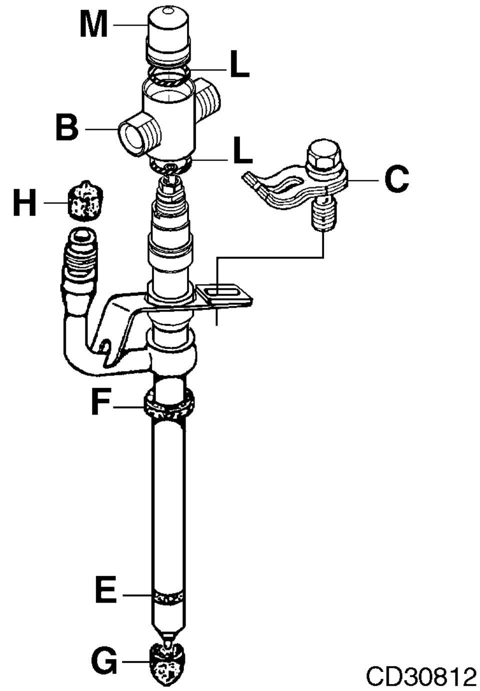
CD,CTM125,199 –19–07FEB01–1/1

Install Fuel Injection Nozzle



CD30675 –UN–16JUN98

Conventional nozzle



CD30812 –UN–28MAY01

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. Slide seal washer (F) onto nozzle body. Using JD-258 pilot tool, slide the new carbon stop seal until it fits properly into the groove.

Continued on next page

CD,CTM125,200 –19–07FEB01–1/2

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.

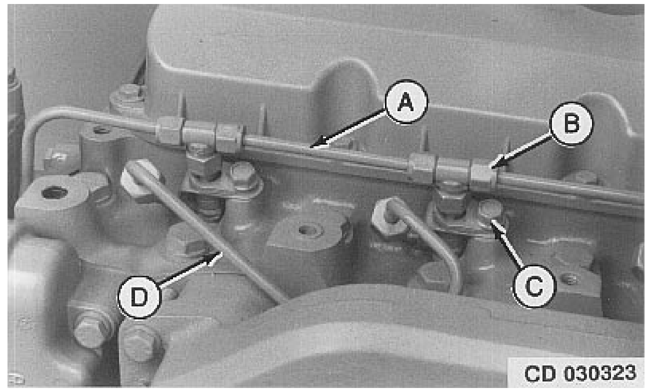
3. Connect fuel injection line (D) to nozzle. Tighten pressure line to specification using two wrenches as shown.

4. Tighten cap screws (C) to specification.

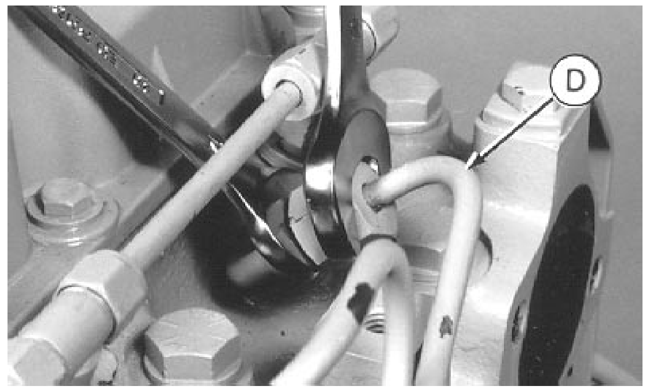
5. Install leak-off lines (A) and T-fittings (B). Tighten nut to specification.

Fuel injection nozzle—Specification

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)



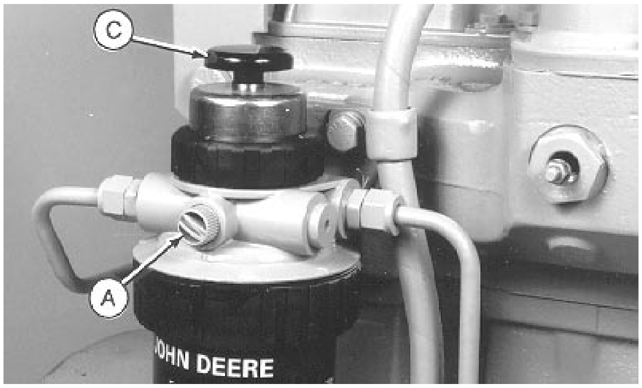
CD30323 –UN–17FEB95



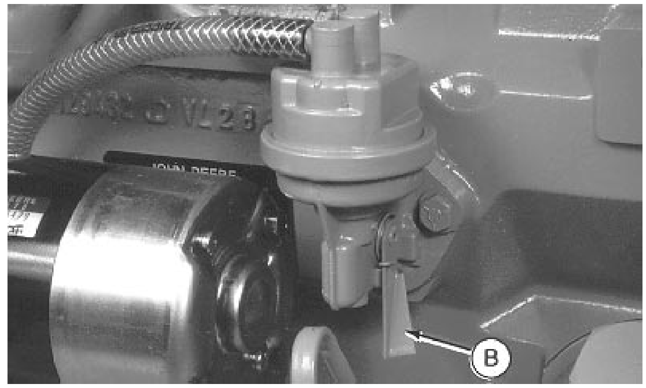
CD30676 –UN–20MAY98

CD,CTM125,200 –19–07FEB01–2/2

Bleed Fuel System



CD30677 –UN–20MAY98



CD30678 –UN–20MAY98

A - In Area of Fuel Filter

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.

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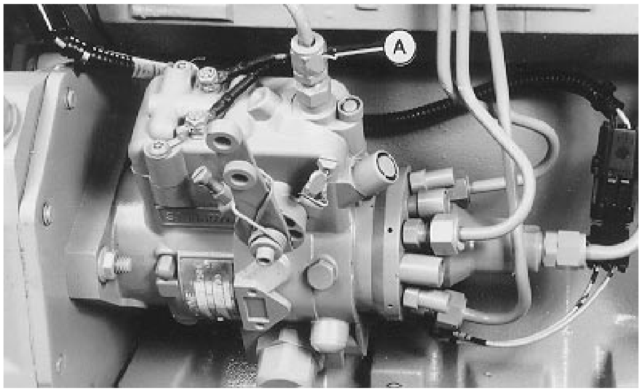
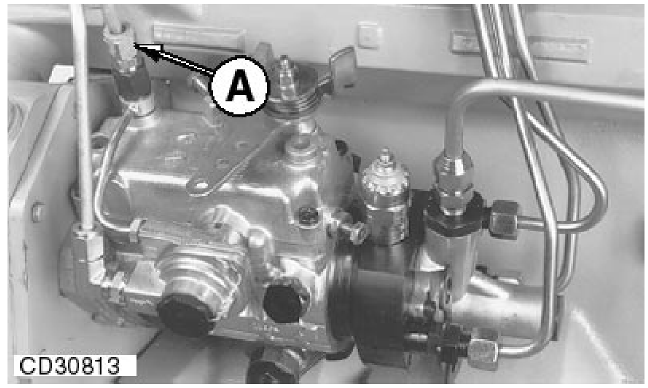


CD30679 –UN–04MAY98

Stanadyne pump



CD30813 –UN–17APR01

Delphi/Lucas pump

B - In Area of 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.

CD,CTM125,203 –19–07FEB01–2/3

C - 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.

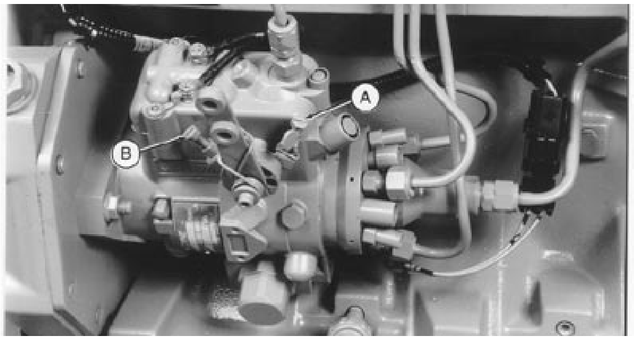
2. Using two open-end wrenches, loosen fuel line on at least three nozzles.

3. Turn over engine with starter motor until fuel flows free from bubbles out of loosened fuel nozzle connections. Retighten connections.

CD30680 –UN–04MAY98

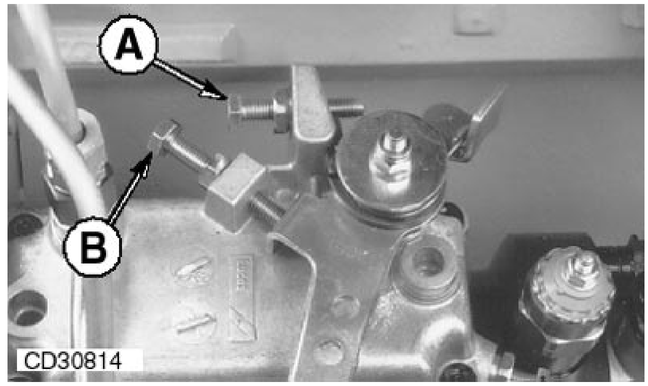
CD,CTM125,203 –19–07FEB01–3/3

Check Engine Speed



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 counter-clockwise to decrease engine speed.

CD,CTM125,204 –19–07FEB01–1/1

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

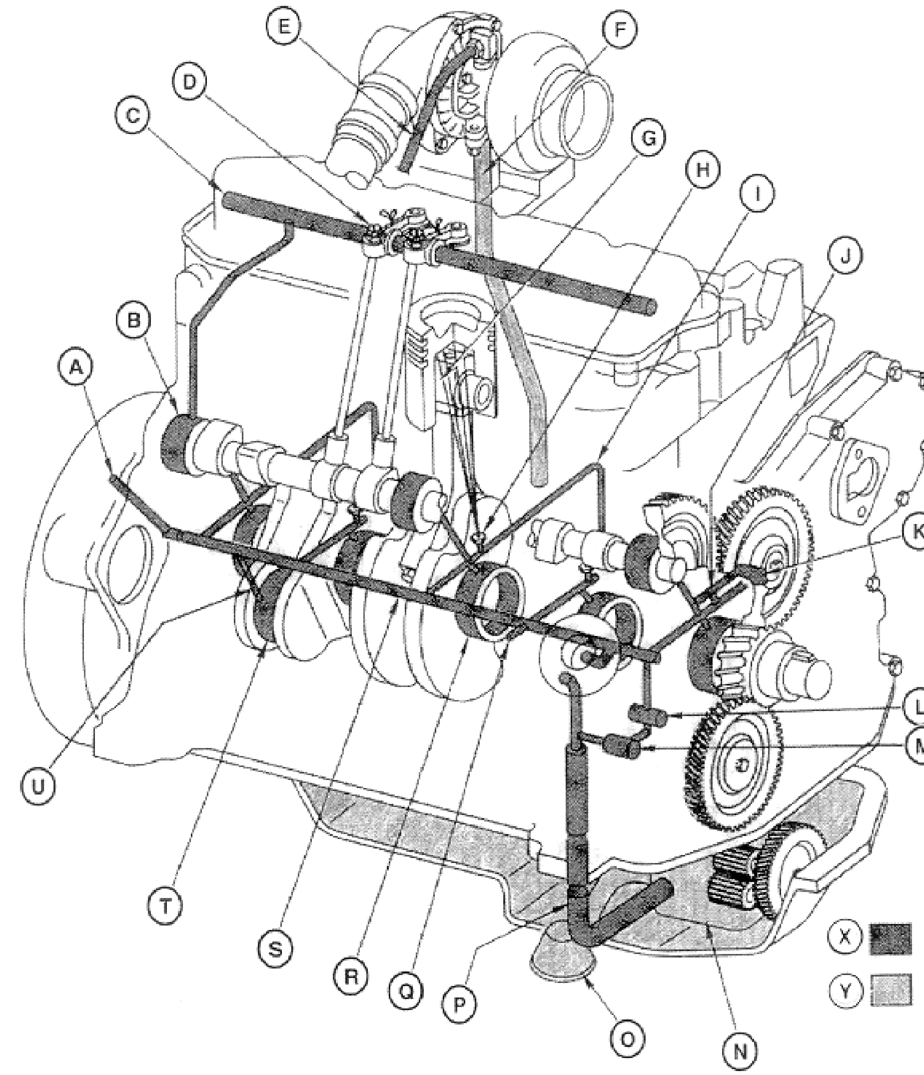
General Tune-Up Recommendations

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

CD,CTM125,208 –19–16FEB01–1/1

Lubrication System



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.

Continued on next page CD,3274,G205,3 –19–03NOV92–1/3

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).

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CD,3274,G205,3 –19–03NOV92–2/3

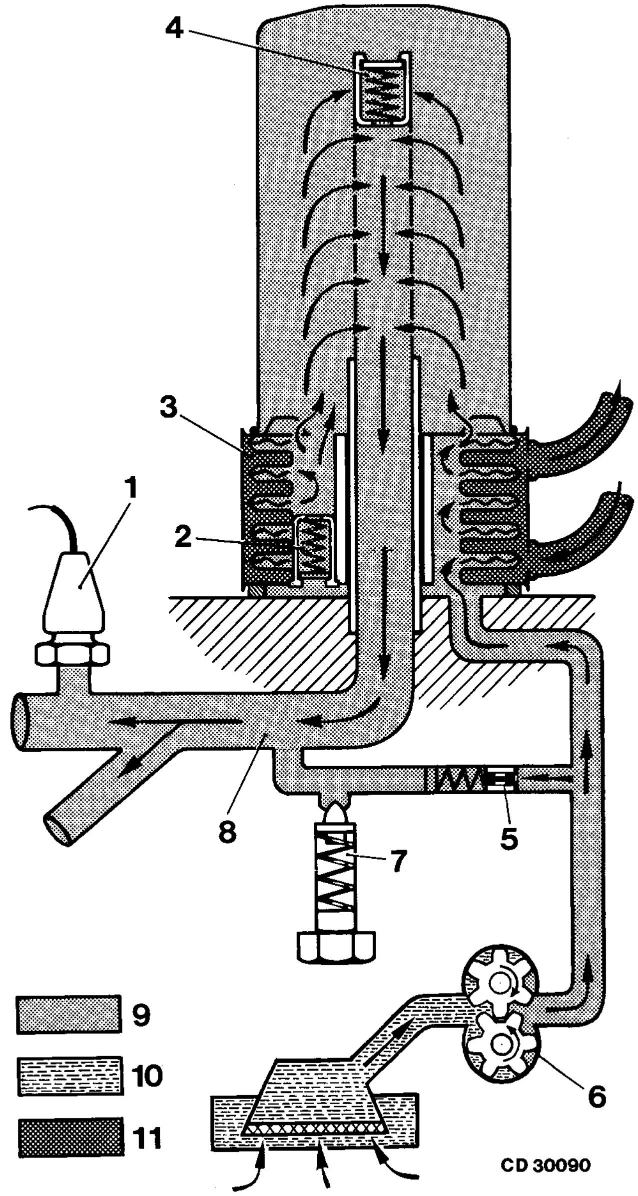
An externally adjustable pressure regulating valve is located at the front of the cylinder block in the oil gallery. It controls the oil pressure and provides constant pressure in the main gallery and in the complete lubrication system.

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.

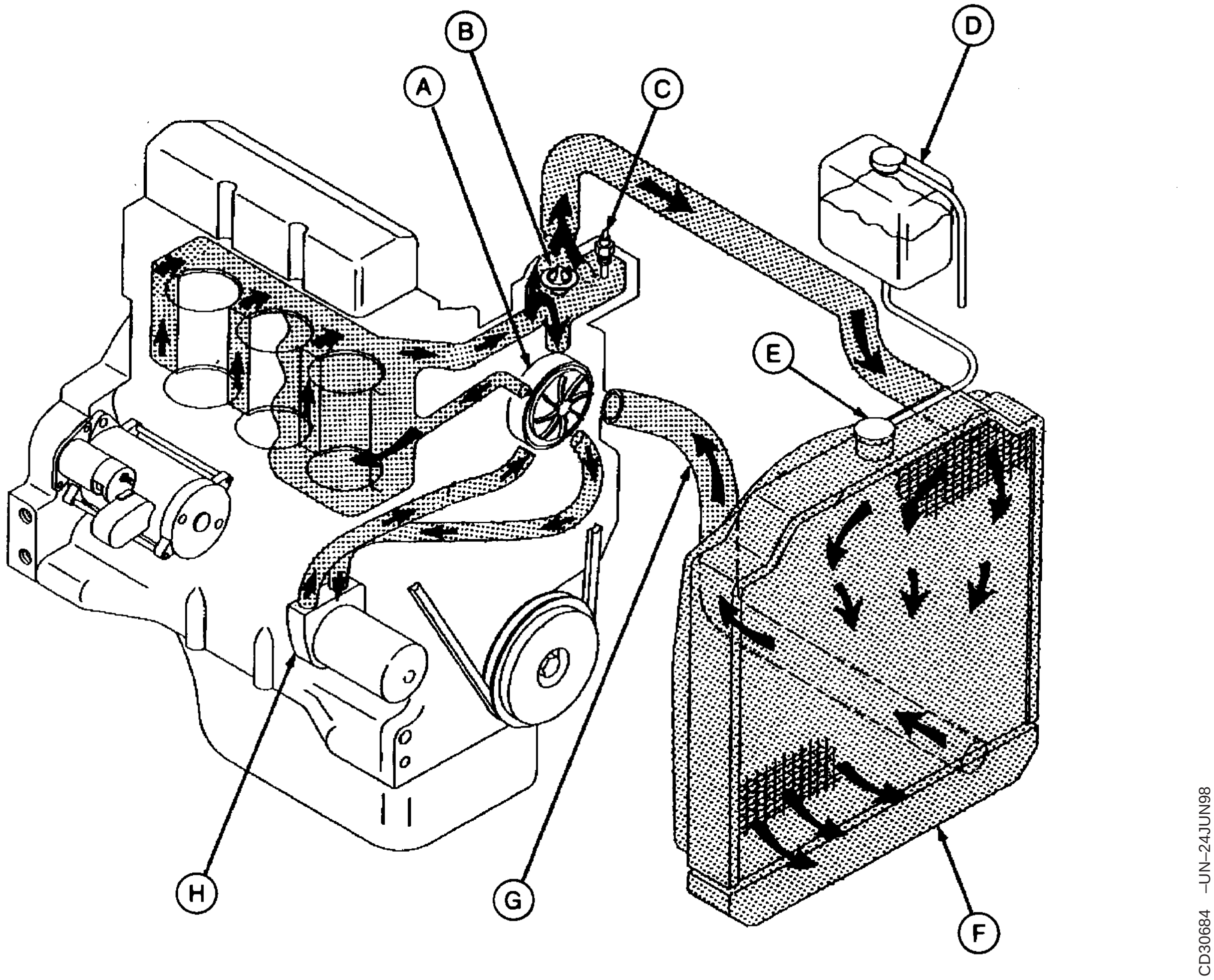


CD30090 –UN–08MAR95

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

CD,3274,G205,3 –19–03NOV92–3/3

Cooling System



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.

Continued on next page

On some engines the water pump has two further hose connectors which lead to the engine oil cooler (H).

CD,CTM125,211 –19–01DEC97–2/2

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

Continued on next page

- 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
- 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

Continued on next page

CD,CTM125,213 –19–04MAY01–2/3

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

CD,CTM125,213 –19–04MAY01–3/3

110
4

Checking Engine Compression

NOTE: Before beginning check, ensure that battery is fully charged and injection nozzle area is thoroughly cleaned.

Start engine and run at slow idle for 10 to 15 minutes.

Remove fuel injection nozzles (see Group 40).

Install 19.58-90.578[1] adapter (A) in injection nozzle bore with R73788[1] nozzle spacer (B) and 2 R92352[1] nozzle seals (C). Attach test gauge FKM10022[1] to adapter.

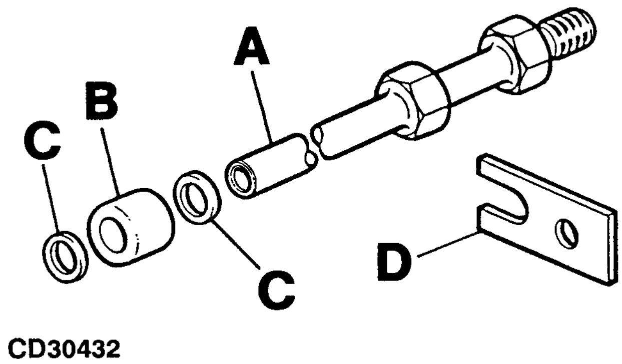
Push throttle lever to “STOP” position. Turn crankshaft for a few seconds with starting motor (minimum cranking speed — 150 rpm).

Compare readings from all cylinders with specification.

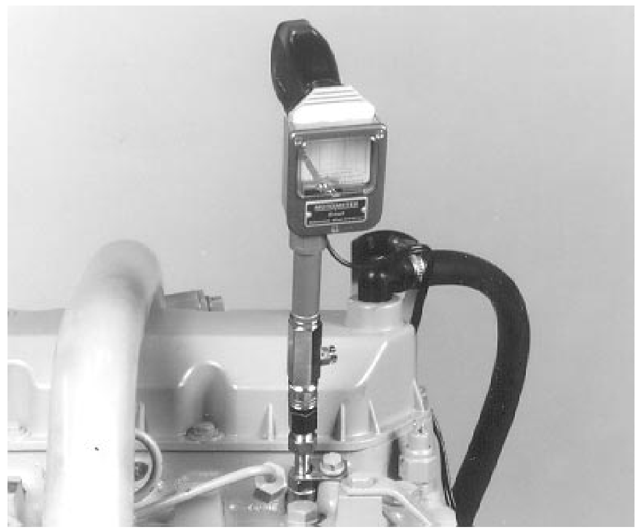
Engine compression pressure—Specification

Minimum—Pressure	2400 kPa (24 bar; 350 psi)
Maximum—Difference between cylinders	350 kPa (3.5 bar; 50 psi)

A—19.58-90.578 adapter[1]
B—R73788 nozzle spacer[1]
C—R92352 nozzle seal[1]
D—Holding plate[1]



CD30432 –UN–10MAY95

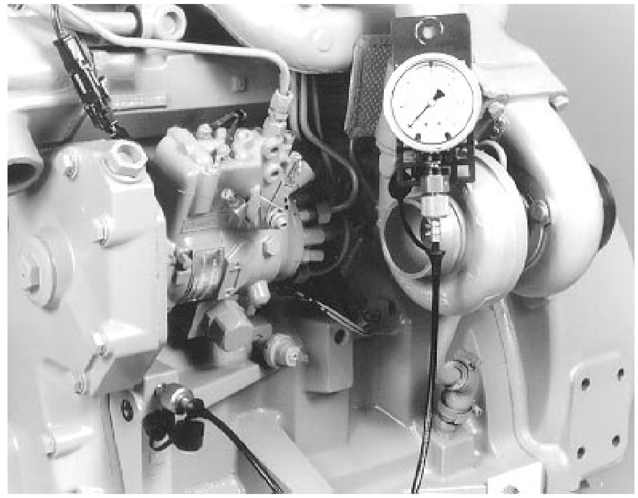


CD30685 –UN–04MAY98

[1]Part of FKM10021 compression test kit

CD,CTM125,216 –19–16FEB01–1/1

Check Engine Oil Pressure



CD30686 –UN–04MAY98

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)

CD,CTM125,217 –19–16FEB01–1/1

Measure Engine Blow-By

Place a hose with a standard gas gauge over end of crankcase vent tube.

Run engine at rated speed (engine at operating temperature and run-in, with at least 100 operating hours).

Measure blow-by over a period of 5 minutes then compare with specifications.

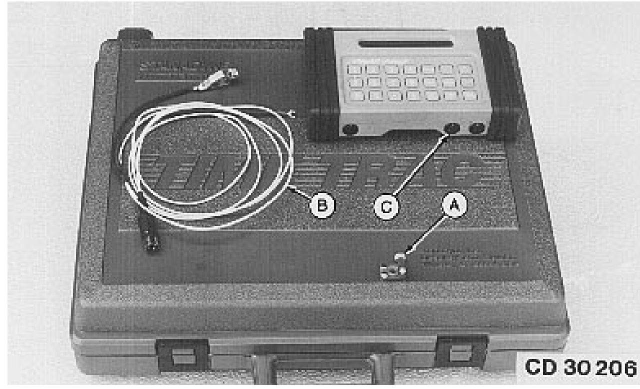
Engine blow-by at crankcase vent tube —Specification

3029D—Maximum flow rate at full load rated speed... 4 m^3/h (141 cu-ft/h)
3029T—Maximum flow rate at full load rated speed... 6 m^3/h (225 cu-ft/h)

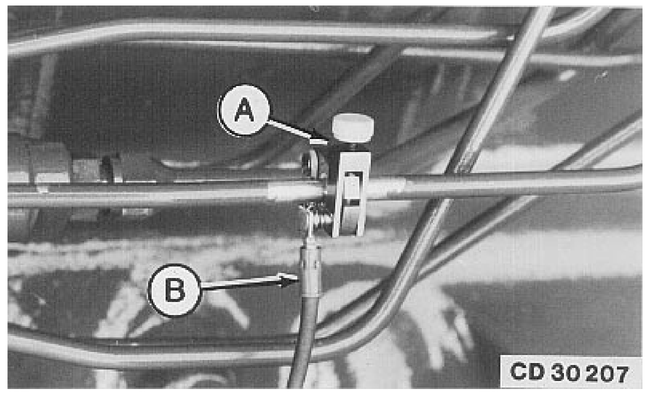
If blow-by is lower, there is no excessive wear between piston rings and liners. For a further check, carry out compression test. If blow-by is higher, there is excessive wear between piston rings and liners, resulting in loss of engine power. Overhaul the engine.

CD,CTM125,218 –19–19FEB01–1/1

Using Stanadyne “TIME-TRAC” as Tachometer



CD30206 –UN–07MAR95



CD30207 –UN–07MAR95

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.

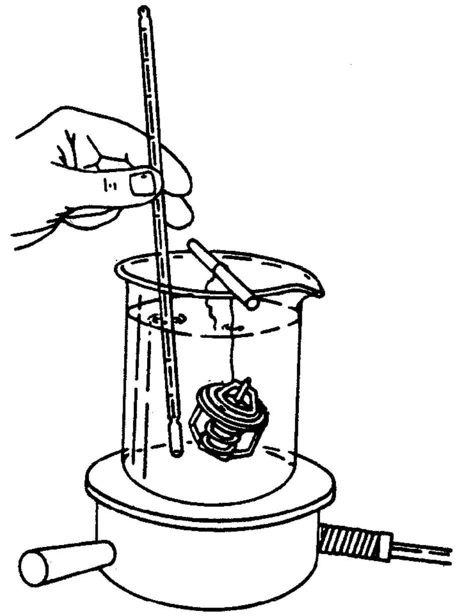
2. Install transducer (A) and connect cable FKM10429-3 (B) between transducer and socket meter (C). Also connect ground wire.

3. Switch on the meter by pressing the “ON/CLEAR” key and start the engine.

A—Clamp-on transducer FKM10429-5
B—Cable FKM10429-3
C—Timing meter FKM10429-1

CD,3274,G210,10 –19–15MAY92–1/1

Inspect Thermostat and Test Opening Temperature



RG5971 –UN–23NOV97

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

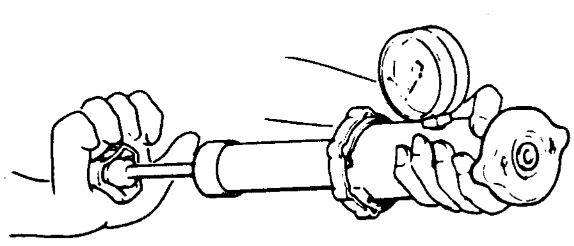
Rating	**Initial Opening (Range)**	**Full Open (Nominal)**
71°C (160°F)	69—72°C (156—162°F)	84°C (182°F)
77°C (170°F)	74—78°C (166—172°F)	89°C (192°F)
82°C (180°F)	80—84°C (175—182°F)	94°C (202°F)
89°C (192°F)	86—90°C (187—194°F)	101°C (214°F)
90°C (195°F)	89—93°C (192—199°F)	103°C (218°F)
92°C (197°F)	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)

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.

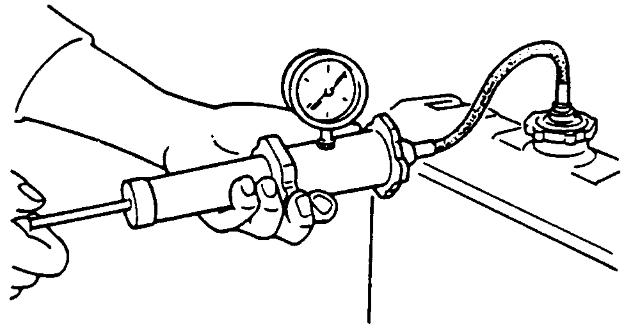
CD,CTM125,229 –19–01DEC97–1/1

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 cap is acceptable.

If gauge does not hold pressure, replace radiator cap.

3. Remove the cap from gauge, turn it 180°, and retest cap. This will verify that the first measurement was accurate.

Test Cooling System:

NOTE: Engine should be warmed up to test overall cooling system.

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.

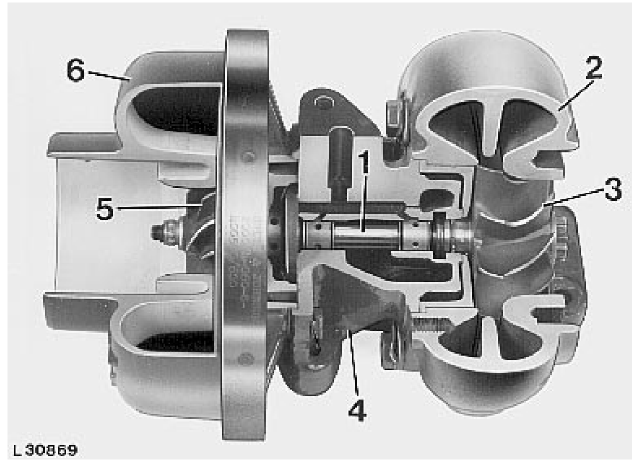
[1]Test pressures recommended are for all Deere OEM cooling systems. On specific vehicle applications, test cooling system and pressure cap according to the recommended pressure for that vehicle.

Continued on next page

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 –19–19FEB01–2/2

Turbocharger Operation



L30869 –UN–23MAY95

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.

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

Check Turbocharger Boost Pressure

CD30687 –UN–04MAY98

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

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).

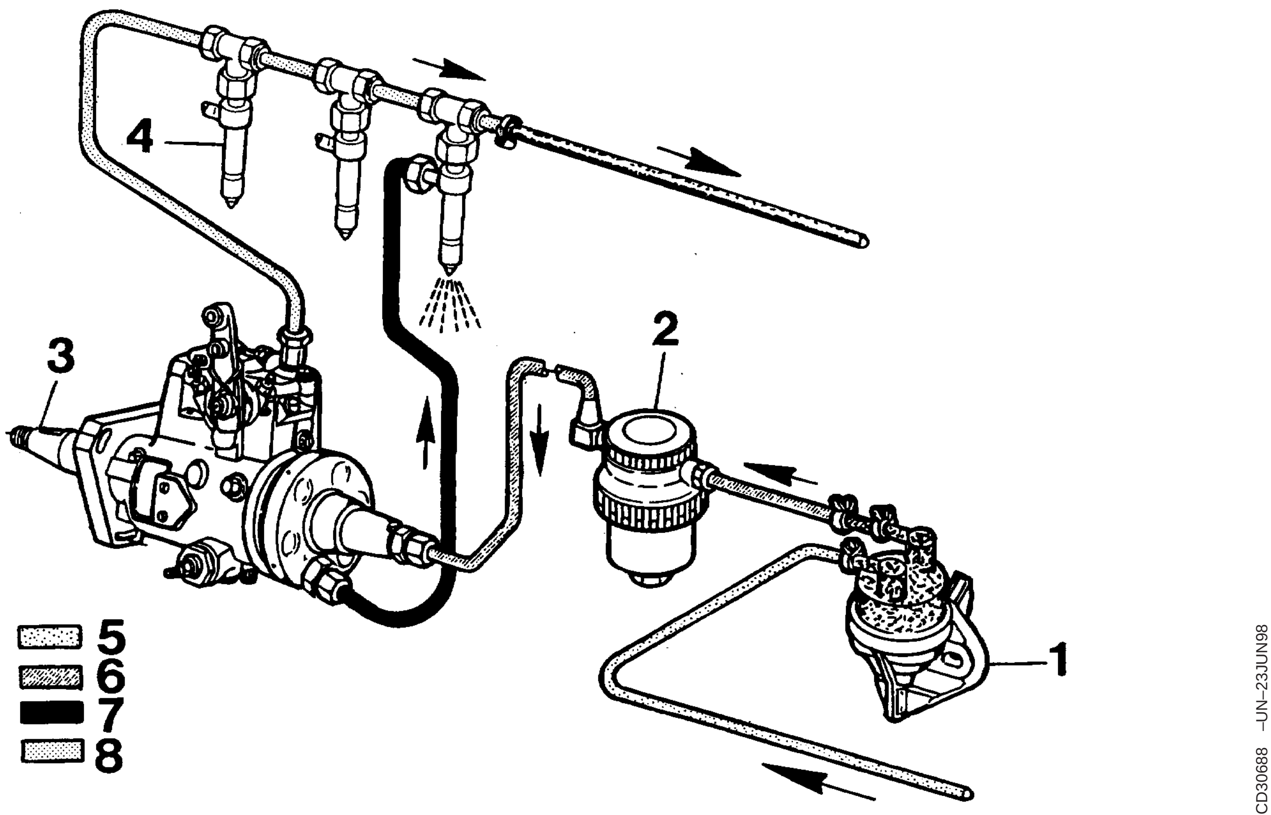
- Bearings not lubricated (insufficient oil pressure)
- Air leak in engine intake or exhaust manifold
- Improper clearance between turbine wheel and turbine housing
- Broken blades (or other wheel failures)

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



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 –19–01DEC97–1/1

120
2

Fuel Supply Pump Operation

CD30334 –UN–17FEB95

Fuel flows from the fuel tank at gravity pressure to the inlet side of the diaphragm-type pump. This pump increases the fuel pressure to 25—30 kPa (0.25—0.30 bar; 3.5—4.5 psi) at slow idle speed and forces fuel through the filter to the fuel injection pump.

The fuel transfer pump is operated by an eccentric lobe on the engine camshaft.

CD,CTM125,223 –19–19FEB01–1/1

Measure Fuel Supply Pump Pressure

CD30690 –UN–19MAY98

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—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.

CD,CTM125,225 –19–01DEC97–1/1

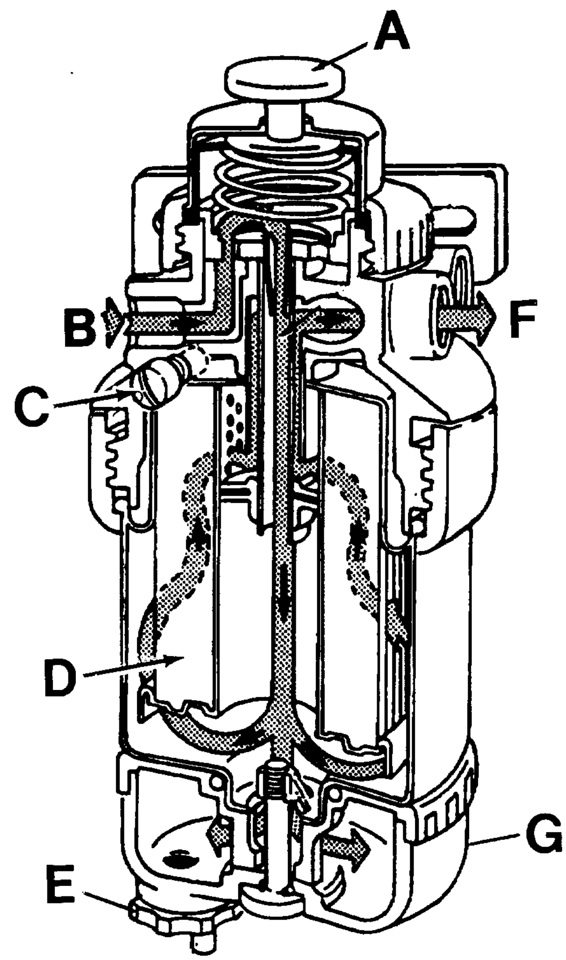
Fuel Filter Operation

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.

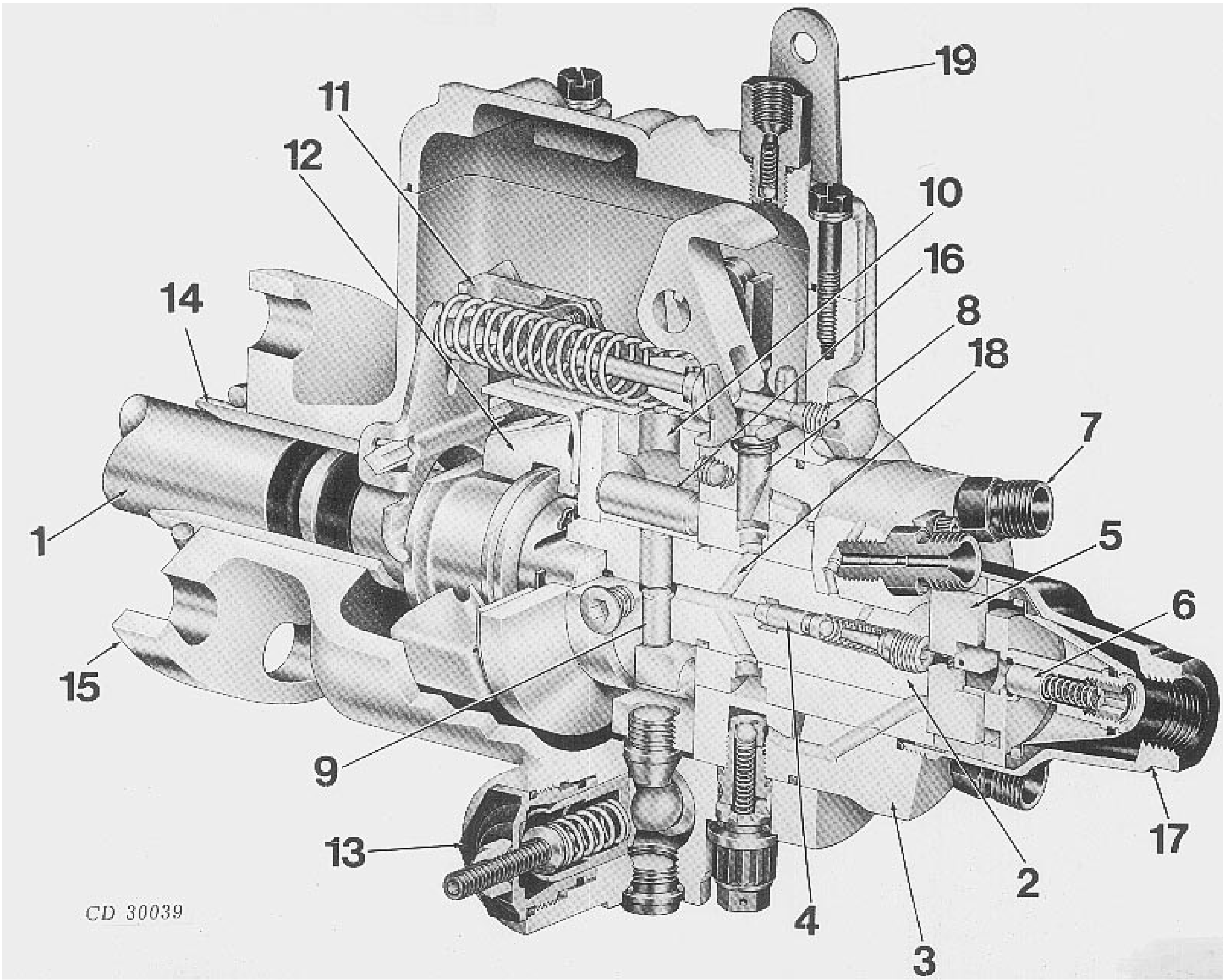


CD30689 –UN–16JUN98

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 –19–04NOV92–1/1

STANADYNE Fuel Injection Pump (DB2/DB4) - Operation



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.

Continued on next page

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.

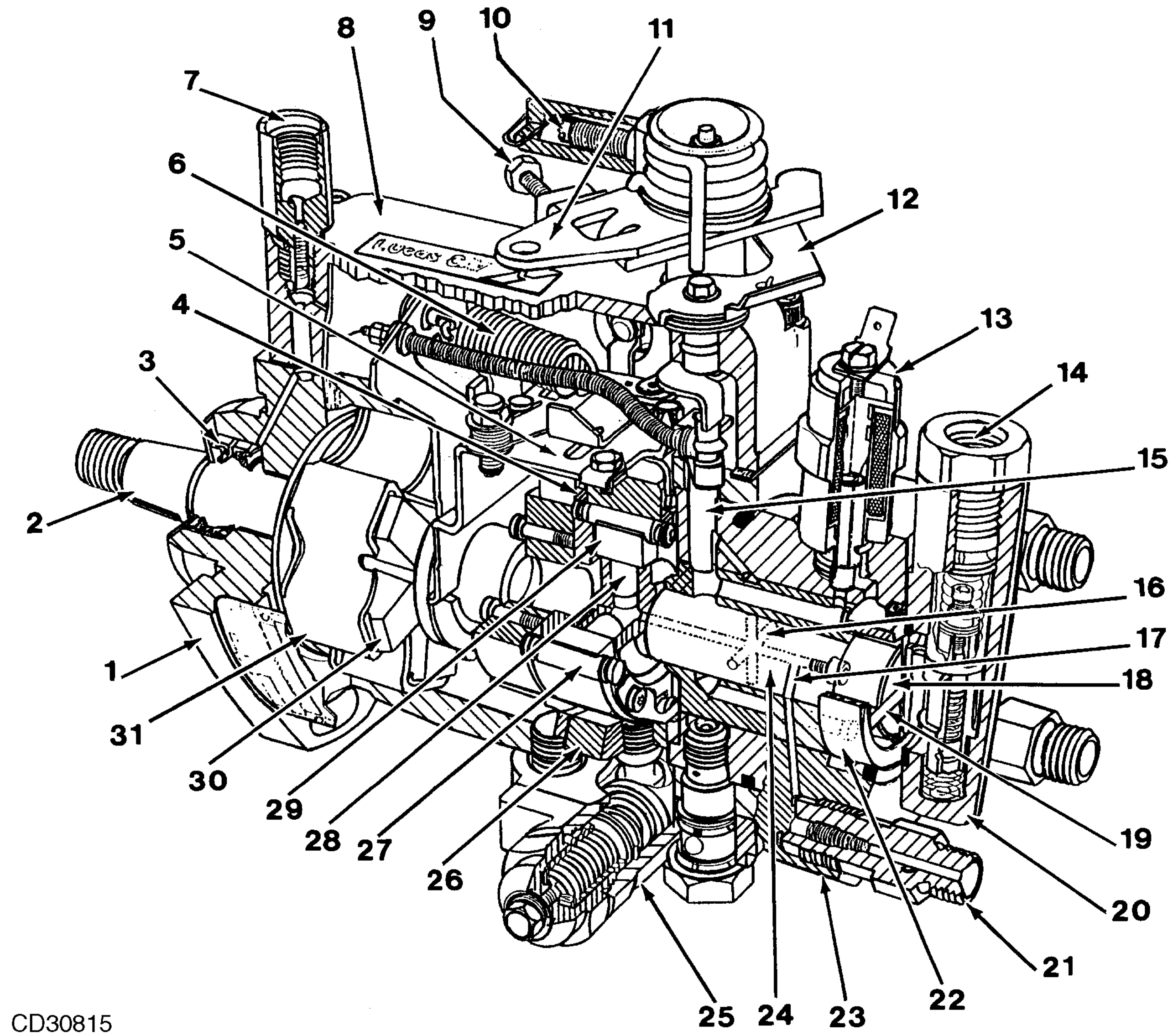
The automatic speed advance (13) either advances or retards hydraulically the beginning of fuel delivery from the pump. This can respond either to speed alone or to a combination of speed and load changes. The pump has also a light load advance system which provides additional advance in light load conditions. 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



CD30815 –UN–22MAR01

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

Continued on next page

CD03523,000011A –19–20FEB01–1/2

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).

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

120
8

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.

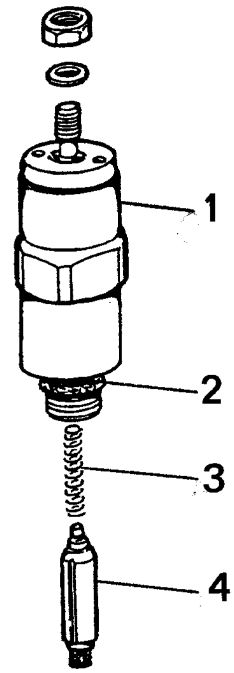
7. Connect the assembled solenoid to ground and apply the appropriate voltage (12 V or 24 V) in order to check if the solenoid operates correctly. Replace solenoid if test is not satisfactory.

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)

9. Reconnect the electrical supply and check for satisfactory operation.



1—Solenoid body
2—O-ring seal
3—Spring
4—Plunger

CD03523,000011B –19–20FEB01–1/1

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.

Continued on next page CD,3274,G220,11 –19–20FEB01–1/3

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.

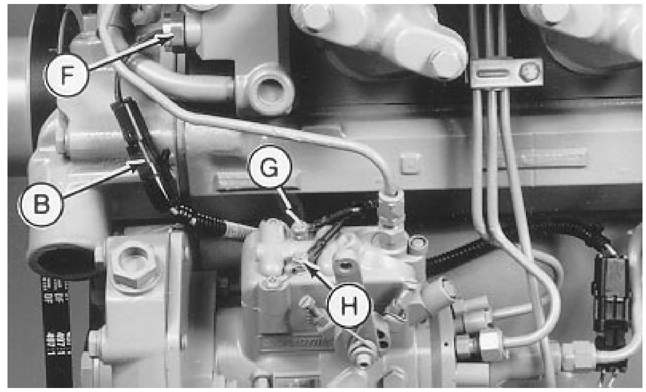
When coolant temperature is below 50°C (122°F), the solenoid valve (C) is activated and opens the cold advance circuit. This directs transfer pump pressure to the cold advance piston (D), forcing the advance piston to the fully advanced position.

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.

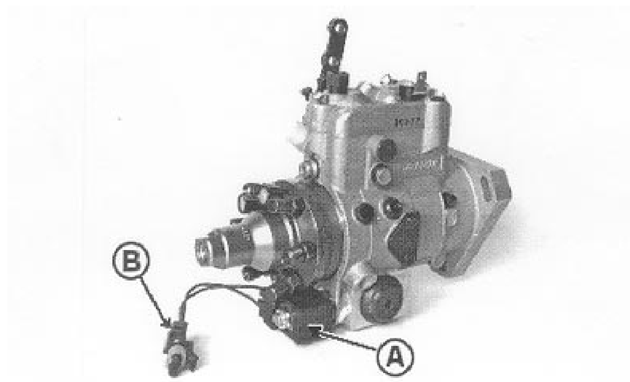
The normal advance is now running and is controlled by the speed and load advance mechanism.

The cold advance system is connected to the fuel shut-off terminals as follows:

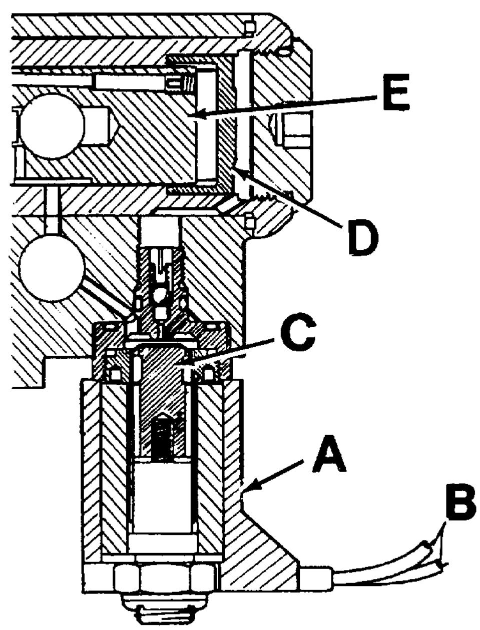
- Red wire to positive terminal (G)
- Black wire to negative (ground) terminal (H)



CD30691 –UN–19MAY98



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

Continued on next page

CD,3274,G220,11 –19–20FEB01–2/3

DELPHI/LUCAS Cold Start Advance

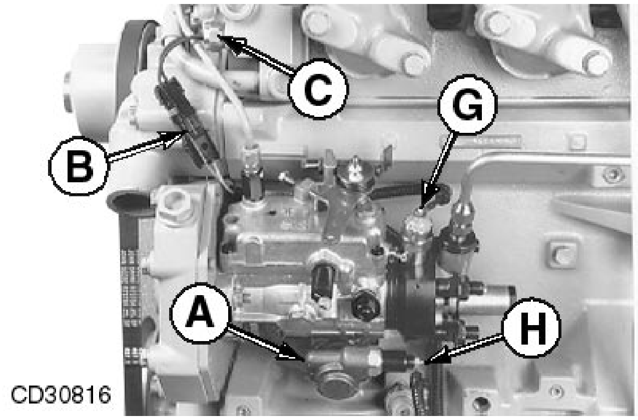
The cold start advance system is a wax motor (A) in relation with the advance piston, and connected through the wire (B) to a thermo-switch (C) located in thermostat cover.

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.

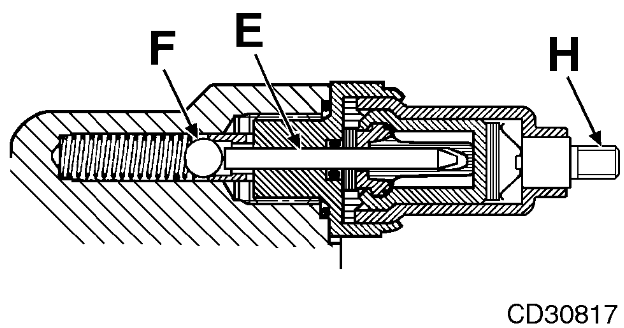
The cold start advance system harness is connected as follows:

- Red wire to fuel shut-off solenoid terminal (G)
- Orange wire to wax motor terminal (H)



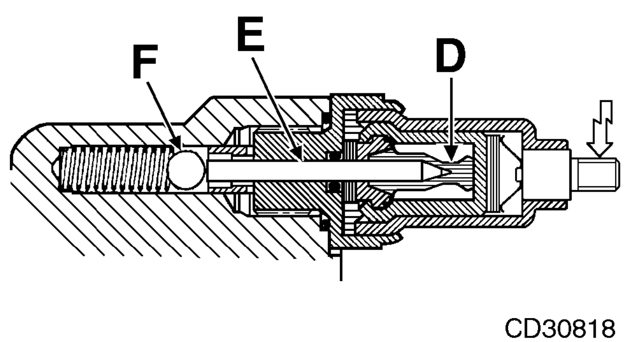
CD30816 –UN–17APR01

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)

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

CD,3274,G220,11 –19–20FEB01–3/3

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).

CD03523,000011C –19–20FEB01–1/3

STANADYNE Cold Start Advance

NOTE: Checks must be performed on a cold engine.

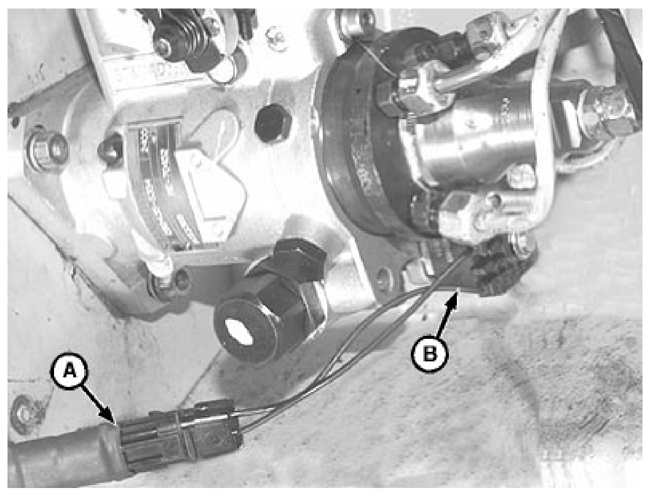
1. Install FKM10429A (JT07158) TIME TRAC Kit .

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

Continued on next page

CD03523,000011C –19–20FEB01–2/3

DELPHI/LUCAS Cold Start Advance

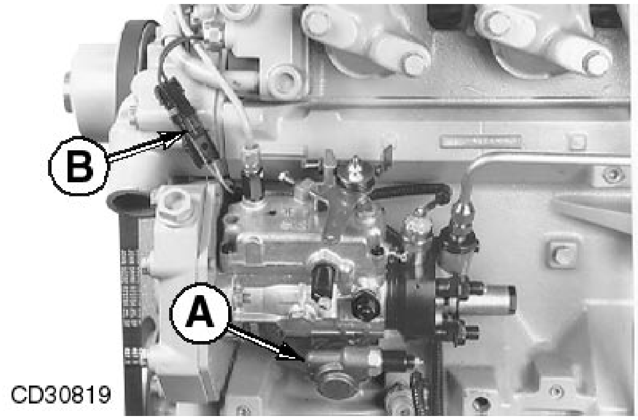
NOTE: Checks must be performed on a cold engine. The cold start advance wax motor (A) is located on the bottom, outboard side of the injection pump. There is a single terminal input lead to the wax motor.

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 –19–20FEB01–3/3

Check Cold Start Switch Operation

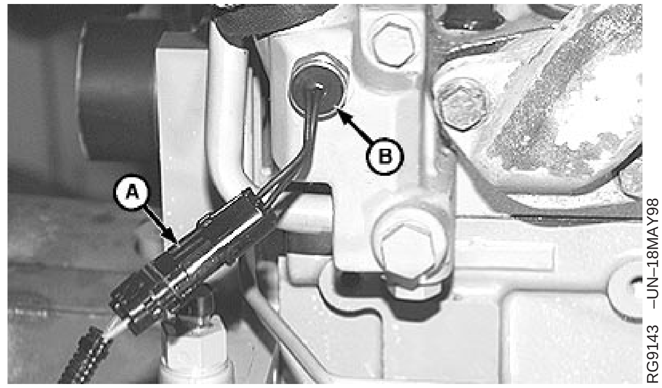
The cold start switch (B) is connected to the cold start advance device on injection pump.

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.)

7. Connect cold start switch connector to pump wiring harness.



Cold Start Switch

A—Connector
B—Cold start switch

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 .

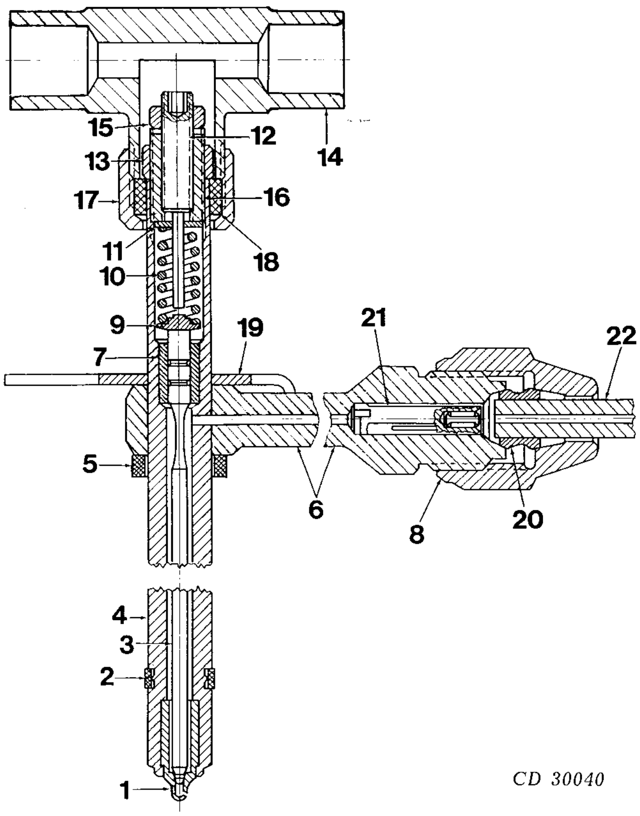
2. Operate engine at full load and rated speed. Note injection pump timing on TIME TRAC.

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.

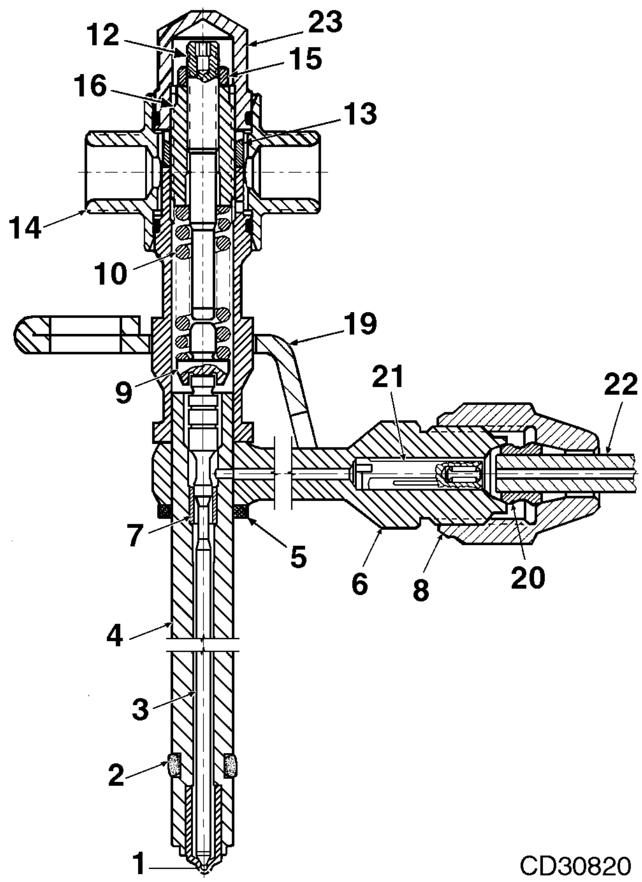
CD03523,000011F –19–20FEB01–1/1

Fuel Injection Nozzles - General Information



Conventional nozzle

CD30040 –UN–08MAR95



"RSN" Nozzle

CD30820 –UN–27MAR01

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 three superimposed spring clamps which press on a location clamp and a cap screw. The contact pressure is limited by a spacer ring. The nozzle is sealed in the cylinder head at its lower end with a carbon stop seal (2). The top end is sealed with seal washer (5). Clamp (19) ensures correct position of the complete fuel injection nozzle in the cylinder head. 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 works basically in the same way as a normal spray type nozzle. 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).

Continued on next page

DPSG,OUOE003,35 –19–20FEB01–1/2

The carbon stop seal (2) prevents carbon from collecting around nozzle in cylinder head. The fuel injection nozzles have four orifices.

DPSG,OUOE003,35 –19–20FEB01–2/2

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

200
1

Essential Tools

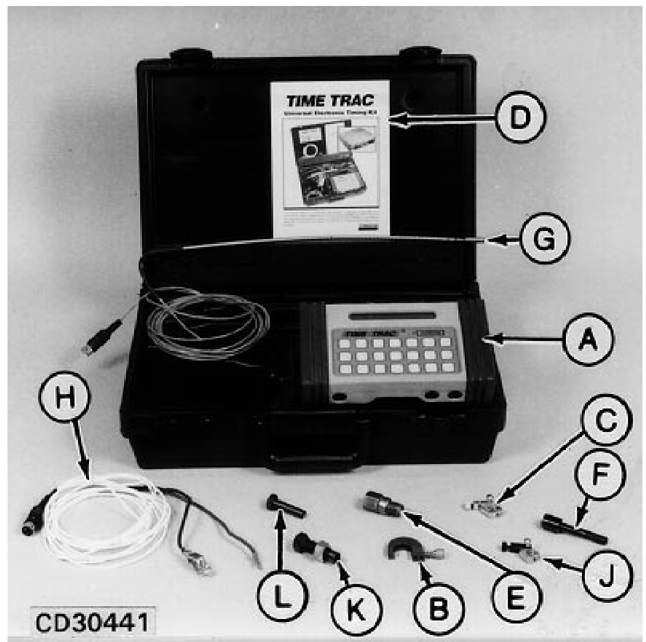
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

SERVICEGARD is a trademark of Deere & Company

CD03523,00000F2 –19–15JAN01–1/35

TIME-TRAC Diesel Engine Timing Tester . . FKM10429A (or JT07158)

To perform the dynamic timing of engines.



CD30441 –UN–10MAY96

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CD03523,00000F2 –19–15JAN01–2/35

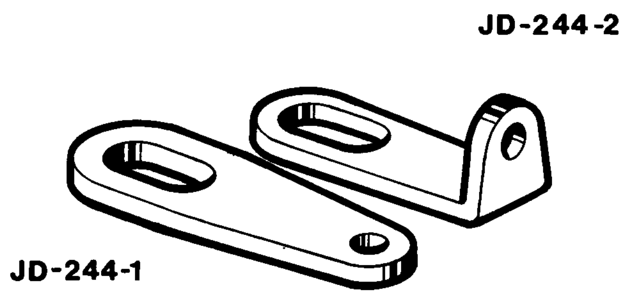
NOTE: FKM10429A contains the following components:

- *A-FKM10429-1 Meter*
- *B-FKM10429-4 Sensor clamp*
- *C-FKM10429-5 6 mm clamp-on transducer*
- *D-FKM10429-8 Instruction manual*
- *E-FKM10429-6 Timing sensor*
- *F-JDE81-4 Timing pin*
- *G-FKM10465-1 Magnetic probe*
- *H-FKM10465-2 Transducer cable*
- *J-FKM10465-3 1/4“ clamp-on transducer*
- *K-JDG793 Magnetic probe adapter*
- *L-JDG821 Magnetic probe adapter*

CD03523,00000F2 –19–15JAN01–3/35

Engine Lifting Straps . . . . JD-244 (or JD244)

Use to lift engine or to remove cylinder head from engine.



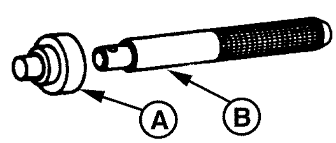
JD244 –UN–10MAY95

CD03523,00000F2 –19–15JAN01–4/35

RG5183 –UN–31OCT97

Bushing Driver (A). . . . . JD-248A (or JD248A)

Use with JDG536 Handle (B) to install oil pressure regulating valve bushing.



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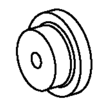
CD03523,00000F2 –19–15JAN01–5/35

Idler gear bushing driver . . . . JD-252 (or JD252)

Use with JDG537 Handle to remove and install idler gear bushings.



RG10566

JD252 (JD-252)

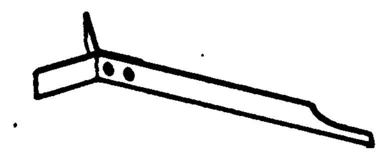
RG10566 –UN–28JAN00

CD03523,00000F2 –19–15JAN01–6/35

RG5118 –UN–23AUG88

Gear timing tool . . . . JD-254A (or JD254A)

Time camshaft gear, injection pump gear, and balancer shafts.

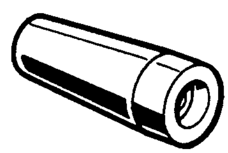


CD03523,00000F2 –19–15JAN01–7/35

CD30304 –UN–08MAR95

Seal installing tool . . . . JD-258 (or JD258)

To install carbon stop seal on nozzle.



CD 030304

CD03523,00000F2 –19–15JAN01–8/35

CD30285 –UN–08MAR95

Bearing driver . . . . JD-262A (or JD262A)

To install water pump bearing.

CD 030285

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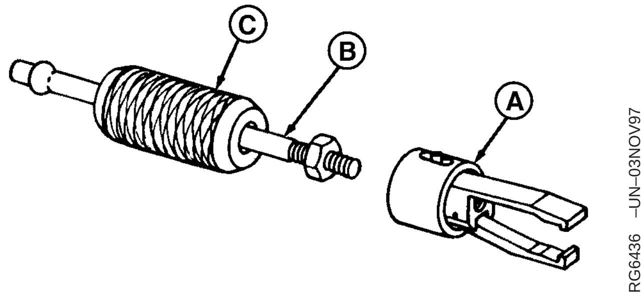
CD03523,00000F2 –19–15JAN01–9/35

Fuel Injection Nozzle Puller JDE38B

Remove Stanadyne 9.5 mm injection nozzles.

A—JDG716 Adapter[1]
B—JDE38-2 Shank
C—JDE38-3 Hammer



JDE38B Fuel injection puller

[1]*If JDE38 or JDE38A Nozzle Puller is available, order JDG716 Adapter only.*

CD03523,00000F2 –19–15JAN01–10/35

RG5084 –UN–23AUG88

Nozzle Bore Cleaning Tool JDE39

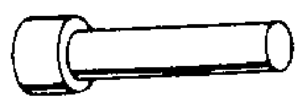
Clean injection nozzle bores in cylinder head.

CD03523,00000F2 –19–15JAN01–11/35

RG5068 –UN–05DEC97

Timing Pin JDE81-4

Lock engine at TDC when timing valve train. Use with JDG820 or JDE83 Flywheel Turning Tool.



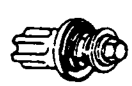
RG5068

CD03523,00000F2 –19–15JAN01–12/35

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 Timing Pin.



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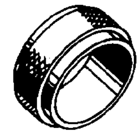
CD03523,00000F2 –19–15JAN01–13/35

RG5031 –UN–05DEC97

Piston Ring Compressor JDE84

Compress rings while installing pistons.

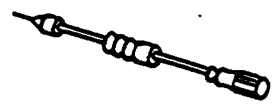


CD03523,00000F2 –19–15JAN01–14/35

RG5109 –UN–23AUG88

Slide hammer seal puller JDG22

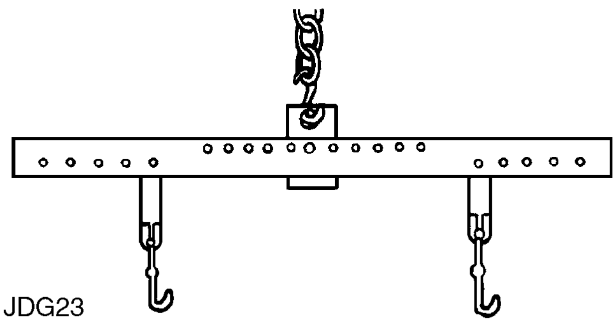
Used to remove seal.



CD03523,00000F2 –19–15JAN01–15/35

Engine Lifting Sling JDG23

Use to lift engine or to remove cylinder head from engine.



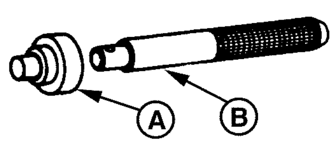
JDG23 –UN–02MAY01

CD03523,00000F2 –19–15JAN01–16/35

RG5183 –UN–31OCT97

Handle (B) JDG536 (OTC813)

Use with JD-248A (JD248A) Bushing Driver (A) to install oil pressure regulating valve bushing.



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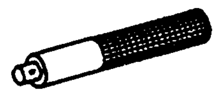
CD03523,00000F2 –19–15JAN01–17/35

Handle JDG537

Use with JD252 (JD-252) Idler Gear Bushing Driver to remove and install idler gear bushings.



RG10567 –UN–28JAN00

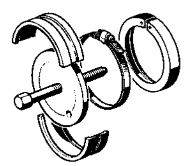
JDG537

CD03523,00000F2 –19–15JAN01–18/35

CD30241 –UN–08MAR95

Rear crankshaft wear sleeve puller . . . . JDG645E (or JDG698A)

Remove wear sleeve from rear crankshaft flange.

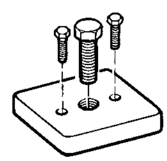


CD03523,00000F2 –19–15JAN01–19/35

CD30306 –UN–08MAR95

Injection pump removal tool. JDG670A

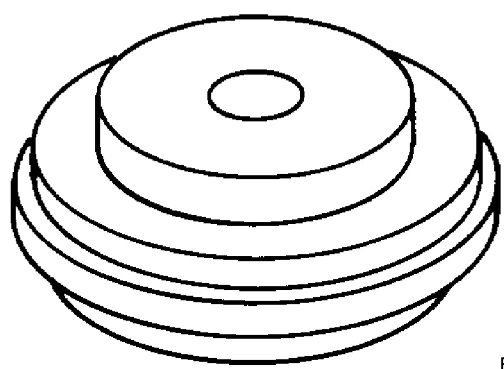
To remove drive gear from injection pump shaft.



CD03523,00000F2 –19–15JAN01–20/35

Valve Seat Insert Installing Adapter. . . . . JDG675 (or JDG698A)

Use with JDG676 Pilot Driver to install intake and exhaust valve seat inserts.



RG5240

RG5240 –UN–05DEC97

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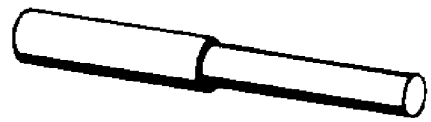
CD03523,00000F2 –19–15JAN01–21/35

RG5065 –UN–05DEC97

Valve Seat Driver JDG676

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



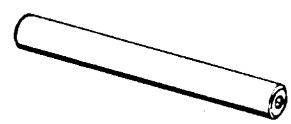
RG5065

CD03523,00000F2 –19–15JAN01–22/35

RG5612 –UN–12APR90

Valve Stem Seal Installer JDG678

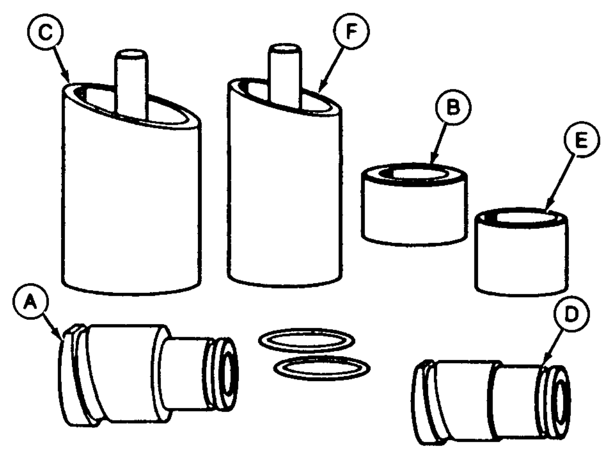
Use to install valve stem seals.



CD03523,00000F2 –19–15JAN01–23/35

Connecting Rod Bushing Remover and Installer. JDG738

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

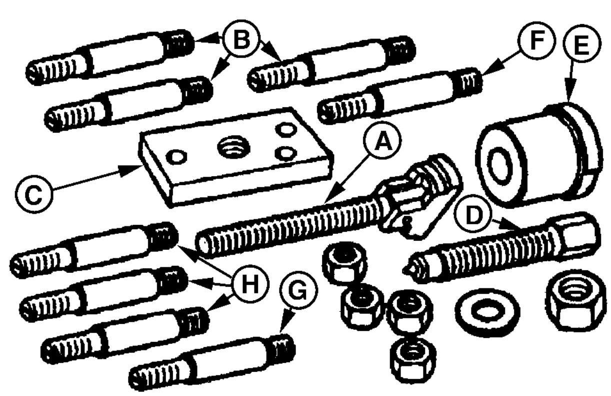


RG7028 –UN–26OCT94

CD03523,00000F2 –19–15JAN01–24/35

Camshaft bushing service set . . . . . . JDG739B (formerly JDG739 or JDG739A)

Used to replace camshaft bushing.



RG7651 –UN–07NOV97

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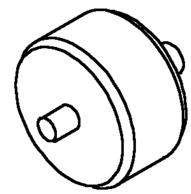
CD03523,00000F2 –19–15JAN01–25/35

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.

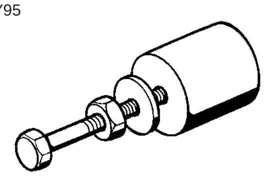


CD03523,00000F2 –19–15JAN01–26/35

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 –19–15JAN01–27/35

RG4950 –UN–23AUG88

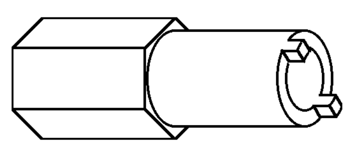
Flywheel Turning Tool . . . . . JDG820 (formerly JDE81-1)

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 Timing Pin.

CD03523,00000F2 –19–15JAN01–28/35

Injection Nozzle Wrench JDG949

Used to adjust opening pressure on conventional injection nozzles.



RG7644 –UN–23NOV97

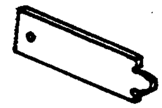
Continued on next page

CD03523,00000F2 –19–15JAN01–29/35

RG5076 –UN–23AUG88

Ring groove wear gauge. JDG957

Used to check top groove of pistons on engine with 6° angle ring.

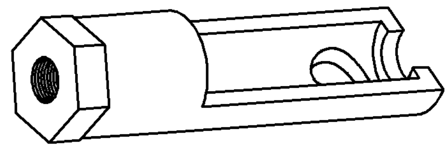


CD03523,00000F2 –19–15JAN01–30/35

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

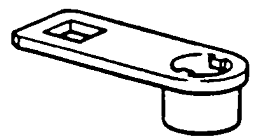
[1]*JDG1515-1 is part of JDG1515 Tool Set.*

CD03523,00000F2 –19–15JAN01–31/35

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

JDG1515-2 Pressure Adjusting Screw Locknut Wrench (RSN)

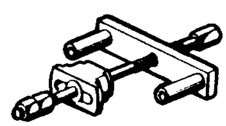
[1]*JDG1515-2 is part of JDG1515 Tool Set.*

CD03523,00000F2 –19–15JAN01–32/35

CD30234 –UN–08MAR95

Cylinder liner puller KCD10001

Used to remove and install cylinder liners.



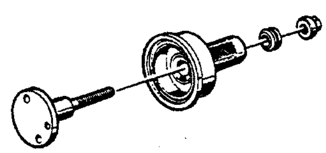
CD 030234

CD03523,00000F2 –19–15JAN01–33/35

CD30709 –UN–22FEB99

Oil seal/Wear sleeve installer set KCD10002A
(Formerly KCD10002) or JT30040B

Install rear crankshaft oil seal/wear sleeve assembly.

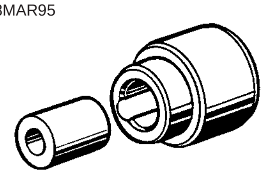


CD03523,00000F2 –19–15JAN01–34/35

CD30252 –UN–08MAR95

Front crankshaft oil seal driver KJD10164

Install front crankshaft oil seal.



CD 030252

CD03523,00000F2 –19–15JAN01–35/35

Service Equipment & Recommended Tools

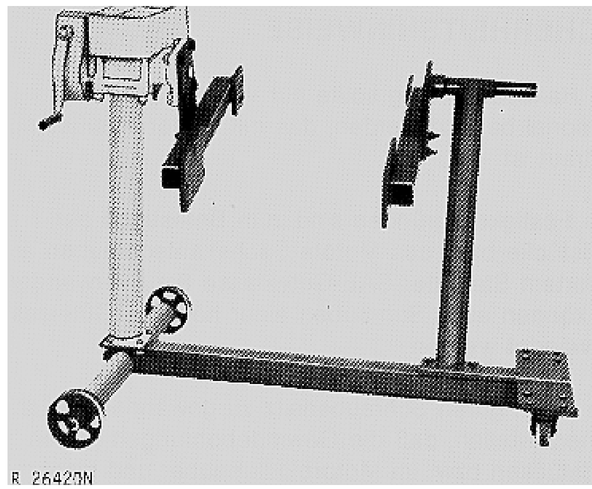
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

SERVICEGARD is a trademark of Deere & Company

CD03523,00000F3 –19–15JAN01–1/31

Engine Repair Stand D01003AA

To support engine during repair



R26420N –UN–22MAY95

CD03523,00000F3 –19–15JAN01–2/31

Bushing, Bearing and Seal Driver Set D01045AA

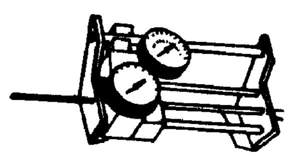
Install pilot bearing in flywheel.

CD03523,00000F3 –19–15JAN01–3/31

RG5061 –UN–05DEC97

Spring Compression Tester D01168AA

Test valve spring compression.



RG5061

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CD03523,00000F3 –19–15JAN01–4/31

Push Puller D01200AA

Use with D01218AA to remove crankshaft gear.

CD03523,00000F3 –19–15JAN01–5/31

Pulling Attachment. D01218AA

Use with D01200AA Push Puller to remove crankshaft gear.

CD03523,00000F3 –19–15JAN01–6/31

Precision Straightedge D05012ST

Check cylinder head flatness.

CD03523,00000F3 –19–15JAN01–7/31

Cooling System Pressure Pump D05104ST

Used to pressure test radiator cap and cooling system.

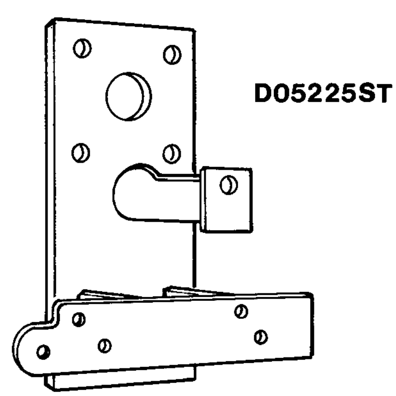
R26406N –UN–29NOV88

D05104ST

CD03523,00000F3 –19–15JAN01–8/31

Engine Repair Stand Adapter D05225ST

To allow installation of engine onto D01003AA Engine Repair Stand



D05225ST –UN–22MAY95

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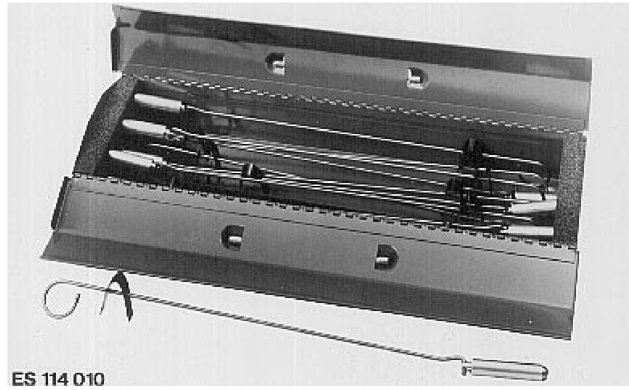
CD03523,00000F3 –19–15JAN01–9/31

Magnetic follower holder kit D15001NU

Hold cam followers when removing and installing camshaft.



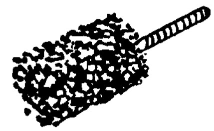
ES114010 –UN–07MAR95

CD03523,00000F3 –19–15JAN01–10/31

RG5074 –UN–07NOV97

Flexible Cylinder Hone D17004BR

Hone cylinder liners.

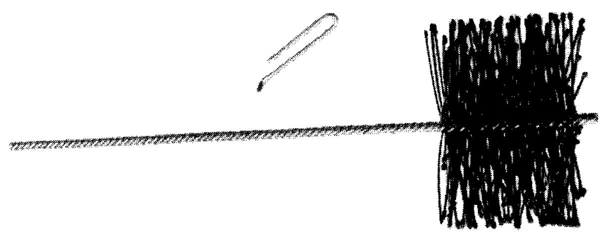


RG5074

CD03523,00000F3 –19–15JAN01–11/31

O-Ring Groove Cleaning Brush D17015BR

Clean cylinder liner O-ring groove in block.



RG5075

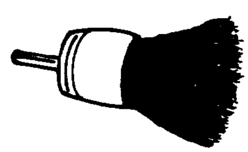
RG5075 –UN–07NOV97

CD03523,00000F3 –19–15JAN01–12/31

RG5063 –UN–05DEC97

End Brush D17024BR

Clean valve seat and bores.



RG5063

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CD03523,00000F3 –19–15JAN01–13/31

ES107506 –UN–07MAR95

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

CD03523,00000F3 –19–15JAN01–14/31

Universal pressure test kit. . . . . . FKM10002 or JT05470

To measure engine oil or intake manifold pressure.

FKM10002 –UN–13MAY96

CD03523,00000F3 –19–15JAN01–15/31

Compression test set FKM10021

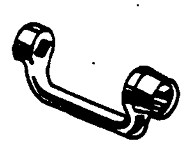
To check engine cylinder compression.

L30722A –UN–07MAR95

CD03523,00000F3 –19–15JAN01–16/31

RG5085 –UN–23AUG88

Torque Wrench Adapter . . . . JD-307 (or JD307)

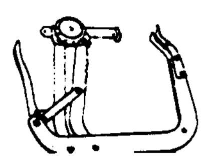


Use with standard torque wrench to tighten head bolts under rocker arm assembly.

CD03523,00000F3 –19–15JAN01–17/31

RG5070 –UN–23AUG88

Valve Spring Compressor JDE138



Use to compress valve springs when removing and installing valves.

Continued on next page CD03523,00000F3 –19–15JAN01–18/31

RG5154 –UN–23AUG88

3/4 in. Special Crowsfoot Wrench JDF22

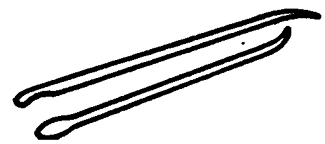
Tighten injection lines at pump and nozzles.

CD03523,00000F3 –19–15JAN01–19/31

RG5133 –UN–23AUG88

O-Ring Seal Tool Set .JDG127

Use to remove and install O-Ring seals.

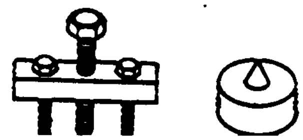


CD03523,00000F3 –19–15JAN01–20/31

RG5112 –UN–06APR89

Vibration Damper Puller Set JDG410

Remove vibration damper and pulley.

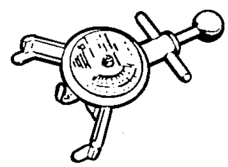


CD03523,00000F3 –19–15JAN01–21/31

JDG529 –UN–10MAY95

Tension gauge JDG529

Measure V-Belt tension.

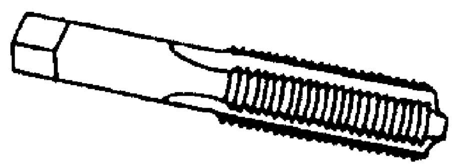


CD03523,00000F3 –19–15JAN01–22/31

RG5100 –UN–05DEC97

Tap JDG680

Used to restore threaded holes in cylinder block for cylinder head cap screws.



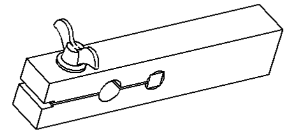
RG5100

CD03523,00000F3 –19–15JAN01–23/31

RG11742 –UN–24MAY01

Spring Chamber Cap Wrench JDG1521

Used to remove the spring chamber cap on RSN nozzles.



JDG1521 Spring Chamber Cap Wrench (RSN)

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CD03523,00000F3 –19–15JAN01–24/31

205
6

JDG1522 –UN–13JUN01

Pressure Adjusting Screw Tool JDG1522

Used to adjust opening pressure on RSN nozzles.

JDG1522

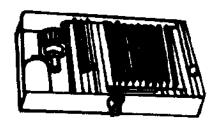
JDG1522 Pressure Adjusting Screw Tool (RSN)

CD03523,00000F3 –19–15JAN01–25/31

RG5064 –UN–05DEC97

Valve Guide Knurler Kit JT05949

Knurl valve guides.



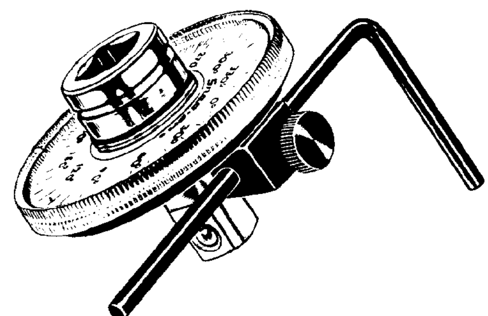
RG5064

JT05949

CD03523,00000F3 –19–15JAN01–26/31

Torque Angle Gauge JT05993

To accurately torque-turn cap screws in cylinder head and connecting rods.



RG5698 –UN–05DEC97

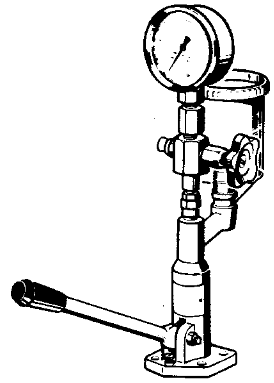
RG5698

JT05993

Continued on next page CD03523,00000F3 –19–15JAN01–27/31

Injection nozzle tester (R. BOSCH) JT25510

Check nozzle opening pressure.



CD 030307

CD30307 –UN–07MAR95

CD03523,00000F3 –19–15JAN01–28/31

CD30308 –UN–08MAR95

Fuel pressure line .KJD10109

To connect injection nozzle to BOSCH tester.

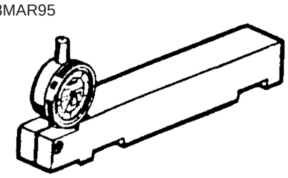
CD 030308

CD03523,00000F3 –19–15JAN01–29/31

CD30235 –UN–08MAR95

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.



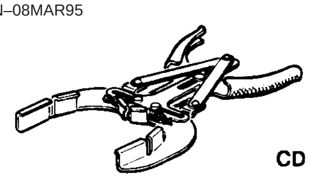
CD 030235

CD03523,00000F3 –19–15JAN01–30/31

CD30236 –UN–08MAR95

Piston ring expander KJD10140

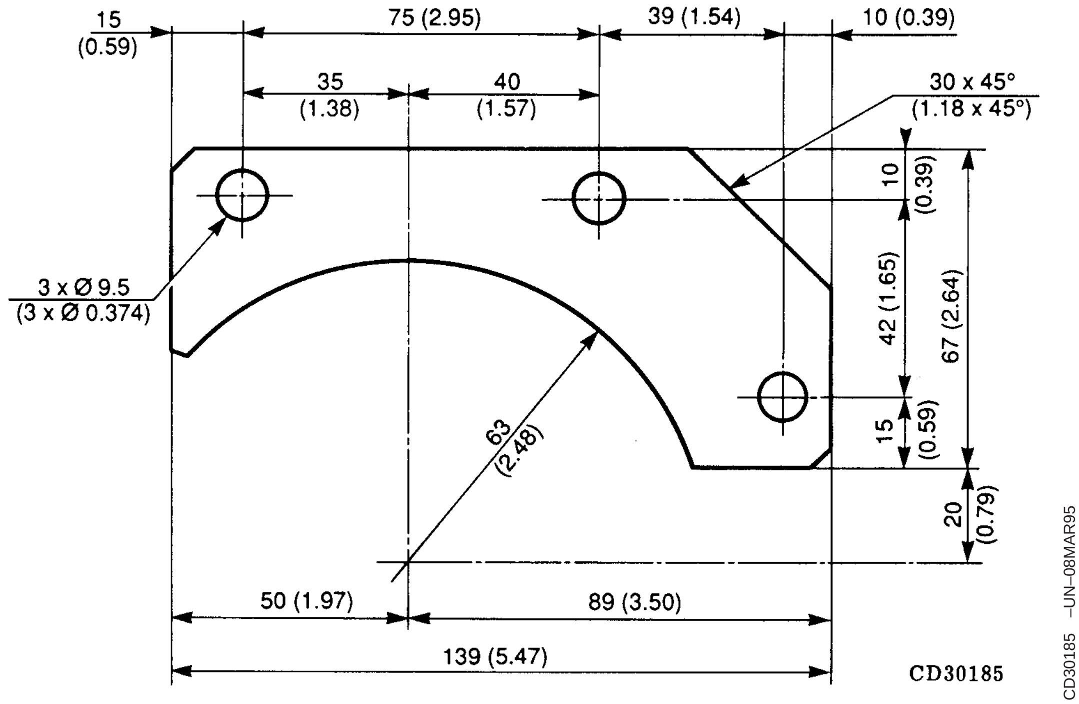
Used to replace piston rings.



CD 030236

CD03523,00000F3 –19–15JAN01–31/31

Template for front plate replacement



CD03523,000010D –19–05FEB01–1/1

Cylinder Head and Valves Specifications

Item	Measurement	Specification
Valve lift		
Intake valve	Valve lift at 0.00 mm (in.) clearance Wear Tolerance	11.56—12.37 mm (0.455—0.487 in.) 11.13 mm (0.438 in.)
Exhaust valve	Valve lift at 0.00 mm (in.) clearance Wear Tolerance	11.28—12.12 mm (0.444—0.477 in.) 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 Wear tolerance	0.05—0.10 mm (0.002—0.004 in.) 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 Maximum runout Angle	1.50—2.00 mm (0.059—0.079 in.) 0.08 mm (0.003 in.) 30°
Intake Valve	Recess Wear tolerance	0.61—1.11 mm (0.024—0.044 in.) 1.63 mm (0.064 in.)
Exhaust Valve	Recess Wear tolerance	1.22—1.72 mm (0.048—0.068 in.) 2.26 mm (0.089 in.)

Continued on next page

CD03523,00000E8 –19–10JAN01–1/3

Item	Measurement	Specification
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.)
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°

Continued on next page CD03523,00000E8 –19–10JAN01–2/3

Item	Measurement	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.)
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
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 –19–10JAN01–3/3

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.)

Continued on next page

CD03523,00000F1 –19–15JAN01–1/3

Item	Measurement	Specification
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		
3029D	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.)
3029T	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.)
Piston pin		
3029D	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.)
3029T	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.)

Continued on next page

CD03523,00000F1 –19–15JAN01–2/3

Item	Measurement	Specification
Piston pin bore		
3029D	Diameter	32.003—32.013 mm (1.2600—1.2603 in.)
3029T	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 Torque Turn	56 N•m (40 lb-ft) 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 –19–15JAN01–3/3

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 Wear tolerance	0.13—0.40 mm (0.005—0.016 in.) 0.50 mm (0.02 in.)
5/6-piece thrust bearing	End Play Wear tolerance	0.03—0.35 mm (0.001—0.014 in.) 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 Maximum out-of-roundness	0.03 mm (0.0012 in.) 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 Maximum wear	0.046—0.116 mm (0.0018—0.0046 in.) 0.15 mm (0.006 in.)
Undersized crankshaft main bearing	1st Size 2nd Size 3rd Size	0.25 mm (0.01 in.) 0.50 mm (0.02 in.) 0.76 mm (0.03 in.)

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Item	Measurement	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%
Pulley-to-crankshaft	Torque	150 N•m (110 lb-ft)
Crankshaft main bearing bolt	Torque	135 N•m (100 lb-ft)
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)
5/8 in. cap screw	Torque	230 N•m (170 lb-ft)

CD03523,00000F6 –19–16JAN01–2/2

Camshaft and Timing Gear Train Specifications

Item	Measurement	Specification
Helical timing gear		
Upper idler/crankshaft gear	Backlash Wear tolerance	0.07—0.30 mm (0.003—0.012 in.) 0.40 mm (0.016 in.)
Upper idler/camshaft gear	Backlash Wear tolerance	0.07—0.35 mm (0.003—0.014 in.) 0.51 mm (0.020 in.)
Upper idler/injection pump gear	Backlash Wear tolerance	0.07—0.35 mm (0.003—0.014 in.) 0.51 mm (0.020 in.)
Lower idler/crankshaft gear	Backlash Wear tolerance	0.07—0.35 mm (0.003—0.014 in.) 0.51 mm (0.020 in.)
Lower idler/oil pump gear	Backlash Wear tolerance	0.04—0.38 mm (0.0016—0.015 in.) 0.40 mm (0.016 in.)
Spur timing gear Engines for 5300/5300N Tractors (-242551CD) All other Engines (-270818CD)		
Upper idler/crankshaft gear	Backlash Wear tolerance	0.04—0.35 mm (0.0016—0.014 in.) 0.60 mm (0.024 in.)
Upper idler/camshaft gear	Backlash Wear tolerance	0.08—0.45 mm (0.003—0.018 in.) 0.85 mm (0.033 in.)
Upper idler/injection pump gear	Backlash Wear tolerance	0.08—0.45 mm (0.003—0.018 in.) 0.85 mm (0.033 in.)
Lower idler/crankshaft gear	Backlash Wear tolerance	0.04—0.35 mm (0.0016—0.014 in.) 0.65 mm (0.025 in.)
Lower idler/oil pump gear	Backlash Wear tolerance	0.08—0.40 mm (0.003—0.016 in.) 0.75 mm (0.030 in.)
Camshaft/aux. drive gear	Backlash Wear tolerance	0.09—1.24 mm (0.0035—0.049 in.) 1.34 mm (0.053 in.)

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Item	Measurement	Specification
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 Maximum wear	0.08—0.23 mm (0.003—0.009 in.) 0.38 mm (0.015 in.)
Thrust Plate	Thickness Maximum wear	3.935—3.985 mm (0.155—0.157 in.) 3.8 mm (0.15 in.)
Camshaft Journal	Diameter Maximum wear	55.872—55.898 mm (2.1997—2.2007 in.) 55.85 mm (2.199 in.)
Camshaft Journal-to-bore	Max. clearance	0.18 mm (0.007 in.)
Camshaft Intake Lobe	Height Maximum wear	6.93—7.42 mm (0.273—0.292 in.) 6.68 mm (0.263 in.)
Camshaft Exhaust Lobe	Height Maximum wear	6.76—7.26 mm (0.266—0.286 in.) 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 Maximum wear	0.14—0.29 mm (0.006—0.012 in.) 0.40 mm (0.016 in.)
Upper idler gear shaft (helical gear)	Diameter	44.437—44.463 mm (1.7495—1.7505 in.)

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Item	Measurement	Specification
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)
Injection pump drive gear nut access plug	Torque	30 N•m (22 lb-ft)

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Item	Measurement	Specification
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)

CD03523,00000FC –19–18JAN01–4/4

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 gear axial clearance		
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.)
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.)
Oil pump		
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)

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Item	Measurement	Specification
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)
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)

CD03523,00000FF –19–24JAN01–2/2

Oil Dipstick Guide Height Specifications

Dipstick Guide Height Adjustment

Machine Model No.	Engine Model	Dipstick guide height
5000-Series Tractors: (Agritalia-built)		
5300/5300N	CD3029DAT01	136 mm (5.35 in.)
5400/5400N	CD3029TAT02	156 mm (6.14 in.)
5010-Series Tractors: (Agritalia-built)		
5310/5310N	CD3029DAT50	156 mm (6.14 in.)
5410/5410N	CD3029TAT50	156 mm (6.14 in.)
5010-Series Tractors: (Augusta-built)		
5105	PE3029DLV51	156 mm (6.14 in.)
5205	PE3029DLV52	156 mm (6.14 in.)
5210	CD3029DLV50	156 mm (6.14 in.)
5210	PE3029DLV50	156 mm (6.14 in.)
5210	PE3029DLV53	156 mm (6.14 in.)
5210	PE3029DLV54	156 mm (6.14 in.)
5310/5310N	CD3029TLV50	156 mm (6.14 in.)
5310/5310N	PE3029TLV50	156 mm (6.14 in.)
5310/5310N	PE3029TLV52	156 mm (6.14 in.)
5020-Series Tractors: (Augusta-built)		
5220	PE3029DLV53	156 mm (6.14 in.)
5320/5320N	PE3029TLV52	156 mm (6.14 in.)

Engine Model	Dipstick guide height
Engines for GOLDONI Tractors:	
CD3029DFG21	187 mm (7.36 in.)
CD3029DFG22	187 mm (7.36 in.)
CD3029TFG21	187 mm (7.36 in.)
CD3029DFG51	187 mm (7.36 in.)
CD3029TFG51	187 mm (7.36 in.)

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OEM Engines (Non-Certified)	Option code	Dipstick guide height
CD3029DF120	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.)
CD3029DF121	4004	187 mm (7.36 in.)
	4005	390 mm (15.35 in.)
CD3029DF122	4001,4002	189 mm (7.44 in.)
CD3029DF123	4004	187 mm (7.36 in.)
CD3029DF124	4004	187 mm (7.36 in.)
CD3029DF128	4004	187 mm (7.36 in.)
CD3029DF160	4006	205 mm (8.07 in.)
	4022	196 mm (7.72 in.)
	4024	136 mm (5.35 in.)
	4033	155 mm (6.10 in.)
CD3029DF161	4022	141 mm (5.55 in.)
	4024	136 mm (5.35 in.)
CD3029DF162	4006	205 mm (8.07 in.)
	4024	136 mm (5.35 in.)
	4027	208 mm (8.19 in.)
CD3029DF163	4024	136 mm (5.35 in.)
CD3029DF164	4024	136 mm (5.35 in.)
	4033	155 mm (6.10 in.)
CD3029DF165	4024	136 mm (5.35 in.)
PE3029DF120	4004	187 mm (7.36 in.)
	4005	390 mm (15.35 in.)
	4006	205 mm (8.07 in.)
	4022	196 mm (7.72 in.)
PE3029DF160	4022	196 mm (7.72 in.)
CD3029TF120	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.)
CD3029TF121	4006	205 mm (8.07 in.)
	4025	408 mm (16.06 in.)
CD3029TF123	4006	205 mm (8.07 in.)
CD3029TF160	4006	205 mm (8.07 in.)

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OEM Engines (Non-Certified)	Option code	Dipstick guide height
	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.)
CD3029TF161	4021	156 mm (6.14 in.)
	4022	141 mm (5.55 in.)
CD3029TF162	4006	205 mm (8.07 in.)
	4026	156 mm (6.14 in.)
	4027	208 mm (8.19 in.)
CD3029TF163	4006	205 mm (8.07 in.)
	4024	136 mm (5.35 in.)
	4027	208 mm (8.19 in.)
PE3029TF120	4006	205 mm (8.07 in.)
	4023	212 mm (8.35 in.)
	4025	408 mm (16.06 in.)
PE3029TF160	4023	212 mm (8.35 in.)
	4026	156 mm (6.14 in.)

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OEM Engines (Certified)	Option code	Dipstick guide height
CD3029DF150	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.)
CD3029DF151	4004	187 mm (7.36 in.)
CD3029DF152	4004	187 mm (7.36 in.)
CD3029DF180	4006	205 mm (8.07 in.)
	4022	196 mm (7.72 in.)
	4024	136 mm (5.35 in.)
	4033	155 mm (6.10 in.)
PE3029DF150	4004	187 mm (7.36 in.)
	4005	390 mm (15.35 in.)
	4006	205 mm (8.07 in.)
	4022	196 mm (7.72 in.)
PE3029DF180	4022	196 mm (7.72 in.)
CD3029TF150	4006	205 mm (8.07 in.)
	4023	212 mm (8.35 in.)
	4024	136 mm (5.35 in.)
	4025	408 mm (16.06 in.)
CD3029TF151	4011	507 mm (19.96 in.)
CD3029TF152	4006	205 mm (8.07 in.)
CD3029TF180	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.)
PE3029TF150	4006	205 mm (8.07 in.)
	4023	212 mm (8.35 in.)
	4025	408 mm (16.06 in.)
PE3029TF180	4023	212 mm (8.35 in.)
	4026	156 mm (6.14 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

Machine Model No.	Engine Model	Distance
5000-Series Tractors: (Agritalia-built)		
5300/5300N	CD3029DAT01	136 mm (5.35 in.)
5400/5400N	CD3029TAT02	136 mm (5.35 in.)
5010-Series Tractors: (Agritalia-built)		
5310/5310N	CD3029DAT50	137 mm (5.39 in.)
5410/5410N	CD3029TAT50	136 mm (5.35 in.)
5010-Series Tractors: (Augusta-built)		
5105	PE3029DLV51	137 mm (5.39 in.)
5205	PE3029DLV52	136 mm (5.39 in.)
5210	CD3029DLV50	136 mm (5.35 in.)
5210	PE3029DLV50	136 mm (5.35 in.)
5210	PE3029DLV53	136 mm (5.35 in.)
5210	PE3029DLV54	136 mm (5.35 in.)
5310/5310N	CD3029TLV50	136 mm (5.35 in.)
5310/5310N	PE3029TLV50	136 mm (5.35 in.)
5310/5310N	PE3029TLV52	136 mm (5.35 in.)
5020-Series Tractors: (Augusta-built)		
5220	PE3029DLV53	136 mm (5.35 in.)
5320/5320N	PE3029TLV52	136 mm (5.35 in.)

Engine Model	Distance
Engines for GOLDONI Tractors:	
CD3029DFG21	137 mm (5.39 in.)
CD3029DFG22	137 mm (5.39 in.)
CD3029TFG21	137 mm (5.39 in.)
CD3029DFG51	137 mm (5.39 in.)
CD3029TFG51	137 mm (5.39 in.)

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OEM Engines (Non-Certified)	Option code	Distance
CD3029DF120	2007, 2020, 2021,	140 mm (5.51 in.)
	2010, 2022	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
CD3029DF121	2020	140 mm (5.51 in.)
	2023	165 mm (6.50 in.)
CD3029DF122	2034	140 mm (5.51 in.)
CD3029DF123	2020	140 mm (5.51 in.)
CD3029DF124	2034	140 mm (5.51 in.)
CD3029DF128	2034, 2042	140 mm (5.51 in.)
CD3029DF160	2020, 2021	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
CD3029DF161	2020	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
CD3029DF162	2022, 2024	137 mm (5.39 in.)
CD3029DF163	2020	140 mm (5.51 in.)
CD3029DF164	2020	140 mm (5.515 in.)
CD3029DF165	2024	137 mm (5.39 in.)
	2033	140 mm (5.51 in.)
PE3029DF120	2020, 2021	140 mm (5.51 in.)
PE3029DF160	2020, 2021	140 mm (5.51 in.)
CD3029TF120	2020, 2021	140 mm (5.51 in.)
	2020, 2028	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
CD3029TF121	2020	140 mm (5.51 in.)
	2023	165 mm (6.50 in.)
CD3029TF123	2020	140 mm (5.51 in.)
CD3029TF160	2020, 2021	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
CD3029TF161	2020	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
CD3029TF162	2022, 2024	137 mm (5.39 in.)
CD3029TF163	2024	137 mm (5.39 in.)
	2033	140 mm (5.51 in.)
PE3029TF120	2020, 2021	140 mm (5.51 in.)

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OEM Engines (Non-Certified)	Option code	Distance
PE3029TF160	2020, 2021	140 mm (5.51 in.)

OEM Engines (Certified)	Option code	Distance
CD3029DF150	2010, 2022	137 mm (5.39 in.)
	2020, 2021	140 mm (5.51 in.)
	2023	165 mm (6.50 in.)
CD3029DF151	2020	140 mm (5.51 in.)
CD3029DF152	2020	140 mm (5.51 in.)
CD3029DF180	2020, 2021	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
PE3029DF150	2020, 2021	140 mm (5.51 in.)
PE3029DF180	2020, 2021	140 mm (5.51 in.)
CD3029TF150	2020, 2021	140 mm (5.51 in.)
	2022, 2028	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
CD3029TF151	2022	137 mm (5.39 in.)
	4025	140 mm (5.51in.)
CD3029TF152	2020	140 mm (5.51 in.)
CD3029TF180	2020,2021	140 mm (5.51 in.)
	2022	137 mm (5.39 in.)
	2023	165 mm (6.50 in.)
PE3029TF150	2020, 2021	140 mm (5.51 in.)
PE3029TF180	2020, 2021	140 mm (5.51 in.)

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Air Intake and Exhaust System Specifications

Turbocharger Boost Pressure

5000-Series tractors: (Agritalia-built)

TRACTOR MODEL	ENGINE MODEL	TURBOCHARGER MODEL	RATED SPEED rpm	BOOST PRESSURE at Full Load Rated Speed kPa (bar) (psi) ± 10%
5400/5400N	CD3029TAT02	GARRETT TA25	2400	77 (0.77) (11)

5010-Series tractors: (Agritalia-built)

TRACTOR MODEL	ENGINE MODEL	TURBOCHARGER MODEL	RATED SPEED rpm	BOOST PRESSURE at Full Load Rated Speed kPa (bar) (psi) ± 10%
5410/5410N	CD3029TAT50	SCHWITZER S1B	2300	200 (2) (29)

5010-Series tractors: (Augusta-built)

TRACTOR MODEL	ENGINE MODEL	TURBOCHARGER MODEL	RATED SPEED rpm	BOOST PRESSURE at Full Load Rated Speed kPa (bar) (psi) ± 10%
5310/5310N	CD3029TLV50	SCHWITZER S1B	2400	100 (1) (15)
5310/5310N	PE3029TLV50	SCHWITZER S1B	2400	100 (1) (15)
5310/5310N	PE3029TLV52	SCHWITZER S1B	2400	100 (1) (15)

5020-Series tractors: (Augusta-built)

TRACTOR MODEL	ENGINE MODEL	TURBOCHARGER MODEL	RATED SPEED rpm	BOOST PRESSURE at Full Load Rated Speed kPa (bar) (psi) ± 10%
5320/5320N	CD3029TLV52	SCHWITZER S1B	2400	100 (1) (15)

Engines for GOLDONI Tractors

TRACTOR MODEL	ENGINE MODEL	TURBOCHARGER MODEL	RATED SPEED rpm	BOOST PRESSURE at Full Load Rated Speed kPa (bar) (psi) ± 10%
	CD3029TFG21	GARRETT TA25	2300	70 (0.7) (10)
	CD3029TFG51	SCHWITZER S1B	2500	114 (1.14) (16)

OEM Engines (Non-Certified)

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ENGINE MODEL	FUEL INJECTION PUMP OPTION CODE	TURBOCHARGER MODEL	RATED SPEED rpm	BOOST PRESSURE at Full Load Rated Speed kPa (bar) (psi) ± 10%
CD3029TF120	1602, 1632, 1640	GARRETT TA25 or SCHWITZER S1B	2500	85 (0.85) (12)
CD3029TF121	1602, 1632	GARRETT TA25	2500	85 (0.85) (12)
CD3029TF123	16BT	GARRETT TA25	2500	85 (0.85) (12)
CD3029TF160	1602, 1632, 1634,1640	GARRETT TA25 or SCHWITZER S1B	2500	85 (0.85) (12)
CD3029TF160	1633	GARRETT TA25	2200	55 (0.55) (8)
CD3029TF161	16EV	GARRETT TA25	2500	85 (0.85) (12)
CD3029TF162	1633	GARRETT TA25	2200	85 (0.85) (12)
CD3029TF163	1602	GARRETT TA25	2500	85 (0.85) (12)
PE3029TF120	1602, 1632, 1640	GARRETT TA25	2500	85 (0.85) (12)
PE3029TF120	16TT, 16TU	SCHWITZER S1B	1500	85 (0.85) (12)
PE3029TF160	1602, 1632, 1640	GARRETT TA25	2500	85 (0.85) (12)

OEM Engines (Certified)

ENGINE MODEL	FUEL INJECTION PUMP OPTION CODE	TURBOCHARGER MODEL	RATED SPEED rpm	BOOST PRESSURE at Full Load Rated Speed kPa (bar) (psi) ± 10%
CD3029TF150	16DE, 16EJ	SCHWITZER S1B	2500	135 (1.35) (20)
CD3029TF150	16DF, 16EK	SCHWITZER S1B	2500	114 (1.14) (17)
CD3029TF152	16EA	SCHWITZER S1B	2500	135 (1.35) (20)
CD3029TF180	16DG, 16EL	SCHWITZER S1B	2500	135 (1.35) (20)
CD3029TF180	16DH, 16EM	SCHWITZER S1B	2500	114 (1.14) (17)
PE3029TF150	16DE, 16EJ	SCHWITZER S1B	2500	135 (1.35) (20)
PE3029TF150	16DF, 16EK	SCHWITZER S1B	2500	114 (1.14) (17)
PE3029TF150	16TR, 16TS	SCHWITZER S1B	1800	77 (0.77) (11)
PE3029TF180	16DG, 16EL	SCHWITZER S1B	2500	135 (1.35) (20)
PE3029TF180	16DH, 16EM	SCHWITZER S1B	2500	114 (1.14) (17)

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)

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Item	Measurement	Specification
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	80 N•m (60 lb-ft)
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	80 N•m (60 lb-ft)

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Fuel System Specifications

Fuel Injection Pump Specifications

5000-Series tractors: (Agritalia-built)

TRACTOR MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP	REPLACED BY	RATED SPEED rpm	FAST IDLE rpm	DYN. TIM. deg	SLOW IDLE rpm	NOZZLE TYPE	POWER[a] kW (hp)
5300/5300N	CD3029DAT01	RE57288 (DP200)		2400	2605	18	775	Conv.	42 (57)
5400/5400N	CD3029TAT02	RE67453 (DP200)	RE507499	2400	2605	13	775	Conv.	53 (72)
		RE507499 (DP201)		2400	2605	13	775	Conv.	53 (72)

[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.

5010-Series tractors: (Agritalia-built)

TRACTOR MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP	REPLACED BY	RATED SPEED rpm	FAST IDLE rpm	DYN. TIM. deg	SLOW IDLE rpm	NOZZLE TYPE	POWER[a] kW (hp)
5310/5310N	CD3029DAT50	RE508603 (DB4)		2300	2495	6.5	850	Conv.	40 (54)
5410/5410N	CD3029TAT50	RE508602 (DB4)		2300	2495	6.0	850	Conv.	53 (72)

[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.

5010-Series tractors: (Augusta-built)

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TRACTOR MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP	REPLACED BY	RATED SPEED rpm	FAST IDLE rpm	DYN. TIM. deg	SLOW IDLE rpm	NOZZLE TYPE	POWER[a] kW (hp)
5105	PE3029DLV51	RE504059 (DB2)		2300	2495	6	850	RSN	34 (46)
5205	PE3029DLV52	RE504060 (DB2)		2300	2495	6.5	850	RSN	40 (54)
5210	CD3029DLV50	RE500441 (DB4)		2400	2605	6	825	Conv.	40 (54)
5210	PE3029DLV50	RE500441 (DB4)		2400	2605	6	825	Conv.	40 (54)
5210	PE3029DLV53	RE504951 (DB2)		2400	2605	16	850	RSN	40 (54)
5210	PE3029DLV54	RE500441 (DB2)		2400	2605	7	850	RSN	40 (54)
5310/5310N	CD3029TLV50	RE500442 (DB4)		2400	2605	6	825	Conv.	48 (64)
5310/5310N	PE3029TLV50	RE500442 (DB4)		2400	2605	6	825	Conv.	48 (64)
5310/5310N	PE3029TLV52	RE500442 (DB4)		2400	2605	6	825	Conv.	48 (64)

[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.

5020-Series tractors: (Augusta-built)

TRACTOR MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP	REPLACED BY	RATED SPEED rpm	FAST IDLE rpm	DYN. TIM. deg	SLOW IDLE rpm	NOZZLE TYPE	POWER[a] kW (hp)
5220	PE3029DLV53	RE504951 (DB2)		2400	2605	16	850	RSN	40 (54)
5320/5320N	PE3029TLV52	RE500442 (DB4)		2400	2605	6	825	Conv.	48 (64)

[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.

Engines for GOLDONI Tractors

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ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP	REPLACED BY	RATED SPEED rpm	FAST IDLE rpm	DYN. TIM. deg	SLOW IDLE rpm	NOZZLE TYPE	POWER[a] kW (hp)
CD3029DFG21		RE66492 (DP200)	RE503017 (DB2)	2300	2495	17	800	Conv.	33 (45)
CD3029DFG21		RE503017 (DB2)		2300	2495	18	800	Conv.	33 (45)
CD3029DFG22		RE57288 (DP200)	RE503019 (DB2)	2300	2495	18	800	Conv.	42 (57)
CD3029DFG22		RE503019 (DB2)		2300	2495	17	800	Conv.	42 (57)
CD3029TFG21		RE66496 (DP200)	RE503021 (DB2)	2300	2495	15	800	Conv.	52 (70)
CD3029TFG21		RE503021 (DB2)		2300	2495	15	800	Conv.	52 (70)
CD3029DFG51		RE501258 (DB4)	RE502217 (DB4)	2500	2710	6.5	850	Conv.	43 (58)
CD3029DFG51		RE502217 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
CD3029TFG51		RE501207 (DB4)	RE502238 (DB4)	2500	2710	6	850	Conv.	52 (70)
CD3029TFG51		RE502238 (DB4)		2500	2710	6	850	Conv.	52 (70)

[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.

OEM Engines (Non-Certified)

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ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP	REPLACED BY	RATED SPEED rpm	FAST IDLE rpm	DYN. TIM. deg	SLOW IDLE rpm	NOZZLE TYPE	POWER[a] kW (hp)
CD3029DF120	1602	RE53785 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF120	1603	RE53786 (DB2)		1800	1880	15		Conv.	35 (48)
CD3029DF120	1641	RE64241 (DB2)		1500	1565	15		Conv.	31 (42)
CD3029DF120	1642	RE67271 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF120	1644	RE41939 (DB2)		1800	1800	15		Conv.	34 (46)
CD3029DF120	1645	RE67003 (DB2)		2500	2710	17	850	Conv.	37 (50)
CD3029DF120	1648	RE64242 (DB2)		1500	1565	15		Conv.	30 (40)
CD3029DF120	1650	RE41938 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF120	1655	RE53785 (DB2)		2500	2710	15	1700	Conv.	43 (58)
CD3029DF121	1602	RE53785 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF121	1650	RE41938 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF122	1603	RE53786 (DB2)		1800	1880	15		Conv.	35 (48)
CD3029DF122	1641	RE64241 (DB2)		1500	1565	15		Conv.	31 (42)
CD3029DF122	1644	RE41939 (DB2)		1800	1880	15		Conv.	34 (46)
CD3029DF122	1648	RE64242 (DB2)		1500	1565	15		Conv.	30 (40)
CD3029DF123	16BS	RE53785 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF124	1641	RE64241 (DB2)		1500	1565	15		Conv.	31 (42)
CD3029DF128	1603	RE53786 (DB2)		1800	1880	15		Conv.	35 (48)
CD3029DF128	1641	RE64241 (DB2)		1500	1565	15		Conv.	31 (42)
CD3029DF128	1644	RE41939 (DB2)		1800	1880	15		Conv.	34 (46)
CD3029DF128	1648	RE64242 (DB2)		1500	1565	15		Conv.	30 (40)
PE3029DF120	1602	RE53785 (DB2)		2500	2710	17	800	Conv.	43 (58)
PE3029DF120	1603	RE53786 (DB2)		1800	1880	15		Conv.	35 (48)
PE3029DF120	1641	RE64241 (DB2)		1500	1565	15		Conv.	31 (42)
PE3029DF120	1642	RE67271 (DB2)		2500	2710	17	800	Conv.	43 (58)
PE3029DF120	1644	RE41939 (DB2)		1800	1800	15		Conv.	34 (46)
PE3029DF120	1648	RE64242 (DB2)		1500	1565	15		Conv.	30 (40)
PE3029DF120	1650	RE41938 (DB2)		2500	2710	17	800	Conv.	43 (58)
PE3029DF120	1655	RE53785 (DB2)		2500	2710	15	1700	Conv.	36 (49)
CD3029DF160	1602	RE53785 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF160	1632	RE51940 (DB2)		2200	2390	17	800	Conv.	37 (50)
CD3029DF160	1643	RE67271 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF160	1650	RE41938 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF161	1602	RE53785 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF162	1632	RE51940 (DB2)		2200	23900	17	800	Conv.	37 (50)
CD3029DF162	16YG	RE51940 (DB2)		2200	2390	17	800	Conv.	37 (50)
CD3029DF163	1654	RE63523 (DB2)		2400	2605	17	800	Conv.	48 (64)

[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.

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ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP	REPLACED BY	RATED SPEED rpm	FAST IDLE rpm	DYN. TIM. deg	SLOW IDLE rpm	NOZZLE TYPE	POWER[a] kW (hp)
CD3029DF165	1602	RE53785 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029DF165	16TH	RE53785 (DB2)		2500	2710	17	800	Conv.	43 (58)
PE3029DF160	1602	RE53785 (DB2)		2500	2710	17	800	Conv.	43 (58)
PE3029DF160	1643	RE67271 (DB2)		2500	2710	17	800	Conv.	43 (58)
PE3029DF160	1650	RE41938 (DB2)		2500	2710	17	800	Conv.	43 (58)
CD3029TF120	1602	RE53783 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF120	1632	RE58903 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF120	1640	RE53958 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF121	1602	RE53783 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF121	1632	RE58903 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF123	16BT	RE53783 (DB4)		2500	2710	11	800	Conv.	59 (80)
PE3029TF120	1602	RE53783 (DB4)		2500	2710	11	800	Conv.	59 (80)
PE3029TF120	1632	RE58903 (DB4)		2500	2710	11	800	Conv.	59 (80)
PE3029TF120	1640	RE53958 (DB4)		2500	2710	11	800	Conv.	59 (80)
PE3029TF120	16TT	RE506879 (DB4)		1500	1565	6.5		Conv.	42 (57)
PE3029TF120	16TU	RE506880 (DB4)		1500	1565	6.5		Conv.	42 (57)
CD3029TF160	1602	RE53783 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF160	1632	RE58903 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF160	1633	RE51979 (DB4)		2200	2390	17	800	Conv.	46 (62)
CD3029TF160	1634	RE53783 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF160	1640	RE53958 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF161	16EV	RE53958 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF161	1634	RE53783 (DB4)		2500	2710	11	800	Conv.	59 (80)
CD3029TF162	1633	RE51979 (DB4)		2200	2390	17	800	Conv.	46 (62)
CD3029TF163	1602	RE53783 (DB4)		2500	2710	11	800	Conv.	59 (80)
PE3029TF160	1602	RE53783 (DB4)		2500	2710	11	800	Conv.	59 (80)
PE3029TF160	1632	RE58903 (DB4)		2500	2710	11	800	Conv.	59 (80)
PE3029TF160	1640	RE53958 (DB4)		2500	2710	11	800	Conv.	59 (80)

[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.

OEM Engines (Certified)

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ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP	REPLACED BY	RATED SPEED rpm	FAST IDLE rpm	DYN. TIM. deg	SLOW IDLE rpm	NOZZLE TYPE	POWER[a] kW (hp)
CD3029DF150	16DP	RE501258 (DB4)	RE502217 (DB4)	2500	2710	6.5	850	Conv.	43 (58)
CD3029DF150	16DP	RE502217 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
CD3029DF150	16DQ	RE501259 (DB4)		2500	2710	7	850	Conv.	37 (50)
CD3029DF150	16EG	RE501983 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
CD3029DF150	16EQ	RE501258 (DB4)	RE502182 (DB4)	2500	2710	8	1700	Conv.	43 (58)
CD3029DF150	16EQ	RE502182 (DB4)	RE502509 (DB4)	2500	2710	8	1700	Conv.	43 (58)
CD3029DF150	16EQ	RE502509 (DB4)		2500	2710	8	1700	Conv.	43 (58)
CD3029DF150	16HW	RE501259 (DB4)		2500	2710	7	850	Conv.	36 (49)
CD3029DF150	16PN	RE502217 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
CD3029DF151	16DZ	RE501258 (DB4)	RE502217 (DB4)	2500	2710	6.5	850	Conv.	43 (58)
CD3029DF151	16DZ	RE502217 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
CD3029DF152	16KZ	RE502217 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
PE3029DF150	16DP	RE502217 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
PE3029DF150	16EG	RE501893 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
PE3029DF150	16EQ	RE502509 (DB4)		2500	2710	8	1700	Conv.	43 (58)
PE3029DF150	16HW	RE501259 (DB4)		2500	2710	7	850	Conv.	36 (49)
PE3029DF150	16PH	RE501259 (DB4)		2500	2710	7	850	Conv.	36 (49)
CD3029DF180	16DR	RE501258 (DB4)	RE502217	2500	2710	6.5	850	Conv.	43 (58)
CD3029DF180	16DR	RE502217 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
CD3029DF180	16DS	RE501259 (DB4)		2500	2710	7	850	Conv.	36 (49)
CD3029DF180	16EH	RE501983 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
CD3029DF180	16NP	RE502217 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
PE3029DF180	16DR	RE501258 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
PE3029DF180	16EH	RE501983 (DB4)		2500	2710	6.5	850	Conv.	43 (58)
CD3029TF150	16DE	RE501205 (DB4)	RE502218 (DB4)	2500	2710	6	850	Conv.	59 (80)
CD3029TF150	16DE	RE502218 (DB4)		2500	2710	6	850	Conv.	59 (80)
CD3029TF150	16DF	RE501207 (DB4)	RE502238 (DB4)	2500	2710	6	850	Conv.	52 (70)
CD3029TF150	16EJ	RE501985 (DB4)		2500	2710	6	850	Conv.	59 (80)
CD3029TF150	16EK	RE501986 (DB4)		2500	2710	6	850	Conv.	52 (70)
CD3029TF152	16EA	RE501205 (DB4)	RE502218 (DB4)	2500	2710	6	850	Conv.	59 (80)
CD3029TF152	16EA	RE502218 (DB4)		2500	2710	6	850	Conv.	59 (80)
PE3029TF150	16DE	RE502218 (DB4)		2500	2710	6	850	Conv.	59 (80)
PE3029TF150	16DF	RE502238 (DB4)		2500	2710	6	850	Conv.	52 (70)
PE3029TF150	16EJ	RE501985 (DB4)		2500	2710	6	850	Conv.	59 (80)
PE3029TF150	16EK	RE501986 (DB4)		2500	2710	6	850	Conv.	52 (70)
PE3029TF150	16TR	RE506877 (DB4)		1800	1880	6.5		Conv.	48 (64)
PE3029TF150	16TS	RE506877 (DB4)		1800	1880	6.5		Conv.	48 (64)

[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.

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ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP	REPLACED BY	RATED SPEED rpm	FAST IDLE rpm	DYN. TIM. deg	SLOW IDLE rpm	NOZZLE TYPE	POWER[a] kW (hp)
CD3029TF180	16DG	RE501205 (DB4)	RE502218 (DB4)	2500	2710	6	850	Conv.	59 (80)
CD3029TF180	16DG	RE502218 (DB4)		2500	2710	6	850	Conv.	59 (80)
CD3029TF180	16DH	RE501207 (DB4)	RE502238 (DB4)	2500	2710	6	850	Conv.	52 (70)
CD3029TF180	16DH	RE502238 (DB4)		2500	2710	6	850	Conv.	52 (70)
CD3029TF180	16EL	RE501985 (DB4)		2500	2710	6	850	Conv.	52 (80)
CD3029TF180	16EM	RE501986 (DB4)		2500	2710	6	850	Conv.	52 (70)
PE3029TF180	16DG	RE502218 (DB4)		2500	2710	6	850	Conv.	59 (80)
PE3029TF180	16DH	RE502238 (DB4)		2500	2710	6	850	Conv.	52 (70)
PE3029TF180	16EL	RE501985 (DB4)		2500	2710	6	850	Conv.	52 (80)
PE3029TF180	16EM	RE501986 (DB4)		2500	2710	6	850	Conv.	52 (70)

[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.

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)

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Item	Measurement	Specification
STANADYNE DB2 or DB4 Fuel Injection Pump		
Drive gear nut	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

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Item	Measurement	Specification
Fuel Injection Nozzle		
Nozzle (all types)	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
Conventional nozzle (3029D - Non Certified Engines)	Opening pressure for setting (New or reconditioned)	22600—23200 kPa (226—232 bar; 3277—3364 psi)
	Opening pressure for checking (New or reconditioned)	22300 kPa (223 bar; 3233 psi) Mini
	Opening pressure for setting (Used)	21500—22100 kPa (215—221 bar; 3118—3205 psi)
	Opening pressure for checking (Used)	20400 kPa (204 bar; 2958 psi) Mini
	Valve lift	1/2 turn
	Number of tip orifice	4
	Diameter of tip orifice	0.27 mm (0.0106 in.)
Conventional nozzle (3029D - Certified Engines)	Opening pressure for setting (New or reconditioned)	24400—24900 kPa (244—249 bar; 3540—3620 psi)
	Opening pressure for checking (New or reconditioned)	24100 kPa (241 bar; 3500 psi) Mini
	Opening pressure for setting (Used)	23000—23600 kPa (230—236 bar; 3340—3420 psi)
	Opening pressure for checking (Used)	21800 kPa (218 bar; 3170 psi) Mini
	Valve lift	3/4 turn
	Number of tip orifice	4
	Diameter of tip orifice	0.27 mm (0.0106 in.)

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Item	Measurement	Specification
Conventional nozzle (3029T Engines)	Opening pressure for setting (New or reconditioned)	26100—26600 kPa (261—266 bar; 3780—3857 psi)
	Opening pressure for checking (New or reconditioned)	25700 kPa (257 bar; 3727 psi) Mini
	Opening pressure for setting (Used)	24700—25200 kPa (247—252 bar; 3580—3654 psi)
	Opening pressure for checking (Used)	23500 kPa (235 bar; 3407 psi) Mini
	Vale Lift	3/4 turn
	Number of tip orifice	4
	Diameter of tip orifice	0.29 mm (0.0116 in.)
Rate Shaping Nozzle (3029D - Certified Engines)	Opening pressure for setting (New or reconditioned)	24400—24900 kPa (244—249 bar; 3540—3620 psi)
	Opening pressure for checking (New or reconditioned)	24100 kPa (241 bar; 3500 psi) Mini
	Opening pressure for setting (Used)	23000—23600 kPa (230—236 bar; 3340—3420 psi)
	Opening pressure for checking (Used)	21800 kPa (218 bar; 3170 psi) Mini
	Valve lift	7/8 turn
	Number of tip orifice	4
	Diameter of tip orifice	0.28 mm (0.0111 in.)

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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	Maximum flow rate at full load rated speed	6 m^3/h (225 cu-ft/h)
Engine oil consumption	Normal Overhaul point	Up to 0.5% of fuel consumption rate Up to 0.625% of fuel consumption rate
Cooling System Test	Pressure	70 kPa (0.7 bar) (10 psi)
Fuel supply pump	Pressure	15—30 kPa (0.15—0.30 bar; 2—4.5 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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