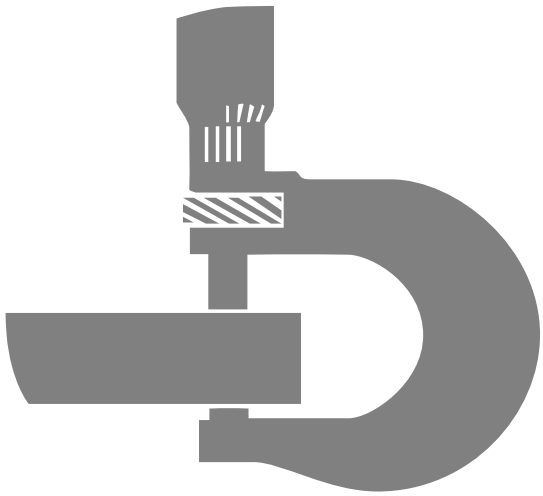
3029
4039, 4045
6059, 6068
Engines (Saran)
(-499999CD)

COMPONENT TECHNICAL MANUAL



John Deere Usine de Saran
CTM3274 (01JUL99)
European Version
Printed in Germany
ANGLAIS

3029, 4039, 4045, 6059, 6068 Engines (Saran) (-499999CD)

CTM3274 (01JUL99)

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 two parts: repair and operation and tests. Repair sections contain necessary instructions to repair the component. Operation and tests sections help you identify the majority of routine failures quickly.

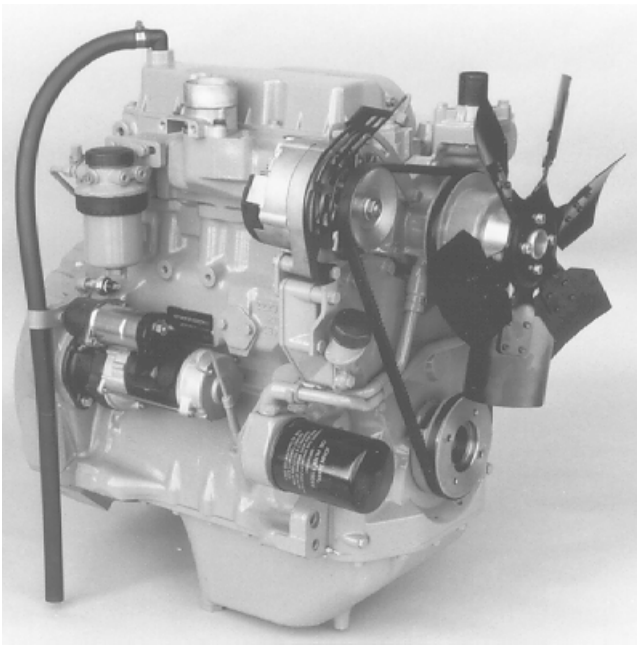
Information is organized in groups for the various components requiring service instruction. At the beginning of each group are summary listings of all applicable essential tools, service equipment and tools, other materials needed to do the job, service parts kits, specifications, wear tolerances, and torque values.

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

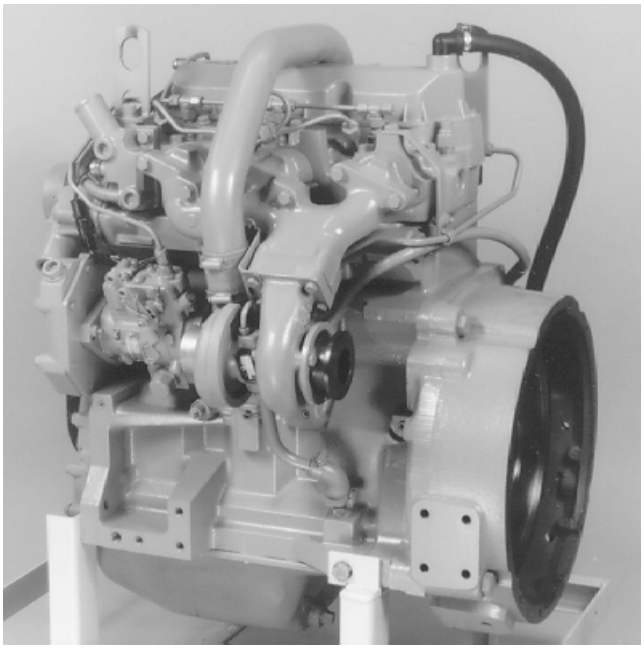
Fundamental service information is available from other sources covering basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes.

DX,CTMIFC -19-22MAY92

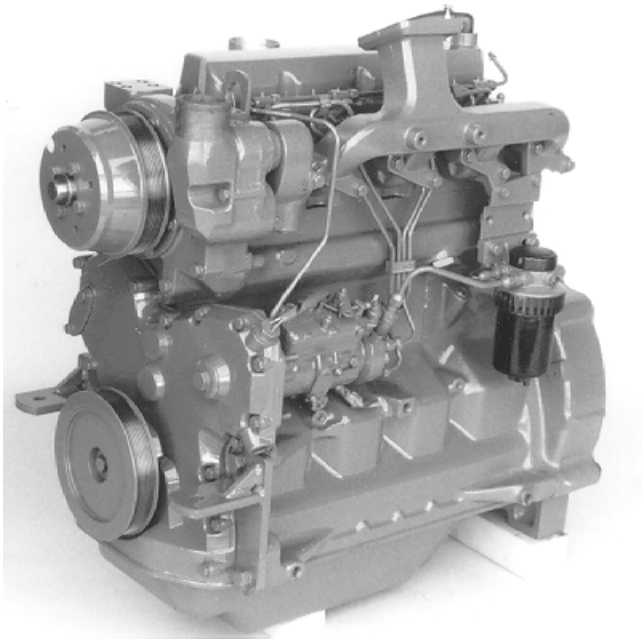
ENGINE IDENTIFICATION VIEWS



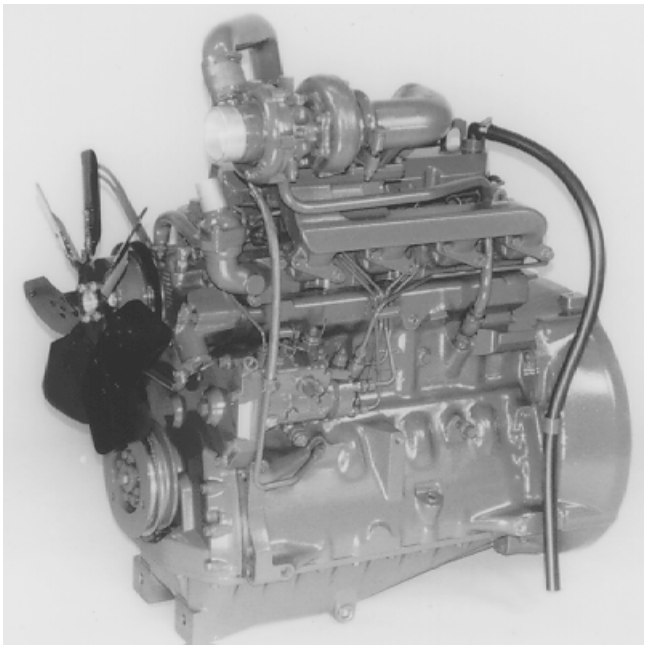
3029D



3029T



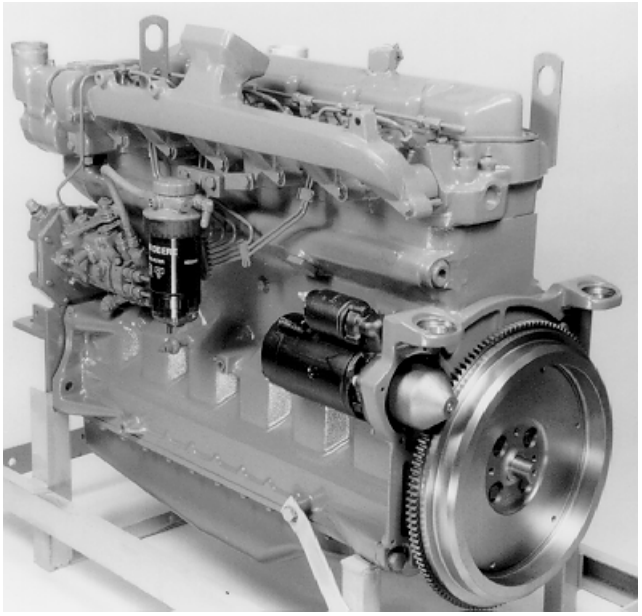
4039D



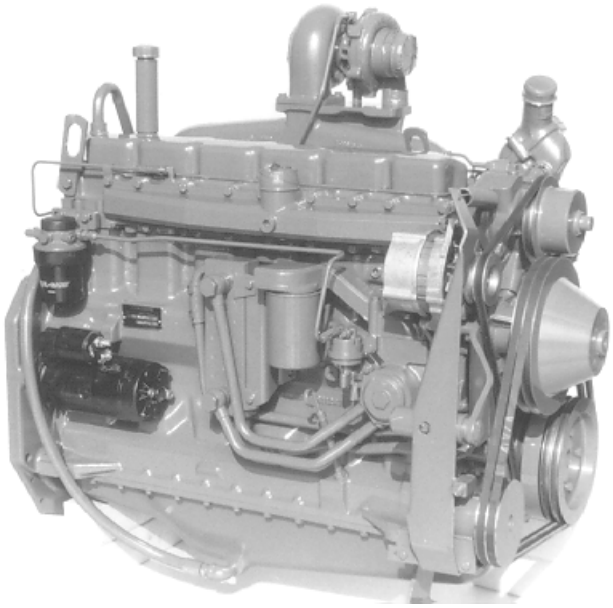
4039T

CD,3274,G00,27 -19-04JAN99

ENGINE IDENTIFICATION VIEWS (CONT'D)



6068D



6068H

CD,3274,G00,28 -19-04JAN99

Engine application chart

This Component Technical Manual contains service information on the 3029, 4039, 4045, 6059 and 6068 engines produced by JOHN DEERE Saran (FRANCE) for the applications listed in the application chart.

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

3000-SERIES TRACTORS	ENGINE MODEL	SERIAL NUMBER
3100	CD3029DRT65	(189846 -)
3110	CD3029DRT65	
3200/3200X	CD4039DRT35	(181345 -)
3210/3210X	CD4039DRT35	
3300/3300X	CD4045DRT35	(182145 -)
3310/3310X	CD4045DRT35	
3400/3400X	CD4039TRT35	(181775 -)
3410/3410X	CD4039TRT35	

4000-SERIES TELESCOPIC HANDLERS	ENGINE MODEL	SERIAL NUMBER
4400	CD4039TF005	(237697 -)
4500	CD4039TF005	

5000-SERIES TRACTORS (Agritalia-built)	ENGINE MODEL	SERIAL NUMBER
5300/5300N	CD3029DAT01	(315424 -)
5400/5400N	CD3029TAT02	(289398 -)
5500/5500N	CD4039TAT01	(346168 -)

5000-SERIES TRACTORS (Augusta-built)	ENGINE MODEL	SERIAL NUMBER
5400N	CD3029TLV01	
5500N	CD4039TLV01	(201353 -)

5000-SERIES TRACTORS (For India)	ENGINE MODEL	SERIAL NUMBER
5300	CD3029DPY01	(383283 -)

(Continued on next page)

CD,3274,G00,24 -19-04JAN99

ENGINE APPLICATION CHART (CONT')

6000-SERIES TRACTORS	ENGINE MODEL	SERIAL NUMBER
6100 (Direct fan drive)	CD4045DL001	(101582 -)
6100 (Viscous fan drive)	CD4045DL002	(101582 -)
6200 (Direct fan drive)	CD4039TL001	(101625 -)
6200 (Viscous fan drive)	CD4039TL004	(101625 -)
6300 (Direct fan drive)	CD4039TL003	(101649 -)
6300 (Viscous fan drive)	CD4039TL006	(101649 -)
6400 (Direct fan drive)	CD4045TL001	(101682 -)
6400 (Viscous fan drive)	CD4045TL003	(101682 -)
6506 (Viscous fan drive)	CD6068DL001	(214852 -)
6600 (Viscous fan drive)	CD6059TL001	(128886 -)
6800 (Viscous fan drive)	CD6068TL001	(124505 -)
6900 (Viscous fan drive)	CD6068TL002	(186326 -)

WATERLOO TRACTORS	ENGINE MODEL	SERIAL NUMBER
7600	T06068TRW01	

ZWEIBRÜCKEN COMBINES	ENGINE MODEL	SERIAL NUMBER
2054	6068HZ001	(116452 -)
2254	6068HZ001	

ENGINES FOR CHINESE COMBINES	SERIAL NUMBER
CD6059TYC01	(367019 -)
CD6059TYC02	(363170 -)

ENGINES FOR GOLDONI TRACTORS	SERIAL NUMBER
CD3029DFG21	(287123 -)
CD3029DFG22	(287325 -)
CD3029TFG21	(287526 -)

(Continued on next page)

CD,3274,G00,25 -19-04JAN99

ENGINE APPLICATION CHART (CONT')

SARAN OEM ENGINES	SERIAL NUMBER	SARAN OEM ENGINES	SERIAL NUMBER
CD3029DF		CD3029TF	
CD3029DF001		CD3029TF001	
CD3029DF005	(162670 -)	CD3029TF002	(170797 -)
CD3029DF031		CD3029TF031	
CD3029DF032		CD3029TF032	(176015 -)
CD3029DF033	(177875 -)	CD3029TF033	(177880 -)
CD3029DF034		CD3029TF120	
CD3029DF120		CD3029TF121	
CD3029DF121		CD3029TF123	(354029 -)
CD3029DF122	(263024 -)	CD3029TF160	
CD3029DF123	(312932 -)	CD3029TF161	(288419 -)
CD3029DF124	(340207 -)	CD3029TF162	
CD3029DF128		CD3029TF163	(342829 -)
CD3029DF160			
CD3029DF161	(288417 -)		
CD3029DF162			
CD3029DF163			
CD3029DF164			
CD3029DF165			
CD4039DF		CD4039TF	
CD4039DF001		CD4039TF001	
CD4039DF002		CD4039TF002	
CD4039DF004	(152613 -)	CD4039TF003	(169516 -)
CD4039DF005	(165009 -)	CD4039TF004	(152616 -)
CD4039DF006	(340212 -)	CD4039TF005	
CD4039DF007	(378895 -)	CD4039TF006	(339780 -)
CD4039DF008		CD4039TF007	(379066 -)
CD4039DF031		CD4039TF008	
CD4039DF032		CD4039TF031	
		CD4039TF032	(166826 -)
CD4045DF001		CD4045TF001	
CD4045DF031		CD4045TF002	(170081 -)
		CD4045TF003	(342250 -)
		CD4045TF008	
		CD4045TF031	

(Continued on next page)

CD,3274,G00,29 -19-04JAN99

ENGINE APPLICATION CHART (CONT')

SARAN OEM ENGINES	SERIAL NUMBER	SARAN OEM ENGINES	SERIAL NUMBER
CD6059DF		CD6059TF	
CD6059DF001		CD6059TF001	
CD6059DF002		CD6059TF002	(158390 -)
CD6059DF003		CD6059TF003	(158394 -)
		CD6059TF004	
		CD6059TF005	(166159 -)
		CD6059TF006	(166960 -)
		CD6059TF008	(341217 -)
CD6068DF001		CD6068TF001	
		CD6068TF002	(187378 -)
		CD6068TF003	
		CD6068TF004	(344260 -)
		CD6068TF008	
		CD6068TF009	

CD,3274,G00,30 -19-04JAN99

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

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

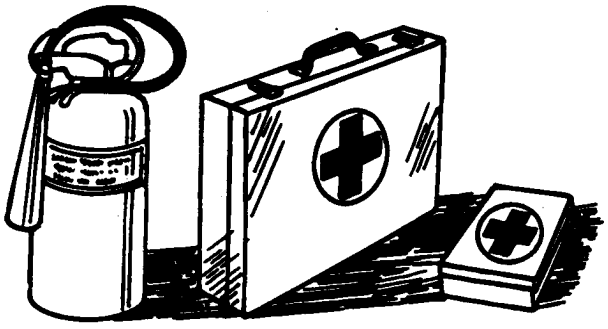
DX,SPARKS -19-03MAR93

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

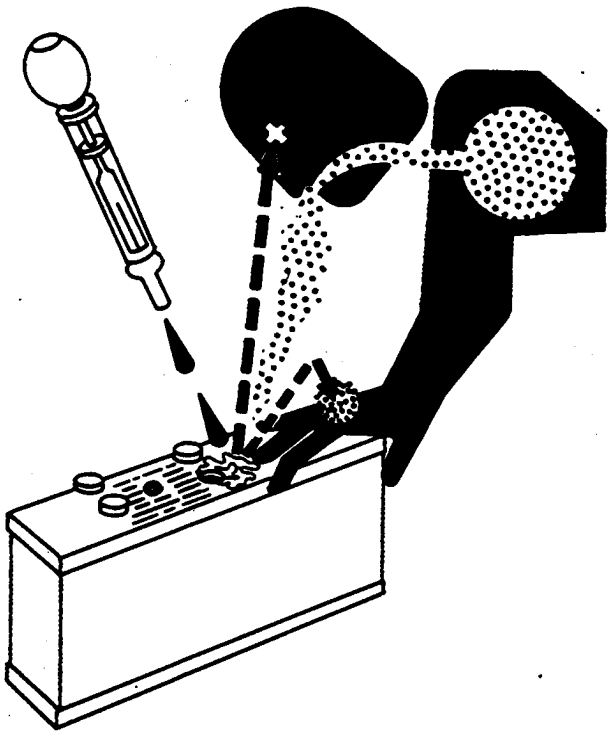
PREVENT ACID BURNS

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.

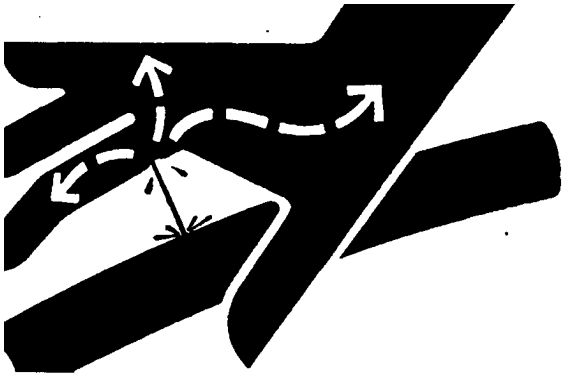
If acid is swallowed:
1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.



TS203 -UN-23AUG88

DX,POISON -19-21APR93

AVOID HIGH-PRESSURE FLUIDS



X9811 -UN-23AUG88

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

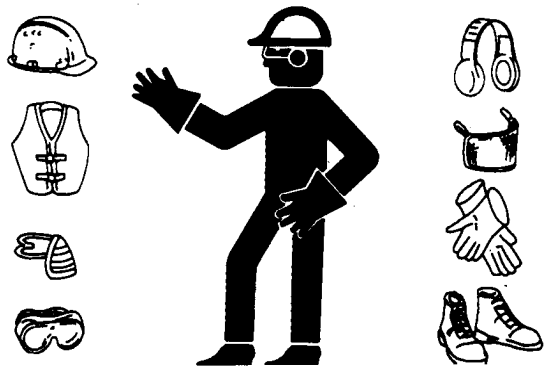
Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

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

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.

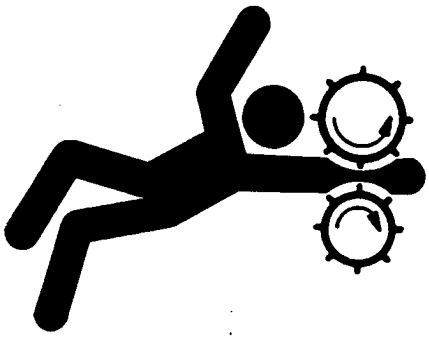
Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

DX,WEAR -19-10SEP90

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

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.

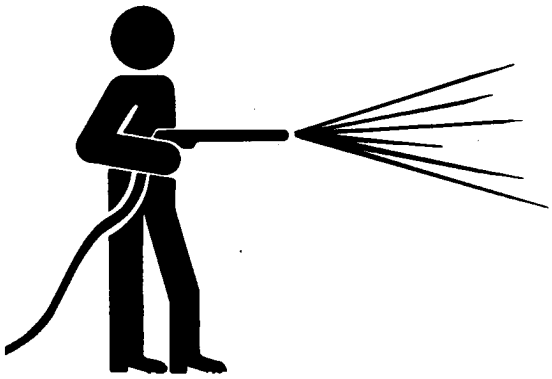
If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

TS220 -UN-23AUG88

DX,AIR -19-04JUN90

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

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

AVOID HEATING NEAR PRESSURIZED FLUID LINES

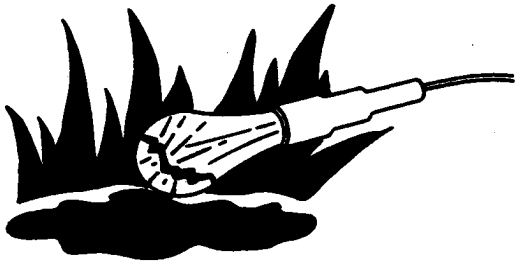
Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond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

TS953 -UN-15MAY90

DX,TORCH -19-03MAR93

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.



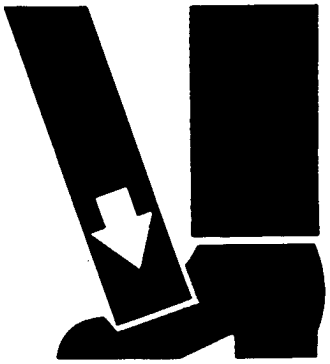
TS223 -UN-23AUG88

DX,LIGHT -19-04JUN90

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

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 -19-04FEB99

USE PROPER TOOLS

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.

TS779 -UN-08NOV89

DX,REPAIR -19-04JUN90

DISPOSE OF WASTE PROPERLY

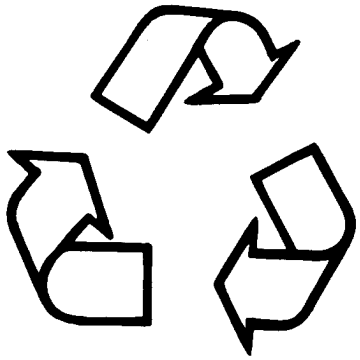
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

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

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

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



TS1133 -UN-26NOV90

DX,DRAIN -19-03MAR93

LIVE WITH SAFETY

00
8

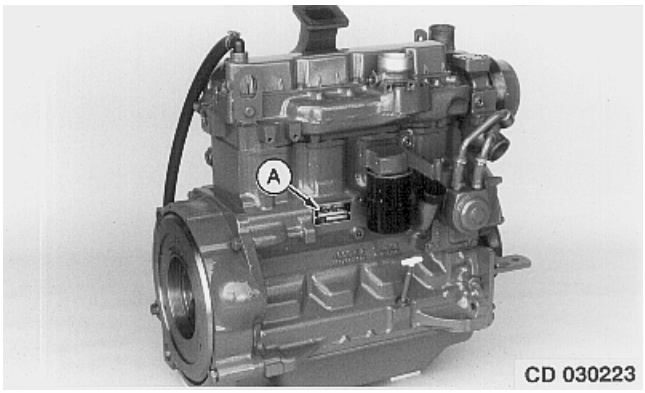
Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

TS231 -19-07OCT88

DX,LIVE -19-15APR98

ENGINE IDENTIFICATION

The engine can be identified from the serial plate (A) located on the right-hand side of the engine.
Some applications also have an additional serial plate located on top of the flywheel housing. Refer to the engine type to identify repair information in the Component Technical Manual.



-UN-07MAR95
CD30223

CD,3274,G01,1 -19-24FEB92

ENGINE PLATE INFORMATION (EARLIER DESIGN)

Three types of plates are used on engines and give the following information:

First line (all plates)

CD . . . . . Manufacturing factory
(CD = Saran, T0 = Dubuque)
4045 . . . . . Engine model designation
4 = Number of cylinders
045 = Total displacement
(045 = 4.5 liters)
D . . . . . Aspiration code
D = Naturally Aspirated
H = air-to-air aftercooled
T = Turbocharged
000000 . . . . Sequential serial number

Second line (all plates)

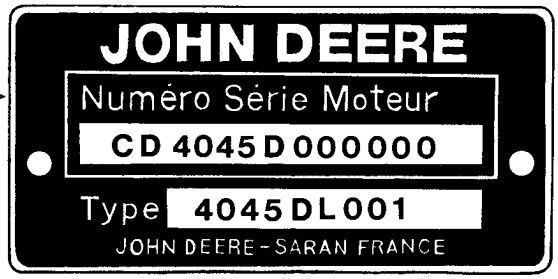
4045D . . . . . See above
L . . . . . User code
F = OEM application
L = Mannheim
RW = Waterloo Tractor
Z = Zweibrücken
001 . . . . . Application number

Third line (OEM plates only)

First field . . . . . Not used
Second field . . . . . Absorption coefficient of smoke emissions (shown on certain OEM engines)

A—Plate used on John Deere equipment
B—Plate used on OEM engines
C—Generic plate used on certain OEM engines

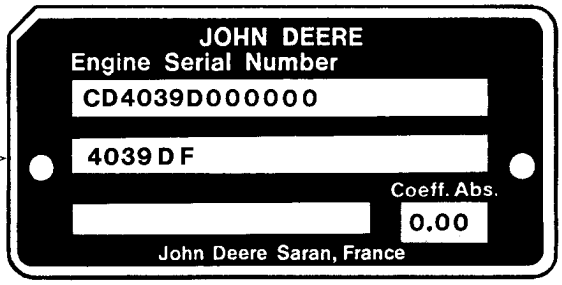
A



CD 030230

-UN-07MAR95
CD30230

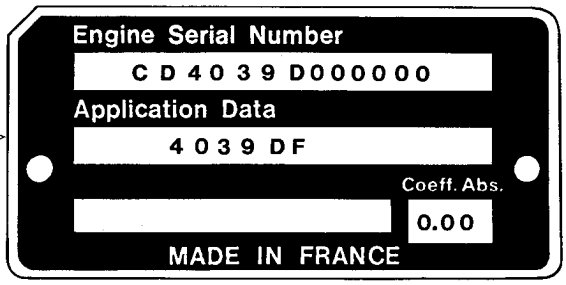
B



CD 030224

-UN-07MAR95
CD30224

C



CD 030225

-UN-07MAR95
CD30225

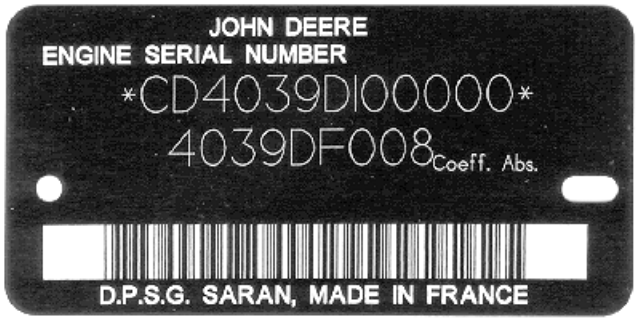
CD,3274,G01,2 -19-04JAN99

ENGINE PLATE INFORMATION (LATER DESIGN)

A new engine plate design as shown, is now affixed to the engine.

01
2

Information on this new plate is the same as previously.



-UN-22FEB99
CD30705

CD,3274,G01,10 -19-04JAN99

REPOWER ENGINE PLATE

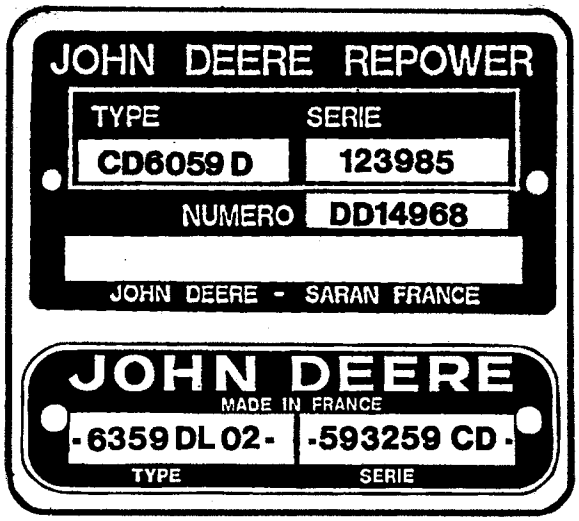
A specific plate is fixed on repower engines for proper identification. This plate gives the following information:

First line
First field . . . . . Engine type
Second field . . . . . Sequential serial number

Second line
DD———— . . . . . Repower engine part number

The third line contains a bar code information for factory use.

NOTE: The serial number plate from original engine must be fixed on the repower plate as shown.



-UN-22FEB99
CD30706

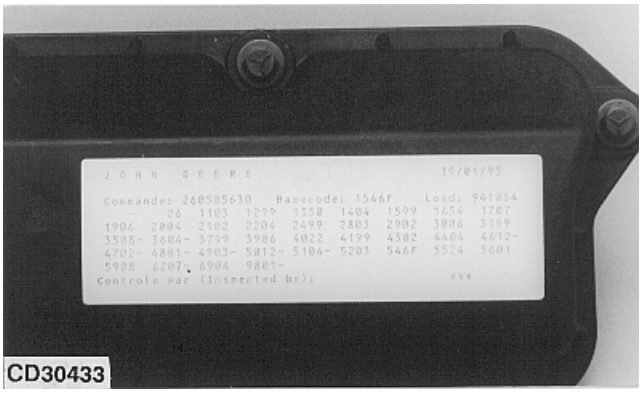
CD,3274,G01,6 -19-04JAN99

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.



-UN-10MAY95 CD30433

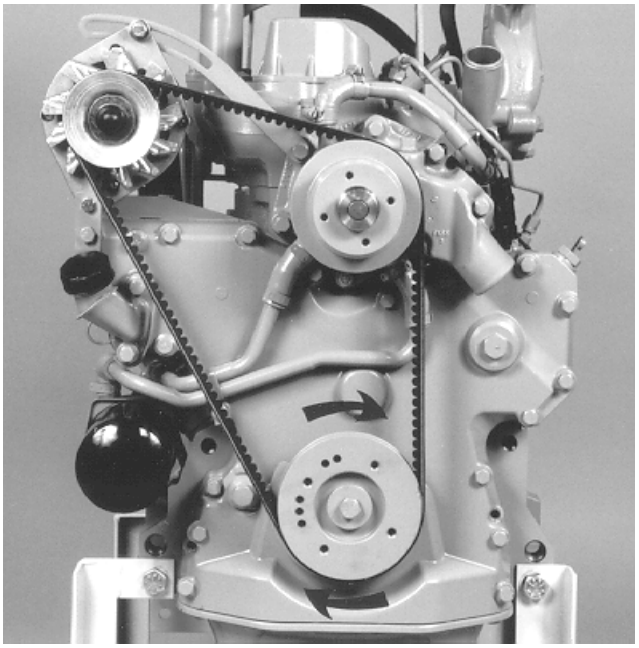
CD,3274,G01,3 -19-01FEB94

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.



-UN-04MAY98 CD30525

CD,CTM125,005 -19-01DEC97

BASIC ENGINE SPECIFICATIONS (3029 - 4039 & 6059)

GENERAL	UNIT of Measure	3029D	3029T	4039D	4039T	6059D	6059T
Number of Cylinders	---	3	3	4	4	6	6
Bore	mm (in.)	106.5 (4.19)	106.5 (4.19)	106.5 (4.19)	106.5 (4.19)	106.5 (4.19)	106.5 (4.19)
Stroke	mm (in.)	110 (4.33)	110 (4.33)	110 (4.33)	110 (4.33)	110 (4.33)	110 (4.33)
Displacement	L ($in.^3$)	2.9 (179)	2.9 (179)	3.9 (239)	3.9 (239)	5.9 (359)	5.9 (359)
Compression Ratio	---	17.8:1	17.8:1	17.8:1	17.8:1	17.8:1	17.8:1
Firing Order	---	1-2-3	1-2-3	1-3-4-2	1-3-4-2	1-5-3-6-2-4	1-5-3-6-2-4
Injection System	---	Direct	Direct	Direct	Direct	Direct	Direct
Aspiration	---	Natural	Turbocharged	Natural	Turbocharged	Natural	Turbocharged
Rated Speed*	rpm	2500	2500	2500	2500	2500	2500
Power** @ Rated Speed	kW (hp)	43 (58)	59 (79)	60 (80)	82 (110)	89 (120)	123 (165)
Power** @ 1800 rpm	kW (hp)	35 (47)		49 (66)	76 (102)		123 (165)
Power** @ 1500 rpm	kW (hp)	31 (42)		40 (54)	63 (85)		104 (140)
Weight (dry)	kg (lbs)	323 (712)	330 (728)	422 (931)	458 (1010)	518 (1143)	525 (1158)

**Vary by application; refer to the machine technical or operator's manual for specific engine speeds and powers.*

***Without fan.*

CD,3274,G01,8 -19-01FEB94

BASIC ENGINE SPECIFICATIONS (4045 & 6068)

GENERAL	UNIT of Measure	4045D	4045T	6068D	6068T	6068H
Number of Cylinders	---	4	4	6	6	6
Bore	mm (in.)	106.5 (4.19)	106.5 (4.19)	106.5 (4.19)	106.5 (4.19)	106.5 (4.19)
Stroke	mm (in.)	127 (5.00)	127 (5.00)	127 (5.00)	127 (5.00)	127 (5.00)
Displacement	L (cu.in.)	4.5 (276)	4.5 (276)	6.8 (414)	6.8 (414)	6.8 (414)
Compression Ratio	---	17.8:1	17.2:1	17.8:1	17.2:1	17.2:1
Firing Order	---	1-3-4-2	1-3-4-2	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4
Injection System	---	Direct	Direct	Direct	Direct	Direct
Aspiration	---	Natural	Turbo-charged	Natural	Turbo-charged	Air-to-air aftercooler
Rated Speed*	rpm	2400	2400	2400	2400	2200
Power** at Rated Speed	kW (hp)	63 (85)	86 (115)	97 (130)	130 (175)	140 (190)
Power** at 1800 rpm	kW (hp)		84 (113)			
Power** at 1500 rpm	kW (hp)		70 (95)		116 (155)	
Weight (dry)	kg (lbs)	474 (1046)	487 (1074)	588 (1297)	602 (1328)	

**Vary by application; refer to the machine technical or operator's manual for specific engine speeds and powers.*

***Without fan.*

CD,3274,G01,9 -19-04JAN99

DIESEL FUEL

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

01
6

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 (5,000 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 -19-12FEB99

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®

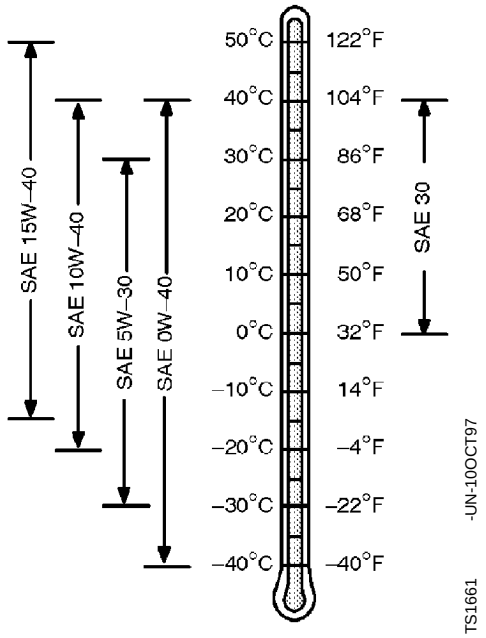
Other oils may be used if they meet one or more of the following:

- API Service Classification 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.



DX,ENOIL -19-10OCT97

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

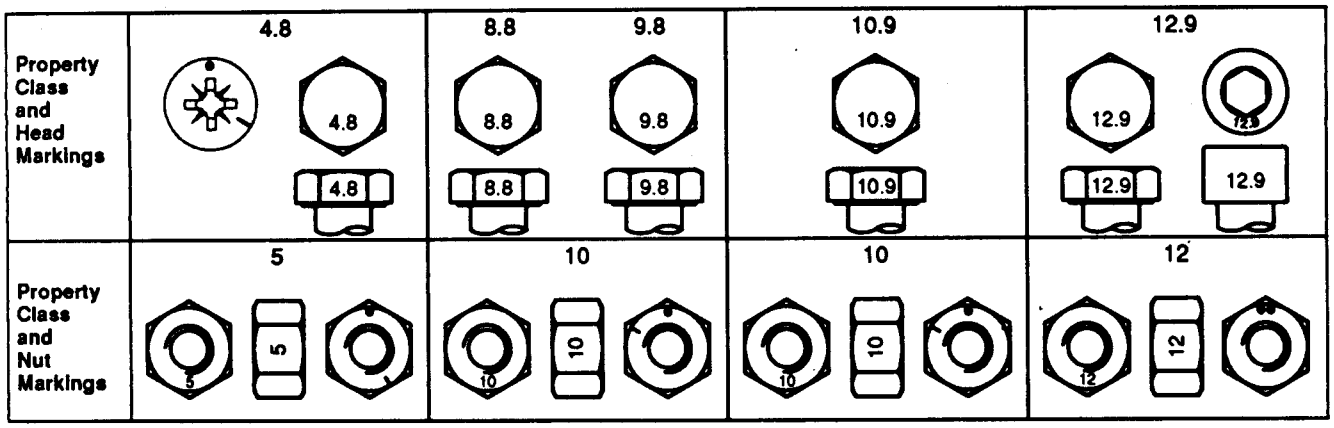
Drain the factory fill engine coolant, flush the cooling system, and refill with new coolant after the first 3 years or 3000 hours of operation. Subsequent drain intervals are determined by the coolant used for service. At each interval, drain the coolant, flush the cooling system, and refill with new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

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

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

DX,COOL8 -19-12FEB99

METRIC BOLT AND CAP SCREW TORQUE VALUES



TS1163 -19-04MAR91

Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]	
	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft
M6	4.8	3.5	6	4.5	9	6.5	11	8.5	13	9.5	17	12	15	11.5	19	14.5
M8	12	8.5	15	11	22	16	28	20	32	24	40	30	37	28	47	35
M10	23	17	29	21	43	32	55	40	63	47	80	60	75	55	95	70
M12	40	29	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	47	80	60	120	88	150	110	175	130	225	165	205	150	260	190
M16	100	73	125	92	190	140	240	175	275	200	350	255	320	240	400	300
M18	135	100	175	125	260	195	330	250	375	275	475	350	440	325	560	410
M20	190	140	240	180	375	275	475	350	530	400	675	500	625	460	800	580
M22	260	190	330	250	510	375	650	475	725	540	925	675	850	625	1075	800
M24	330	250	425	310	650	475	825	600	925	675	1150	850	1075	800	1350	1000
M27	490	360	625	450	950	700	1200	875	1350	1000	1700	1250	1600	1150	2000	1500
M30	675	490	850	625	1300	950	1650	1200	1850	1350	2300	1700	2150	1600	2700	2000
M33	900	675	1150	850	1750	1300	2200	1650	2500	1850	3150	2350	2900	2150	3700	2750
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2750	4750	3500

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.

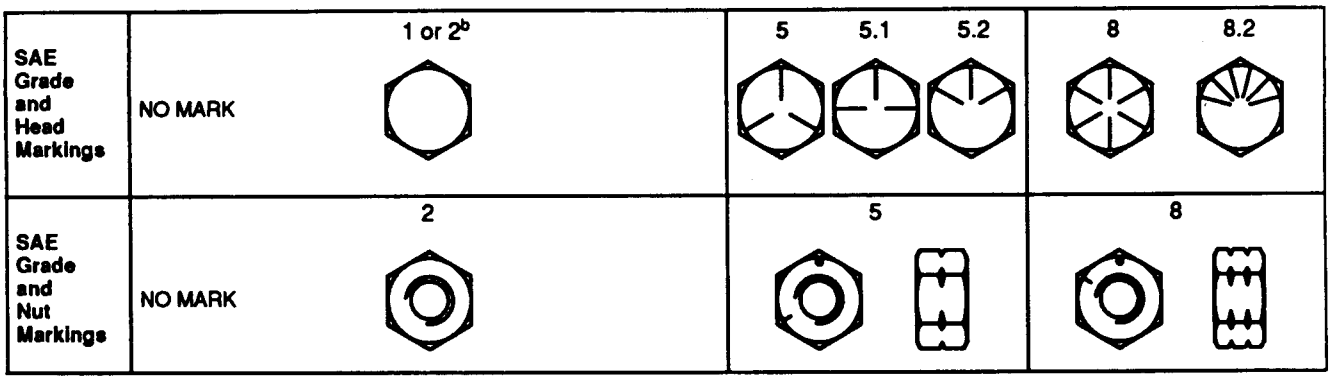
Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

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.

[a] "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated without any lubrication.

DX,TORQ2 -19-20JUL94

UNIFIED INCH BOLT AND CAP SCREW TORQUE VALUES



TS1162 -19-04MAR91

Size	Grade 1				Grade 2[b]				Grade 5, 5.1, or 5.2				Grade 8 or 8.2			
	Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]	
	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft
1/4	3.7	2.8	4.7	3.5	6	4.5	7.5	5.5	9.5	7	12	9	13.5	10	17	12.5
5/16	7.7	5.5	10	7	12	9	15	11	20	15	25	18	28	21	35	26
3/8	14	10	17	13	22	16	27	20	35	26	44	33	50	36	63	46
7/16	22	16	28	20	35	26	44	32	55	41	70	52	80	58	100	75
1/2	33	25	42	31	53	39	67	50	85	63	110	80	120	90	150	115
9/16	48	36	60	45	75	56	95	70	125	90	155	115	175	130	225	160
5/8	67	50	85	62	105	78	135	100	170	125	215	160	240	175	300	225
3/4	120	87	150	110	190	140	240	175	300	225	375	280	425	310	550	400
7/8	190	140	240	175	190	140	240	175	490	360	625	450	700	500	875	650
1	290	210	360	270	290	210	360	270	725	540	925	675	1050	750	1300	975
1-1/8	400	300	510	375	400	300	510	375	900	675	1150	850	1450	1075	1850	1350
1-1/4	570	425	725	530	570	425	725	530	1300	950	1650	1200	2050	1500	2600	1950
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2150	1550	2700	2000	3400	2550
1-1/2	1000	725	1250	925	990	725	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

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 fasteners 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.

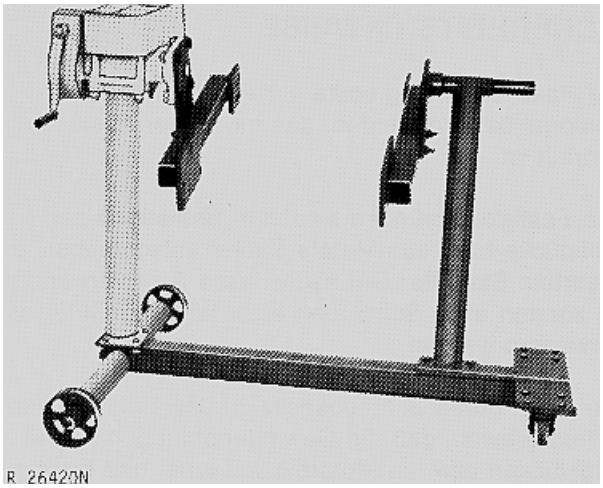
[a] "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated without any lubrication.

[b] Grade 2 applies for hex cap screws (not hex bolts) up to 152 mm (6-in.) long. Grade 1 applies for hex cap screws over 152 mm (6-in.) long, and for all other types of bolts and screws of any length.

DX,TORQ1 -19-20JUL94

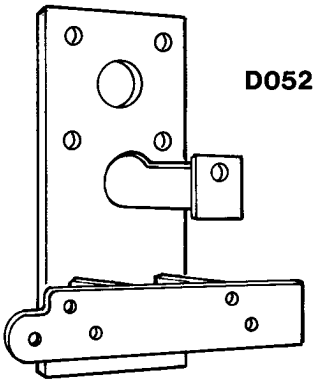
ENGINE REPAIR STAND

To facilitate engine repair, the D01003AA repair stand can be used in conjunction with D05225ST adapter for 300 series engines.



R26420N -UN-22MAY95

D01003AA repair stand



D05225ST -UN-22MAY95

D05225ST adapter

CD,3274,G02,1 -19-24FEB92

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. Approximate engine weights are listed below:

— 3 cyl. engines = 330 kg (728 lb)
— 4 cyl. engines = 450 kg (992 lb)
— 6 cyl. engines = 580 kg (1279 lb)

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.

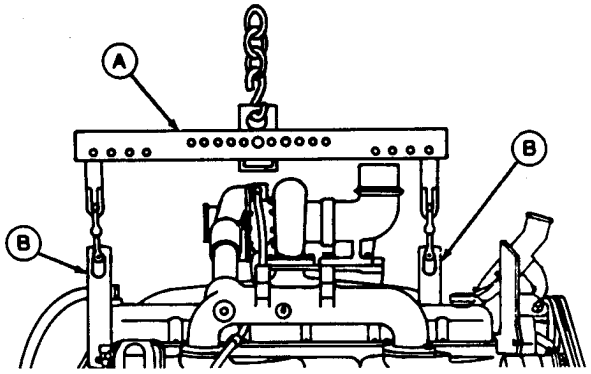
CD,3274,G02,2 -19-24FEB92

ENGINE LIFTING PROCEDURE

Attach JDG23 engine lifting sling (A), or other suitable sling, to JD-244 engine lifting eyes (B) and hoist the engine using a lifting device.

NOTE: Use of an engine lifting sling (as shown) is the preferred method for lifting engines. However, if a sling is not on hand, engine can be lifted by chain(s) attached to lifting eyes and lifting device.

IMPORTANT: If a turbocharged engine with low-profile design is to be lifted, remove the turbocharger before attaching engine to repair stand.



RG4738 -UN-18MAY90

CD,3274,G02,3 -19-01FEB94

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.

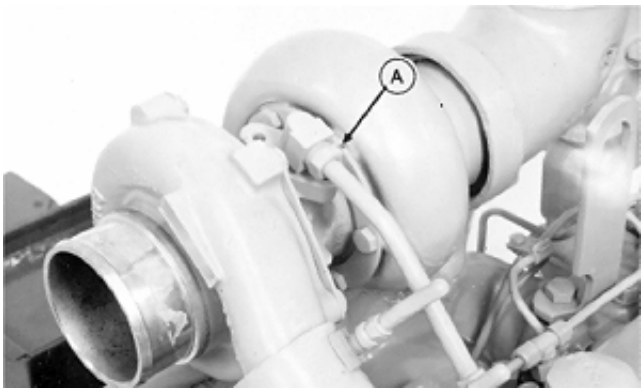
CD,3274,G02,4 -19-24FEB92

DISCONNECT TURBOCHARGER OIL INLET LINE

Drain all engine oil and coolant, if not previously done.

IMPORTANT: When servicing turbocharged engines on a rollover stand, disconnect turbo oil inlet line from turbocharger (A) or oil filter housing before rolling engine over. Failure to do so may cause a hydraulic lock upon starting engine. Hydraulic lock may cause severe engine damage.

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.



RG5642 -UN-02APR90

CD,3274,G02,5 -19-24FEB92

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 water manifold with thermostats (see Group 30).

6. Remove oil cooler piping and water pump (see Groups 25 and 30).

(Continued on next page)

7. Remove dipstick, oil filter, and engine oil cooler. Discard standard-flow oil cooler if oil contained metal particles (see Group 25).

8. Remove oil pressure regulating valve assembly (see Group 25).

9. Remove fuel filter, fuel transfer pump, and fuel lines (see Group 40).

10. Remove injection lines, injection pump, and injection nozzles (see Group 40).

11. Remove starting motor.

12. 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.

13. Remove cylinder head. Check piston protrusion. Verify piston height selection (see Groups 05 and 10).

14. Remove cam followers. Keep in same sequence as removed (see Group 20).

CD,3274,G03,1 -19-24FEB92

ENGINE DISASSEMBLY SEQUENCE - CONTINUED

15. Remove oil pan (see Group 25).

16. Remove flywheel and flywheel housing (see Group 15).

17. Remove crankshaft pulley (see Group 15).

18. Remove timing gear cover (see Group 20).

19. Remove oil pump drive gear, outlet tube (and its O-ring in block) and pump body (see Group 25).

20. Remove oil slinger, timing gears and camshaft. Perform wear checks (see Group 20).

21. Remove balancer shafts (4-cylinder only, if equipped), see Group 20.

22. Remove engine front plate (see Group 20).

23. Remove lube oil system by-pass valve (see Group 25).

24. Stamp cylinder number on rod (if required). Remove pistons and rods. Perform wear checks with “PLASTIGAGE”. On 4 and 6-cylinder engines, remove two at a time (see Group 10).

25. Remove main bearings and crankshaft. Perform wear checks with “PLASTIGAGE” (see Group 15).

26. Remove cylinder liners and mark each one with cylinder number from which removed (see Group 10).

27. Remove piston cooling orifices (see Groups 10 and 15).

28. Remove balancer shaft and camshaft bushings (if equipped), see Group 20.

29. Remove cylinder block plugs and serial number plate (as required) when block is to be put in a “hot tank” (see Group 10).

30. Clean out liner bores (upper and lower areas) with nylon brush (see Group 10).

31. Measure cylinder block (see Groups 10, 15, and 20).

CD,3274,G03,1A -19-01FEB94

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

CD,CTM125,011 -19-01DEC97

ENGINE ASSEMBLY SEQUENCE

The following 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 balancer shaft and 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. Determine bearing clearance using “PLASTIGAGE” (see Group 15).

5. Install flywheel housing, rear oil seal and flywheel (see Group 15).

(Continued on next page)

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 balancer shafts. Check end play (see Group 20).

10. Install oil outlet tube, O-ring in block, and oil pump (see Group 25).

11. Install injection pump on front plate (see Group 40).

12. Install camshaft, timing gears, and oil slinger (see Group 20).

13. Time all gears to TDC, No. 1 cylinder on compression stroke (see Group 20).

14. Install timing gear cover (with new front seal), see Group 20.

CD,3274,G03,2 -19-24FEB92

ENGINE ASSEMBLY SEQUENCE - CONTINUED

15. Install oil pan (see Group 25).

16. Install oil pressure regulating valve (if equipped), see Group 25.

17. Install cam follower in the same sequence as removed (see Group 20).

18. Install cylinder head gasket, cylinder head, push rods, and rocker arm assembly (see Group 05).

19. Install starting motor.

20. Install injection nozzles (with new seals) and injection lines (see Group 40).

21. Install fuel filter, fuel transfer pump, and fuel lines (see Group 40).

22. 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).

23. Install water manifold/thermostat housing with thermostats (see Group 35).

24. Install exhaust manifold and turbocharger. Prelube the turbocharger (see Group 35).

25. Install water pump and hoses (see Group 35).

26. Install crankshaft pulley or vibration damper/pulley (see Group 15).

27. Install alternator, fan, and fan belts (see Group 30).

28. Adjust valves and install rocker arm cover (see Group 05).

29. Install vent tube.

30. Fill engine with clean oil and proper coolant.

31. Perform engine break-in and perform normal standard performance checks (see Group 210).

CD,3274,G03,2A -19-24FEB92

SPECIAL OR ESSENTIAL TOOLS

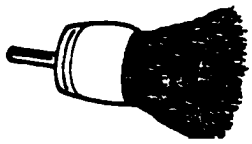
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

DX,TOOLS -19-20JUL95

RG5063 -UN-23AUG88

End Brush D17024BR

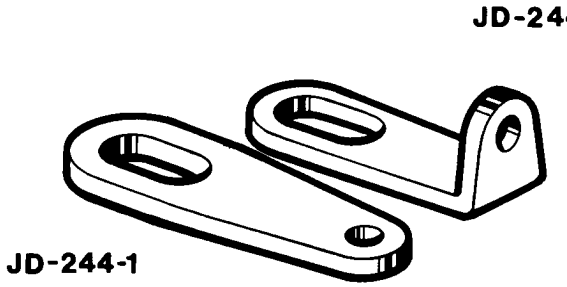
Clean valve seat and bores.



S53,D17024,BR -19-26JAN87

Lifting eyes JD-244

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



JDD244 -UN-22MAY95

CD,JD244 -19-01FEB94

RG5085 -UN-23AUG88

Torque wrench adapter JD-307

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

CD,JD307 -19-04AUG92

RG5084 -UN-23AUG88

Nozzle Bore Cleaning Tool JDE39

Clean injection nozzle bores in cylinder head.

RG,JDE39 -19-14FEB92

RG5068 -UN-23AUG88

Timing Pin JDE81-4

Lock engine at TDC when timing valve train. Use with JDE81-1 or JDE83 Flywheel Turning Tool.

RG,JDE814L -19-02APR90

RG4950 -UN-23AUG88

Flywheel Turning Tool JDE83
or JDG820 (formerly JDE81-1)

Rotate engine flywheel. Use with 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.

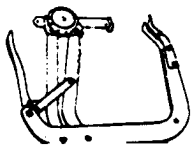
Use JDG820 on engines with a 129 tooth flywheel ring gear and a flywheel housing tool guide bore of 29.9 mm (1.18 in.) diameter.

05
2

CD,JDE83 -19-01FEB94

RG5070 -UN-23AUG88

Valve Spring Compressor JDE138

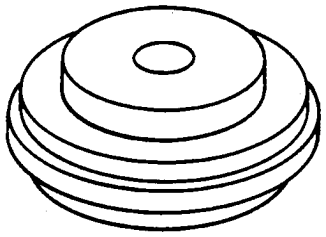


Use to compress valve springs when removing and installing valves.

RG,JDE138 -19-02APR90

Valve Seat Insert Installing Adapter JDG675

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



RG5240 -UN-23AUG88

RG,JDG675 -19-02APR90

RG5065 -UN-23AUG88

Valve Seat Driver JDG676

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

RG,JDG676 -19-20JUL92

RG5612 -UN-12APR90

Valve Stem Seal Installer JDG678

Use to install valve stem seals.

CD,JDG678 -19-24FEB92

RG5100 -UN-23AUG88

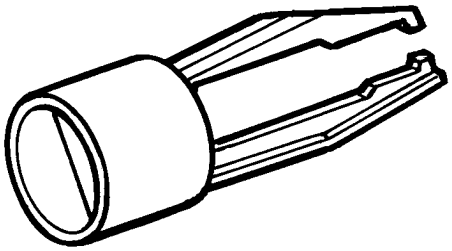
Tap JDG680

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

RG,JDG680 -19-02APR90

Nozzle Puller Adapter JDG716

Use with JDE38-2 and JDE38-3 to pull Stanadyne 9.5 mm injection nozzles.



CD 030338

CD30338 -UN-07MAR95

CD,JDG716 -19-12NOV92

SPECIFICATIONS

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Thickness of new cylinder head	104.87—105.13 mm (4.129—4.139 in.)	
Maximum permissible amount to be machined from cylinder head	0.76 mm (0.03 in.)	
Minimum thickness of cylinder head	104.11 mm (4.099 in.)	
Maximum permissible out-of-flat of cylinder head sealing surface	0.08 mm (0.003 in.)	
Combustion face surface finish	approx. 0.0025 mm C.L.A.* (0.0001 in. C.L.A.)	
Valve stem diameter (standard)		
Intake valve	7.864—7.884 mm (0.3096—0.3104 in.)	
Exhaust valve	7.848—7.874 mm (0.3090—0.3100 in.)	
Bore for valve stem	7.912—7.938 mm (0.3115—0.3125 in.)	
Clearance between bore and valve stem	0.05 to 0.10 mm (0.002 to 0.004 in.)	0.15 mm (0.006 in.)
Valve stem oversize, stem diameter larger than standard by	0.38 mm (0.015 in.) 0.76 mm (0.030 in.)	
Valve seat angle (intake and exhaust)	30°	
Valve face angle (intake and exhaust)	29.25°	
Maximum valve seat runout	0.08 mm (0.003 in.)	
Maximum valve face runout	0.038 mm (0.0015 in.)	
Valve recess (below cylinder head surface):		
Intake valve	0.61—1.11 mm (0.024—0.044 in.)	1.63 mm (0.064 in.)
Exhaust valve	1.22—1.72 mm (0.048—0.068 in.)	2.26 mm (0.089 in.)
Valve seat width (intake and exhaust)	1.50—2.00 mm (0.059—0.079 in.)	

(Continued on next page)

* *C.L.A. (Center Line Average) corresponds to a measure of surface texture.*

CD,3274,G05,49 -19-04JAN99

SPECIFICATIONS - CONTINUED

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Valve seat insert outside diameter:		
Intake valve	47.205—47.231 mm (1.858—1.859 in.)	
Exhaust valve	43.087—43.113 mm (1.696—1.697 in.)	
Valve head diameter:		
Intake valve	46.47—46.73 mm (1.830—1.840 in.)	
Exhaust valve	42.37—42.63 mm (1.668—1.678 in.)	
Firing order:		
3-cylinder engines	1 - 2 - 3	
4-cylinder engines	1 - 3 - 4 - 2	
6-cylinder engines	1 - 5 - 3 - 6 - 2 - 4	
Valve clearance (engine cold):		
Intake valve	0.35 mm (0.014 in.)	
Exhaust valve	0.45 mm (0.018 in.)	
Valve lift (zero valve clearance):		
Intake valve	11.56—12.37 mm (0.455—0.487 in)	11.13 mm (0.438 in.)
Exhaust valve	11.28—12.12 mm (0.444—0.477 in.)	10.85 mm (0.427 in.)
Rocker arm shaft diameter	19.99—20.02 mm (0.787—0.788 in.)	19.94 mm (0.785 in.)
Rocker arm bore diameter	20.07—20.12 mm (0.790—0.792 in.)	20.17 mm (0.794 in.)
Rocker arm shaft spring tension at a length of 46 mm (1.81 in.)	18—27 N (4—6 lb)	
Valve springs free height	approx. 54 mm (2.125 in.)	
Valve spring tension:		
at a length of 46 mm (1.81 in.)	240—180 N (54—62 lb)	
at a length of 34.5 mm (1.36 in.)	590—680 N (133—153 lb)	

CD,3274,G05,50 -19-04JAN99

TORQUES FOR HARDWARE

Rocker arm shaft clamp	50 N·m (35 lb-ft)
Cylinder head cap screws:	
Step 1	100 N·m (75 lb-ft)
Step 2	150 N·m (110 lb-ft)
Step 3	Wait 5 minutes and verify 150 N·m (110 lb-ft)
Step 4	Tighten additional 60° ± 10°
Fuel injection nozzles to cylinder head	40 N·m (30 lb-ft)
Intake manifold to cylinder head	50 N·m (37 lb-ft)
Exhaust manifold to cylinder head	50 N·m (37 lb-ft)
Rocker arm cover to cylinder head	10 N·m (7 lb-ft)

CD,3274,G05,52 -19-01FEB94

CYLINDER HEAD - EXPLODED VIEW

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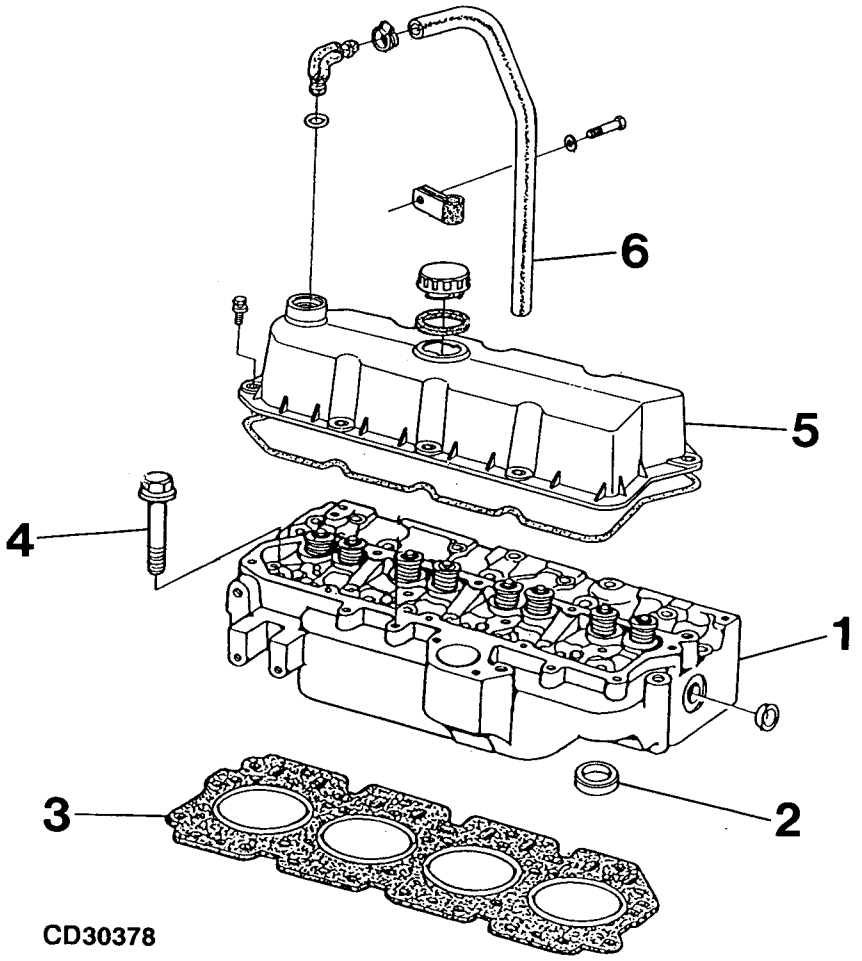
6

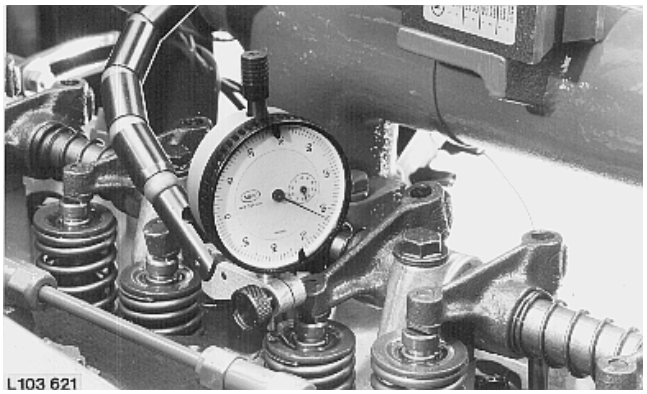


CD30378 -UN-10MAY95

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,3274,G05,53 -19-01FEB94

CHECK VALVE LIFT



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

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 spring cap or 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 given below:

VALVE LIFT at 0.00 mm (in.) clearance

Intake valves	11.56—12.37 mm (0.455—0.487 in.)
Wear tolerance	11.13 mm (0.438 in.)
Exhaust valves	11.28—12.12 mm (0.444—0.477 in.)
Wear tolerance	10.85 mm (0.427 in.)

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,3274,G05,2 -19-24FEB92

REMOVING CYLINDER HEAD

Remove intake and exhaust manifolds.

Using special puller JDG716, remove the fuel injection nozzles.

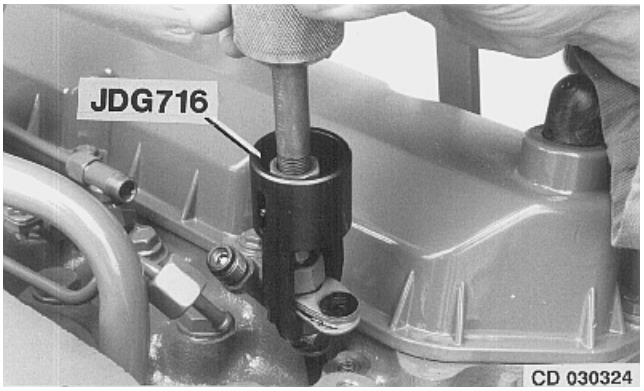
NOTE: Removal of fuel injection nozzles is necessary to prevent them being damaged when cylinder head is removed.

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

Remove rocker arm shaft.

Remove cylinder head cap screws and lift off cylinder head assembly.

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



CD030324 -UN-17FEB95

L103623 -UN-07MAR95

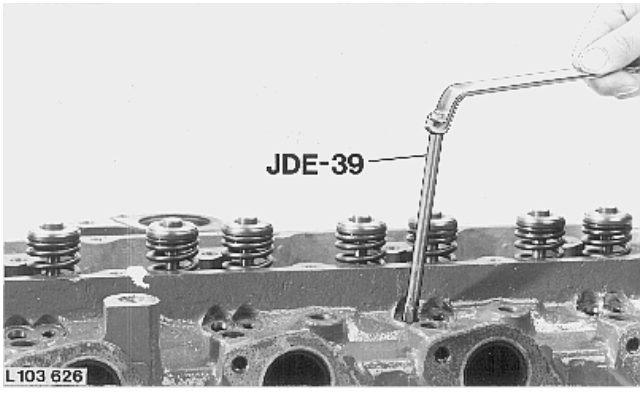
CD,3274,G05,4 -19-24FEB92

CLEANING INJECTION NOZZLE BORES

Using special tool JDE39, 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.

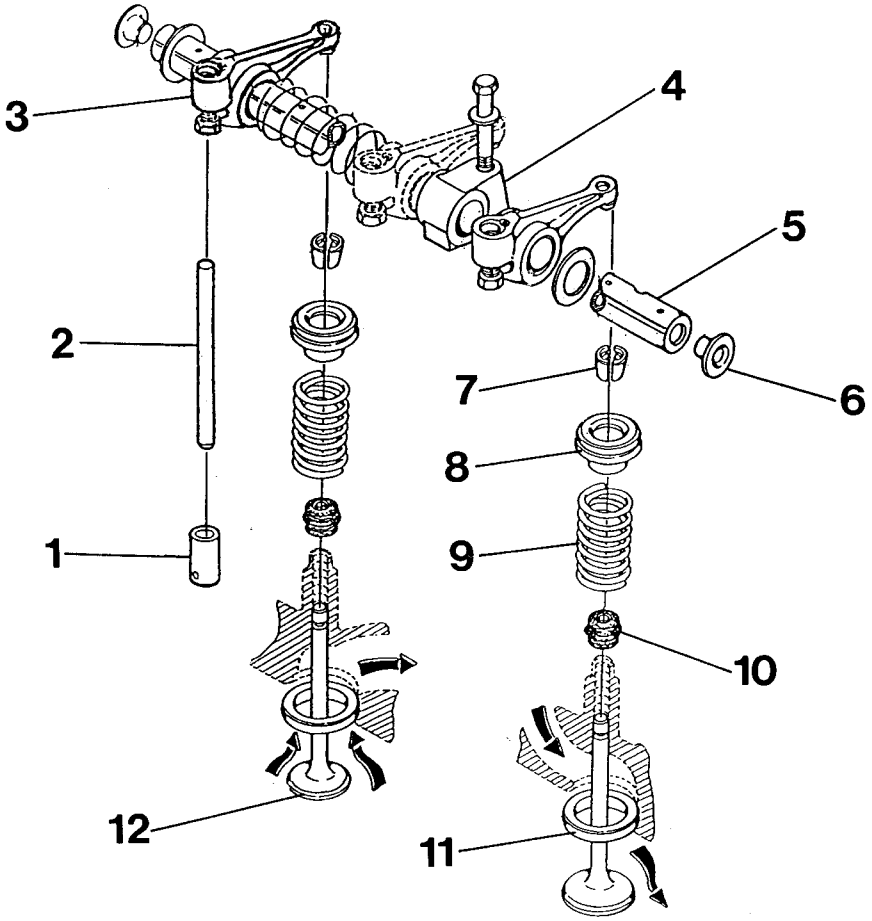
Check cooling passages for lime deposits. Clean when necessary, using a suitable cooling system cleaning solution.



L103626 -UN-18JAN95

CD,3274,G05,5 -19-24FEB92

VALVE ACTUATING PARTS



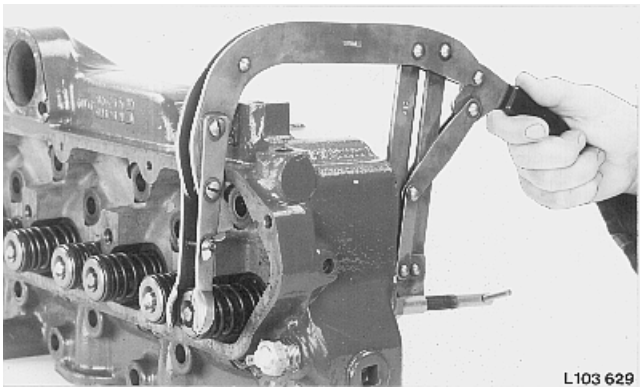
CD30379

CD30379 -UN-10MAY95

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

CD,3274,G05,54 -19-01FEB94

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.

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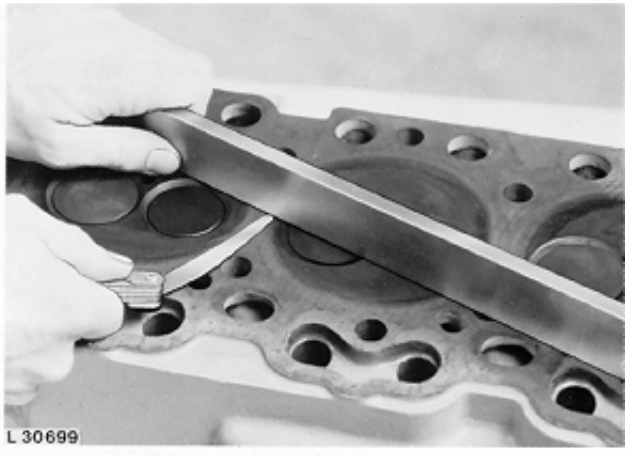
10

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

CHECKING CYLINDER HEAD FLATNESS



Maximum permissible flatness is 0.08 mm (0.003 in.).

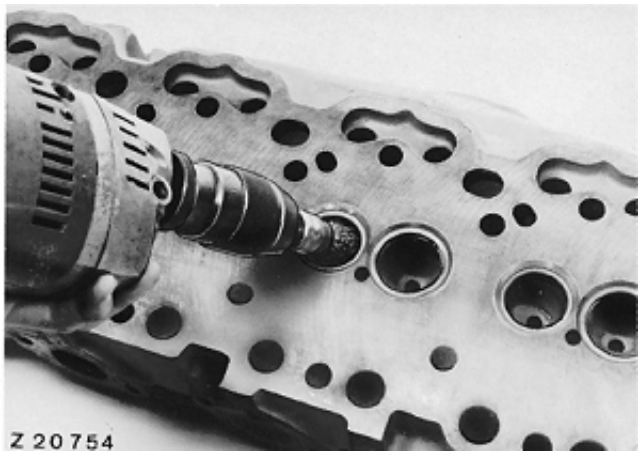
Machined surface of cylinder head must be refaced if flatness is more than specified maximum.

NOTE: Maximum permissible amount to be machined from cylinder head is 0.76 mm (0.03 in.). After any head remachining, always recheck valve recesses.

CD,3274,G05,6 -19-24FEB92

CLEANING VALVE SEATS

Use an electric hand drill with D17024BR End Brush to remove all carbon deposits.

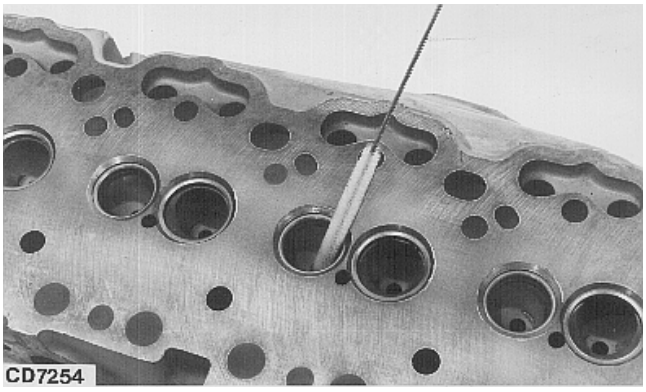


CD,3274,G05,9 -19-24FEB92

CLEANING 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.



CD,3274,G05,10 -19-24FEB92

MEASURE VALVE GUIDES

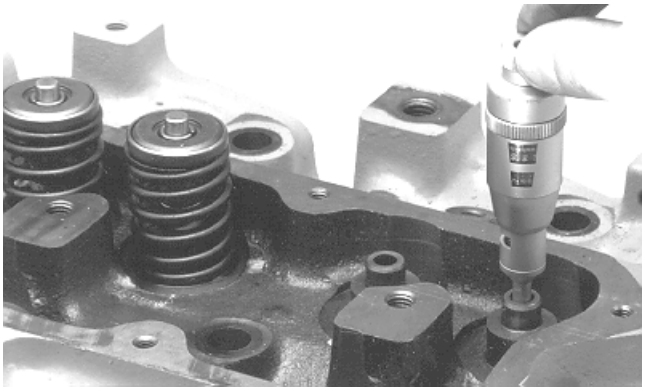
Using a micrometer, measure valve guides then compare with specifications.

VALVE GUIDE SPECIFICATIONS

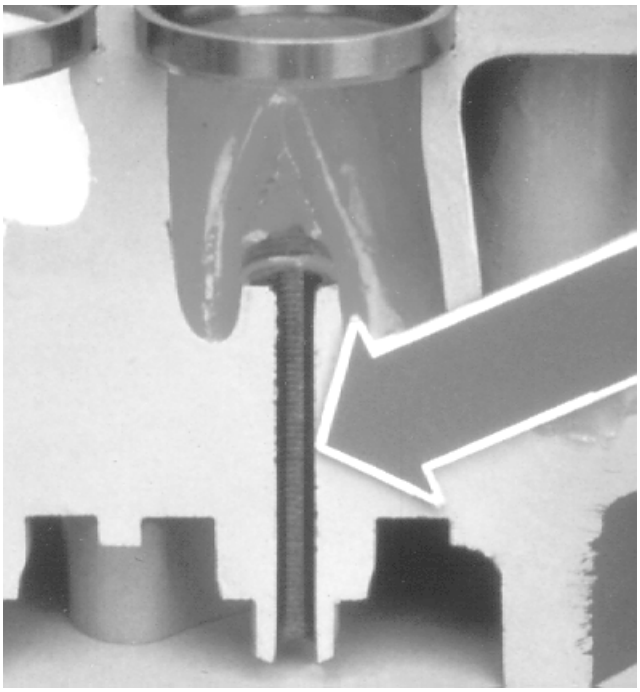
Valve guide bore diameter in a new cylinder head	7.912—7.938 mm (0.312—0.313in.)
New guide-to-valve stem clearance	0.05—0.10 mm (0.002—0.004 in.)
Maximum permissible clearance	0.15 mm (0.006 in.)

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 a proper guide-to-stem clearance.

NOTE: Production valve guides have a very shallow spiral cut (arrow), similar to a thread, to lubricate the valve stem with a metered supply of oil. Be sure, when valve guides are reamed that this groove is restored.



CD30550 -UN-04MAY98



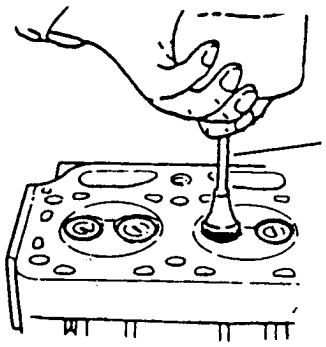
CD30548 -UN-19MAY98

CD,CTM125,027 -19-01DEC97

LAPPING VALVE SEATS

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

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



CD30380 -UN-10MAY95

CD30380

CD,3274,G05,55 -19-01FEB94

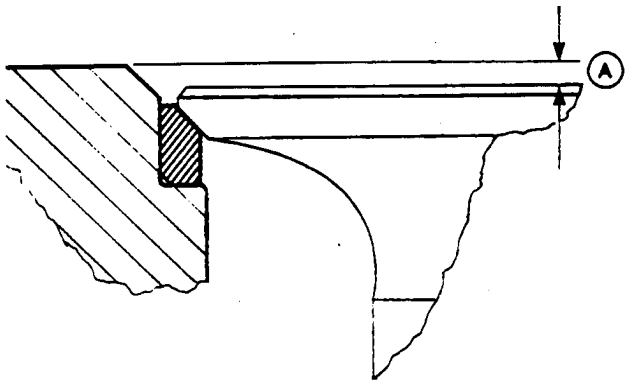
CHECK VALVE RECESS

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

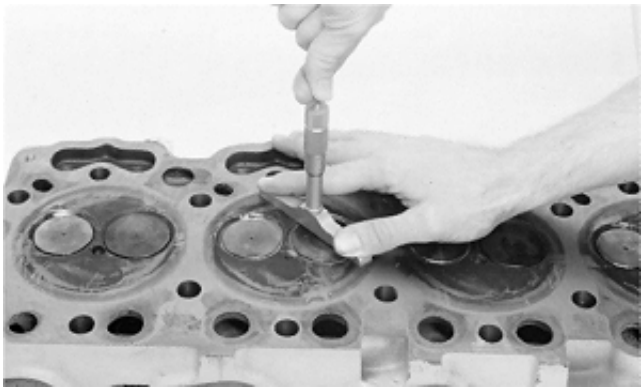
VALVE RECESS SPECIFICATIONS

Intake	0.61—1.11 mm (0.024—0.044 in.)
Wear tolerance	1.63 mm (0.064 in.)
Exhaust	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.



-UN-06DEC88
RG4756



-UN-07NOV88
T81869

CD,3274,G05,13 -19-01FEB94

REMOVE VALVE SEAT INSERTS

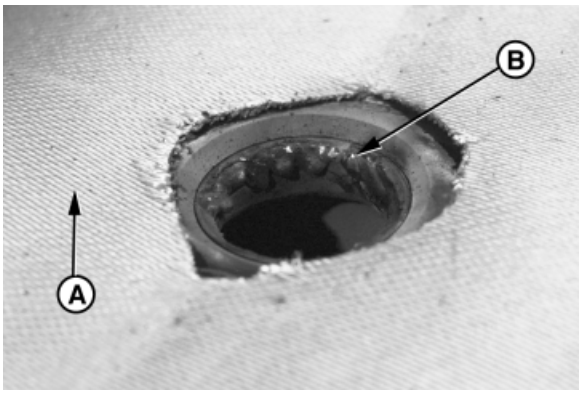
Valve seat inserts are made of sintered metal. Following method, performed by experienced personnel or specialized workshop, can be used to remove inserts.

• **Using an arc welder**

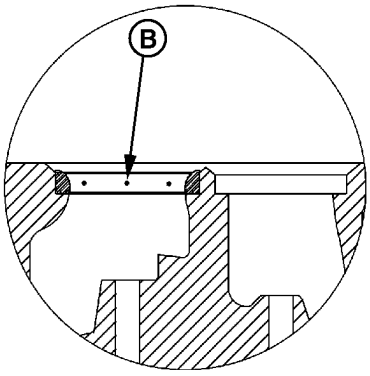
1. Protect the valve guide by installing a cap screw or dowel in guide to protect from weld spatter.

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.

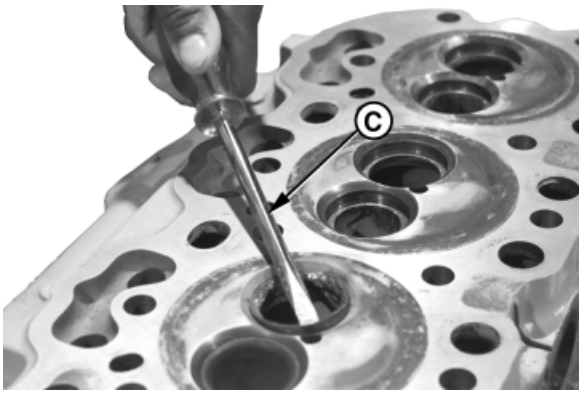
3. After removal of inserts, thoroughly clean area around valve seat bore and inspect for damage or cracks. Replace cylinder head as necessary.



-UN-10NOV97
RG7761



-UN-13NOV97
RG7813



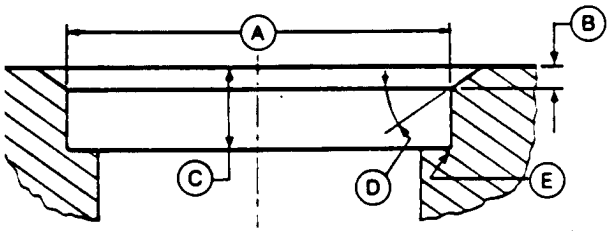
-UN-10NOV97
RG7763

CD,CTM125,030 -19-01DEC97

• **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.

A—Exhaust: 42.987—43.013 mm (1.6924—1.6934 in.)
Intake: 47.104—47.130 mm (1.8545—1.8555 in.)
B—Exhaust: 3.82 mm (0.150 in.) Reference
Intake: 3.45 mm (0.136 in.) Reference
C—9.936—10.064 mm (0.3912—0.3962 in.)
D—38—42°
E—Maximum radius 0.5 mm (0.019 in.)



RG5606 -UN-10MAR90

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15

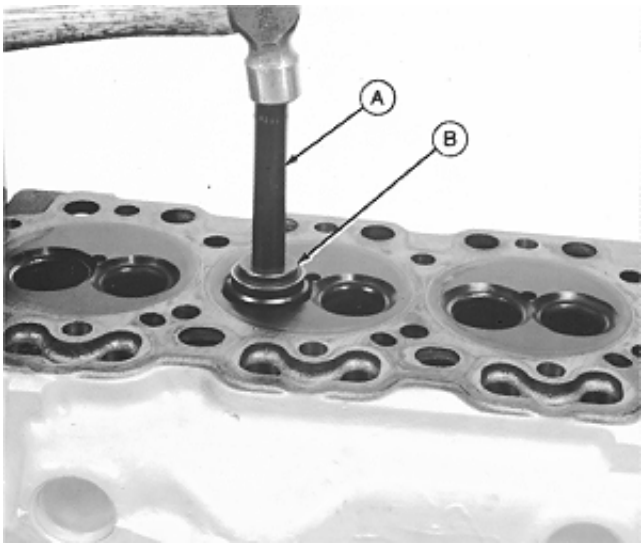
CD,CTM125,031 -19-29JUN99

VALVE SEAT INSERT INSTALLATION

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

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-12APR90

CD,3274,G05,16 -19-01FEB94

CHECK VALVES

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

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

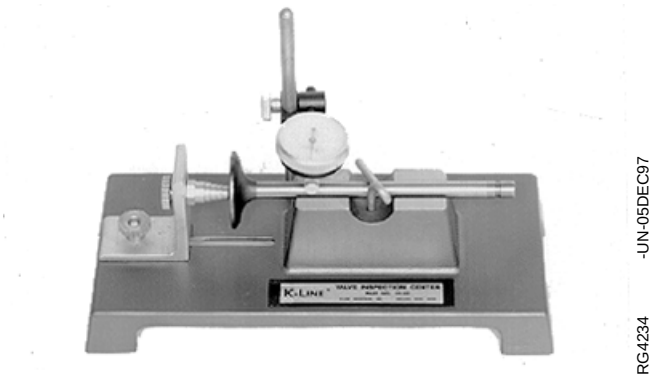
VALVE STEM DIAMETER SPECIFICATIONS

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


T82053 -UN-07NOV88

2. Check for valve face runout and bent valves.

Maximum permissible runout of valve face	0.038 mm (0.0015 in.)

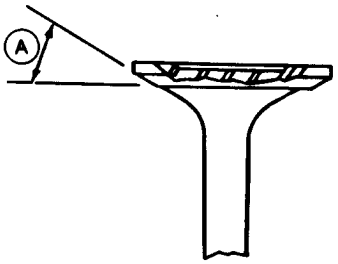


RG4234 -UN-05DEC97

CD,CTM125,032 -19-01DEC97

GRIND VALVES

Serviceable valves should be refaced to specified angle (A). Face angle on intake and exhaust valves is 29.25° ± 0.25°.



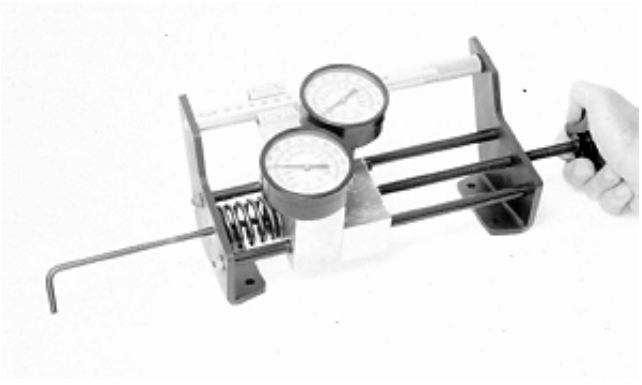
RG4755 -UN-19NOV89

CD,3274,G05,3 -19-24FEB92

CHECK VALVE SPRING TENSION

VALVE SPRING COMPRESSION

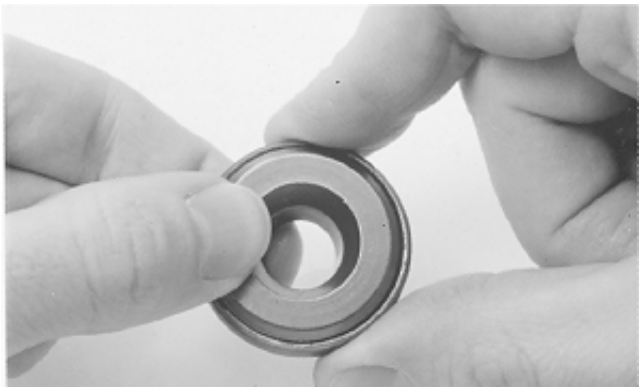
Free length	approx. 54 mm (2.125 in.)
Load with spring compressed to 46 mm (1.81 in.)	240—280 N (54—62 lb)
Load with spring compressed to 34.5 mm (1.36 in.)	590—680 N (133—153 lb)


T82054 -UN-08NOV88

CD,3274,G05,19 -19-01FEB94

INSPECT VALVE ROTATORS

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



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

INSTALL VALVES

1. Apply engine oil to valve stems and guides.

2. Insert valves in head (in same location as found during removal).

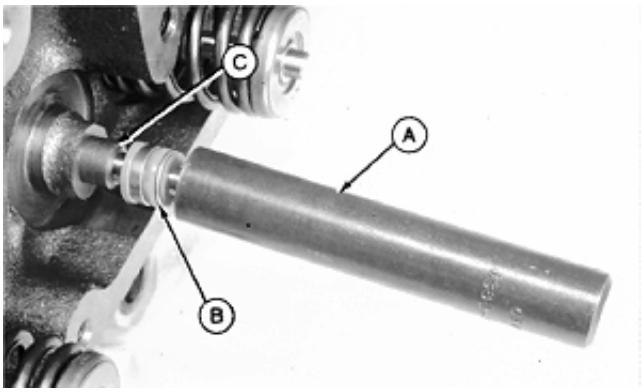
NOTE: Valves must move freely and seat properly.

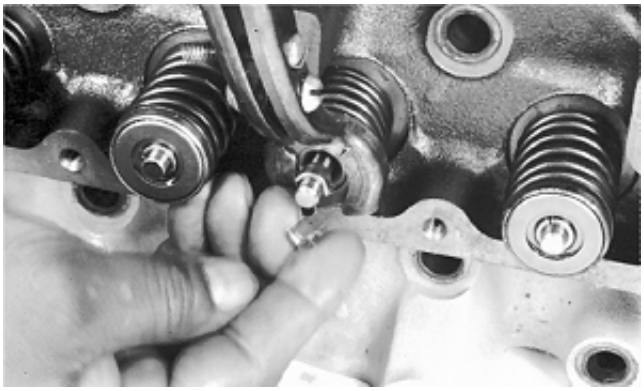
3. Using JDG678 Valve Stem Seal Installer (A), slide seal (B) over valve stem and onto valve guide tower (C).

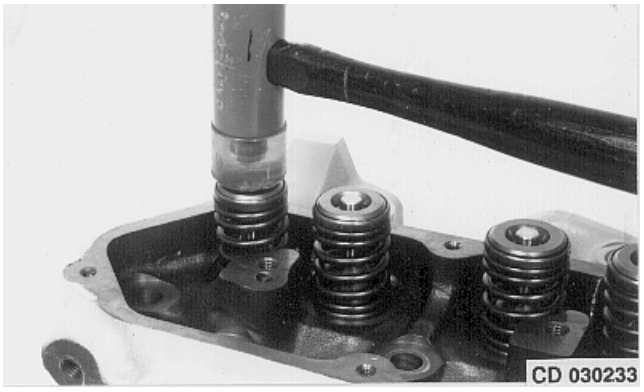
4. Install valve springs and rotators.

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

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







CD,3274,G05,21 -19-01FEB94

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.

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

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

3. Install two guide studs in cylinder block at locating holes (D).

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.

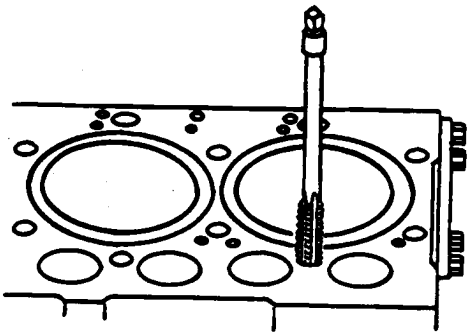
4. Position cylinder head over guide studs and lower into place on cylinder block.

5. Dip cap screws entirely in clean engine oil.

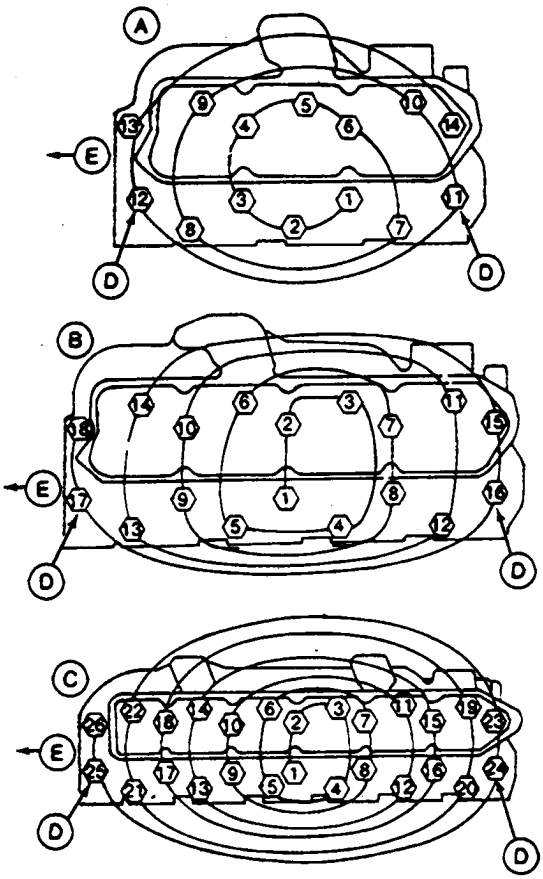
6. Remove guide studs and install cap screws in all open bores.

7. Tighten cap screws in sequence to the torque specified, beginning with No. 1. Use JD-307 Torque Wrench Adapter if necessary.

- Step 1 - Tighten all cap screws to 100 N·m (75 lb-ft)
- Step 2 - Tighten all cap screws to 150 N·m (110 lb-ft)
- Step 3 - Wait 5 minutes and recheck to insure 150 N·m (110 lb-ft) on all cap screws
- Step 4 - Tighten each cap screw an additional 60˚ ± 10˚



RG4718 -UN-13DEC88



RG4773 -UN-06DEC88

A—3 cylinder engine
B—4 cylinder engine
C—6 cylinder engine
D—Guide stud locations
E—Front of engine

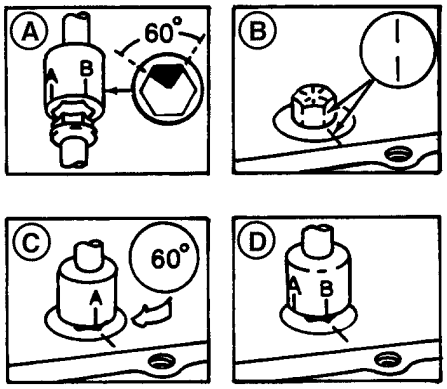
CD,3274,G05,23 -19-01FEB94

TORQUE TURN TIGHTENING METHOD

To ensure that the full 60˚ angle is reached (4th step), the following procedure can be used:

- Step A - Make a mark on socket and make a second mark 60˚ counterclockwise from the first
- Step B - Make a mark on cylinder head next to each cap screw
- Step C - Place socket on cap screw so that first mark aligns with mark on cylinder head
- Step D - 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.



RG5587 -UN-31OCT97

A—Reference mark
B—60˚ mark

05
19

CD,CTM125,035 -19-01DEC97

CHECKING ROCKER ARM SHAFT

Disassembling and checking

1. Remove plugs (A) and bowed washers (B) 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 (See "Specifications" for part dimensions).
5. Replace parts as necessary.

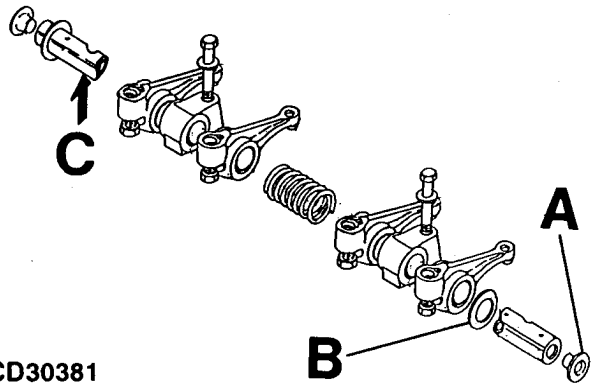
NOTE: If the rocker arm has been damaged by a valve failure, replace it together with the corresponding push rod, valve rotator and keepers.

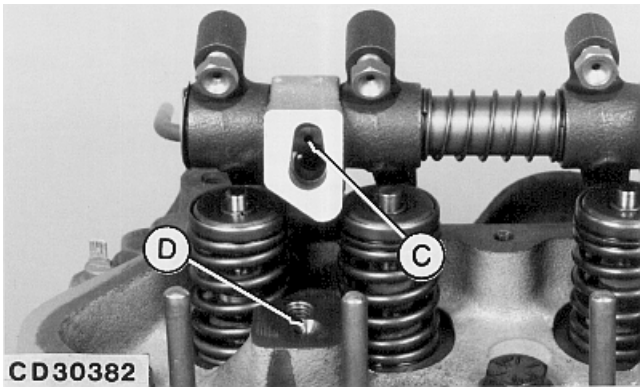
Reassembling

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 (C) in the shaft must be in line with the oil supply hole (D) of cylinder head.

3. Install bowed washers (B) and new plugs (A) on shaft.





A—Plug
B—Bowed washer
C—Oil supply hole in rocker arm shaft
D—Oil supply hole in cylinder head

CD,3274,G05,56 -19-01FEB94

INSTALL ROCKER ARM ASSEMBLY

1. Install push rods 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 50 N·m (35 lb-ft).

-UN-07MAR95 L103631

CD,3274,G05,29 -19-01FEB94

VALVE CLEARANCE

The valve clearance must be adjusted when engine is cold.

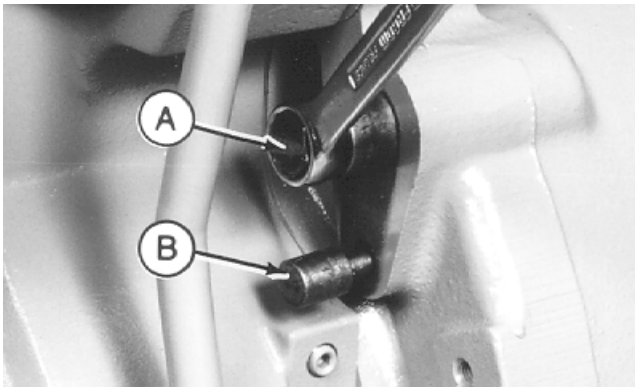
Using JDE83 or JDG820 Flywheel Turning Tool (A), rotate engine flywheel in running direction (clockwise viewed from water pump) until No.1 piston (front) has reached top dead center (TDC) on compression stroke. Insert timing pin JDE81-4 (B) into flywheel bore.

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

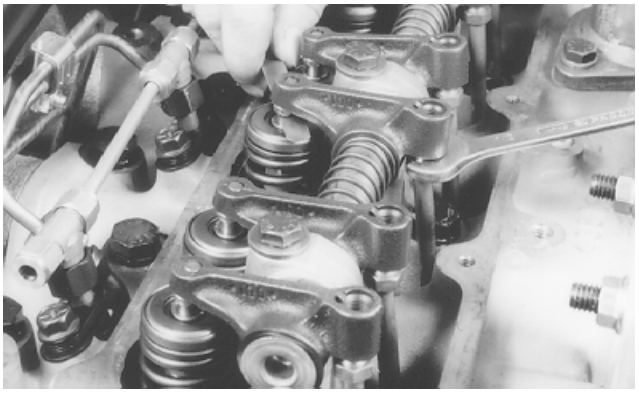
VALVE CLEARANCE SPECIFICATIONS

Intake valve	0.35 mm (0.014 in.)
Exhaust valve	0.45 mm (0.018 in.)

Adjust valve clearance as directed in the following module.



-UN-19MAY98 CD30544



-UN-19MAY98 CD30545

CD,CTM125,036 -19-01DEC97

VALVE ADJUSTMENT SEQUENCE

• 3- Cylinder engine:
Adjust valve clearance on No.1 and 2 exhaust valves and No.1 and 3 intake valves.

Turn crankshaft 360˚ and reinsert timing pin.

Adjust valve clearance on No.3 exhaust valve and No.2 intake valve.

• 4- Cylinder engine:
Adjust valve clearance on No.1 and 3 exhaust valves and No.1 and 2 intake valves.

Turn crankshaft 360˚ so that No.4 piston is at TDC (compression stroke) and reinsert timing pin.

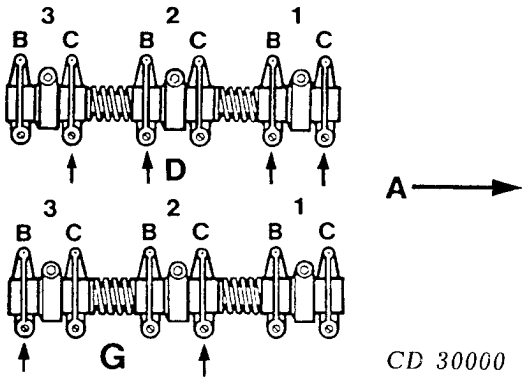
Adjust valve clearance on No.2 and 4 exhaust valves and No.3 and 4 intake valves.

• 6- Cylinder engine:
Adjust valve clearance on No.1, 3 and 5 exhaust valves and No.1, 2 and 4 intake valves.

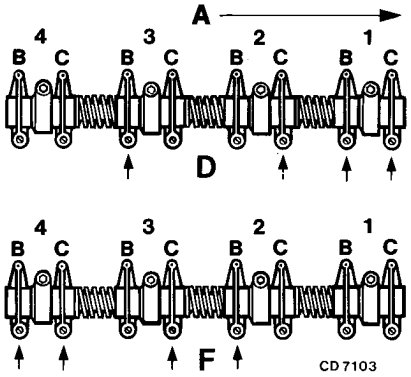
Turn crankshaft 360˚ so that No.6 piston is at TDC (compression stroke) and reinsert timing pin.

Adjust valve clearance on No.2, 4 and 6 exhaust valves and No.3, 5 and 6 intake valves.

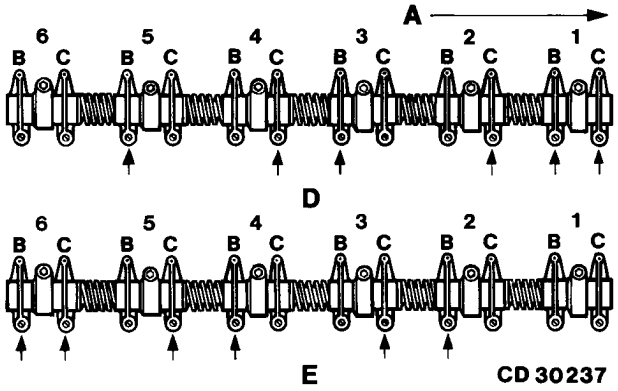
A—Front of engine
B—Exhaust valve
C—Intake valve
D—No. 1 piston at TDC compression stroke
E—No. 6 piston at TDC compression stroke (6-cylinder engine)
F—No. 4 piston at TDC compression stroke (4-cylinder engine)
G—No. 1 piston at TDC exhaust stroke (3-cylinder engine)



CD30000 -UN-08MAR95



CD7103 -UN-08MAR95



CD30237 -UN-08MAR95

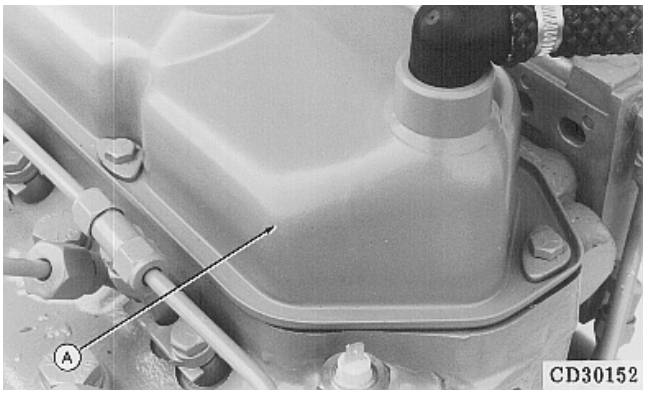
CD,3274,G05,7 -19-24FEB92

INSTALL ROCKER ARM COVER

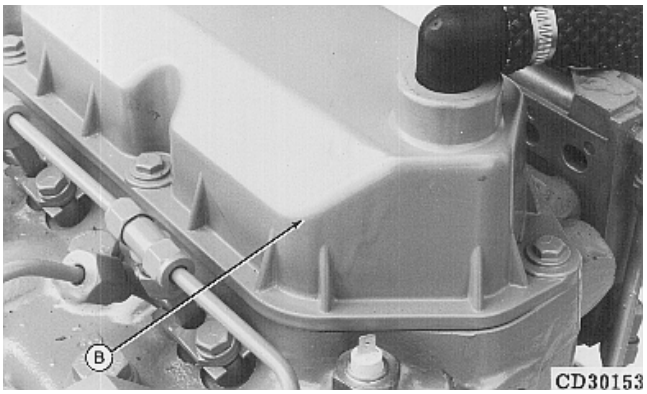
Two types of rocker arm cover are used:

Sheet metal cover (A)
• Install rocker arm cover with gasket (without sealant) and tighten cap screws to 10 N·m (7 lb-ft).
• Gasket can continue to be used until it starts to leak.

Composite material cover (B)
• Install rocker arm cover with built-in sealing ring (without sealant).
• Install the cap screws by hand and tighten to 10 N·m (7 lb-ft), starting from center and moving towards both front and rear ends of the cover.
• The sealing ring is reusable. In case of leak, proceed as follows:
1. Remove sealing ring.
2. Clean cover sealing ring groove with acetone and dry with compressed air.
3. Install new sealing ring with grease in cover groove.
4. Cut the sealing ring slightly longer than necessary.
5. Put the sealing ring ends edge to edge then press the sealing ring all along the groove to ensure proper installation.



-UN-07MAR95 CD30152



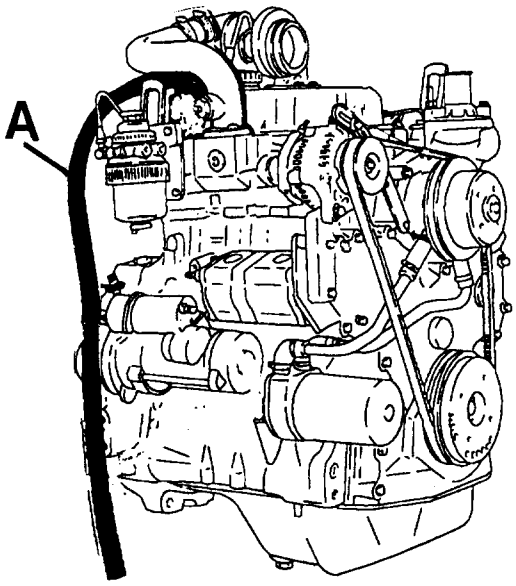
-UN-07MAR95 CD30153

CD,3274,G05,31 -19-24FEB92

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. Start engine and check for oil or coolant leaks.
4. Run engine for 30 minutes at 1500 rpm or perform break-in in case of engine overhaul.
5. Recheck valve clearances and readjust when necessary.

NOTE: Retorque of cylinder head bolts is not required.



-UN-17JUN98 CD30547

CD,CTM125,039 -19-01DEC97

SPECIAL OR ESSENTIAL TOOLS

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

DX,TOOLS -19-20JUL95

RG5074 -UN-23AUG88

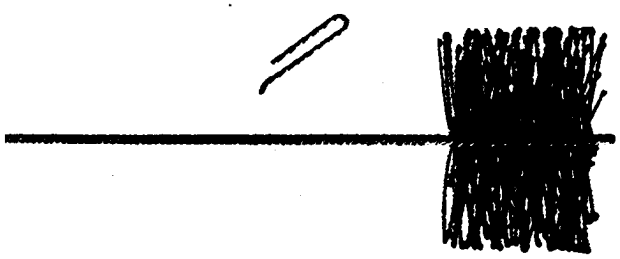
Flexible Cylinder Hone D17004BR

Hone cylinder liners.

S53,D17004,BR -19-03APR90

O-Ring Groove Cleaning Brush D17015BR

Clean cylinder liner O-ring groove in block.



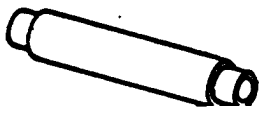
RG5075 -UN-23AUG88

S53,D17015,BR -19-25MAR91

RG5120 -UN-23AUG88

Balancer shaft bushing driver JD-249

Replace balancer shaft bushings.

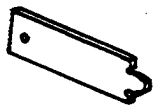


CD,JD249 -19-04AUG92

RG5076 -UN-23AUG88

Ring groove wear gauge JDE62

Used to check top groove of pistons on engine with 15˚ angle ring.



CD,JDE62 -19-04JAN99

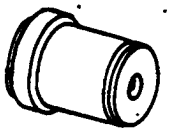
RG5031 -UN-23AUG88

Piston Ring Compressor JDE84

Compress rings while installing pistons.

S53,JDE84 -19-03APR90

RG5107 -UN-23AUG88



Piston pin bushing remover and
installer . . . . . JDE88 (35 mm [1.377 in.] medium pin)
JD-286 (41 mm [1.614 in.] large pin)

Replace piston pin bushing in connecting rods with straight pin-end.

CD,JDE88 -19-04JAN99

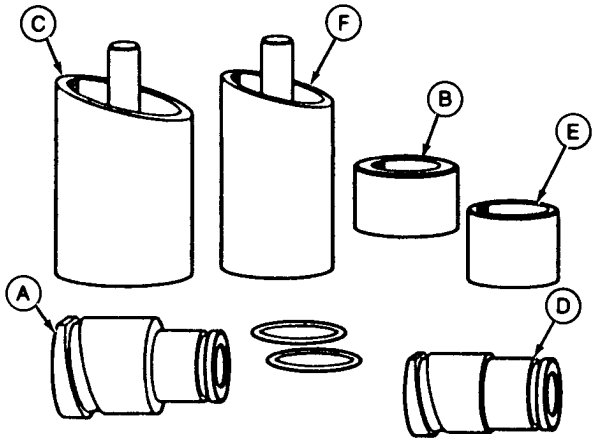
Connecting Rod Bushing Remover and
Installer JDG738

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

10
2

Set consists of:

A—Remover/Replacer Driver JDG738-1
B—Installer Pilot JDG738-2
C—Receiver Cup JDG738-3
D—Remover/Replacer Driver JDG738-4
E—Installer Pilot JDG738-5
F—Receiver Cup JDG738-6



RG7028 -UN-26OCT94

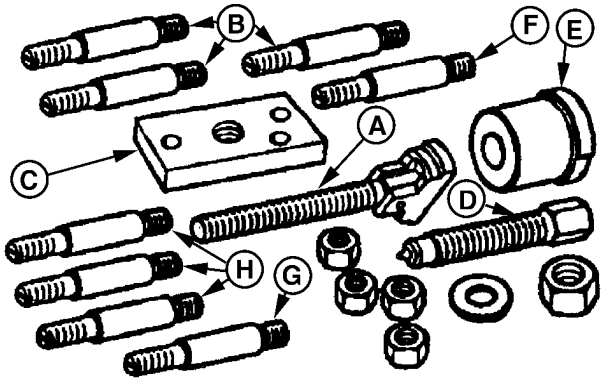
RG,JDG738 -19-27DEC94

Camshaft bushing service set JDG739B
(formerly JDG739 or JDG739A)

Used to replace camshaft bushing.

Set consists of:

A—Bushing remover. JDG739-1
B—Flat bottom legs (3/8-16) (3) JDG739-2
C—Removing/installing plate JDG739-3
D—Bushing installer screw JDG739-4
E—Bushing installer JDB739-5B
F—Tapered bottom leg (3/8-16) JDG739-6
G—Tapered bottom leg (M8 x 1.25) JDG739-7*
H—Flat bottom leg (M8 x 1.25) (3) JDG739-8*



RG7651 -UN-07NOV97

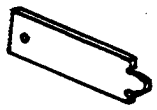
**Metric part, not for this application.*

CD,JDG739B,1 -19-04JAN99

RG5076 -UN-23AUG88

Ring groove wear gauge JDG957

Used to check top groove of pistons on engine with 6˚ an

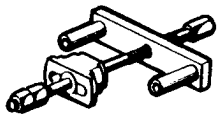


CD,JDG957,1 -19-04JAN99

CD30234 -UN-08MAR95

Cylinder liner puller KCD10001

Used to remove and install cylinder liners.



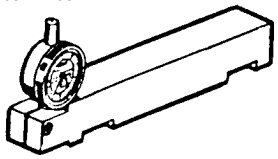
CD 030234

CD,KCD10001 -19-20FEB92

CD30235 -UN-08MAR95

Piston/Liner height gauge KJD10123

Used to measure piston/liner heights.



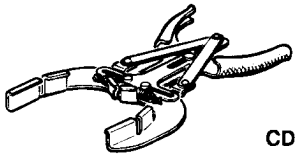
CD 030235

CD,KJD10123 -19-20FEB92

CD30236 -UN-08MAR95

Piston ring expander KJD10140

Used to replace piston rings.



CD 030236

CD,KJD10140 -19-20FEB92

SPECIFICATIONS

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Centerline of main bearing bore-to-top deck of cyl. block:		
3029, 4039, 6059 Engines	301.98—302.11 mm (11.889—11.894 in.)	
4045, 6068 Engines	337.87—338.00 mm (13.302—13.307 in.)	
Maximum acceptable block out-of-flat:		
For entire length or width	0.13 mm (0.005 in.)	
For every 150 mm (5.90 in.) length or width	0.025 mm (0.001 in.)	
Cam follower bore ID	31.70—31.75 mm (1.248—1.250 in.)	
Cam followers OD	31.62—31.64 mm (1.245—1.246 in)	
Cam follower clearance	0.06—0.13 mm (0.002—0.005 in.)	
Camshaft bore without bushing	55.98—56.01 mm (2.204—2.205 in.)	
Camshaft bore with bushing (No. 1 only)		
• cyl. block bore for bushing installation	59.96—59.99 mm (2.361—2.362 in.)	
• bushing ID (installed)	55.96—55.99 mm (2.203—2.204 in.)	
Balancer shaft bushing bore in cyl. block*		
Standard Bushings	41.26—41.29 mm (1.625—1.626 in.)	
Oversize Bushings**	43.24—43.26 mm (1.702—1.703 in.)	
Chamfer	20°—25° x 1.50 mm (0.060 in.)	
Crankshaft main bearing bores	84.46—84.48 mm (3.325—3.326 in.)	
Upper block bore for seating liner	120.70—120.75 mm (4.752—4.754 in.)	
OD of liner at upper bore	120.61—120.69 mm (4.748—4.751 in.)	
Clearance between liner and cylinder block at upper bore	0.10—0.14 mm (0.004—0.005 in.)	

(Continued on next page)

**4039 and 4045 Engines only.*

***4039 engines with one-piece balancer shafts only.*

CD,3274,G10,31 -19-04JAN99

SPECIFICATIONS - CONTINUED

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Lower block bore for seating liner	115.75—115.80 mm (4.557—4.559 in.)	
Outside diameter of liner at lower bore level (measured 10 mm (0.39 in.) below lower shoulder)		
• Engine (- 317306CD)		
Production liner (first class)	115.724—115.748 mm (4.556—4.557 in.)	
Production liner (second class)	115.698—115.723 mm (4.555—4.556 in.)	
Service liner	115.724—115.748 mm (4.556—4.557 in.)	
Clearance between block and liner:		
Production liner (first class)	0.025—0.075 mm (0.001—0.003 in.)	
Production liner (second class)	0.025—0.075 mm (0.001—0.003 in.)	
Service liner	0—0.075 mm (0—0.003 in.)	
• Engine (317307CD -)	115.695—115.735 mm (4.555—4.556 in.)	
Clearance between block and liner	0.015—0.105 mm (0.0006—0.0041 in.)	
Cylinder liner internal diameter	106.49—106.52 mm (4.1925—4.1937 in.)	
Maximum permissible wear		0.25 mm (0.01 in.)
Maximum permissible taper		0.05 mm (0.002 in.)
Maximum permissible out-of-round		0.05 mm (0.002 in.)
Liner counterbore depth in block	5.95—5.99 mm (0.234—0.236 in.)	
Liner height above block	0.01—0.10 mm (0.0004—0.004 in.)	
Maximum permissible height difference at nearest point of two adjacent liners	0.03 mm (0.001 in.)	
Thickness of liner shim CD15466	0.05 mm (0.002 in.)	
Thickness of liner shim R65833	0.10 mm (0.004 in.)	
Minimum dimension for proper compression of liner packing	0.13 mm (0.005 in.)	
Desired cylinder liner wall finish (cross-hatch pattern)	0.0006—0.0011 mm (25—45 micro-in.)	

(Continued on next page)

CD,3274,G10,32 -19-04JAN99

SPECIFICATIONS - CONTINUED

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Piston OD at 19 mm (0.74 in.) from bottom of skirt and measured 90° to piston pin	106.381—106.399 mm (4.1882—4.1890 in.)	
Piston-to-cylinder liner clearance, measured at bottom of skirt	0.09—0.14 mm (0.0035—0.0055 in.)	
Piston ring end gap:		
3029DF120/DF160 (263024CD-)		
3029DAT01		
3029TAT02		
3029TF120/TF160 (287526CD-)		
3029TF001/TF031 (264813CD-)		
3029TLV01 (261581CD-)		
3029DPY01	No.1: 0.33—0.58 mm (0.013—0.023 in.)	
	No.2: 1.23—1.49 mm (0.049—0.059 in.)	
	No.3: 0.30—0.56 mm (0.012—0.022 in.)	
All other engines	No.1: 0.35—0.60 mm (0.014—0.024 in.)	
	No.2 (earlier): 0.33—0.58 mm (0.013—0.023 in.)	
	No.2 (later): 0.71—1.00 mm (0.028—0.039 in.)	
	No.3: 0.30—0.60 mm (0.012—0.024 in.)	
Piston height:		
Measured from center of piston pin bore to top of piston		
• 3029, 4039, 6059 Engines	66.27—66.33 mm (2.609—2.611 in.)	
• 4045 and 6068 Engines	71.64—71.70 mm (2.820—2.823 in.)	
Piston protrusion above block	0.08—0.35 mm (0.003—0.014 in.)	
Piston pin bore*:		
• For small pin (32 mm [1.26 in])	32.003—32.013 mm (1.2600—1.2603 in.)	
• For medium pin (35 mm [1.377 in.])	34.933—34.943 mm (1.3753—1.3757 in.)	
• For large pin (41 mm [1.614 in.])	41.285—41.295 mm (1.6254—1.6258 in.)	
Piston pin Outside Diameter:		
• Small pin	31.994—32.000 mm (1.2596—1.2598 in.)	
• Medium pin	34.92—34.93 mm (1.3748—1.3752 in.)	0.013 mm (0.0005 in.)
• Large pin	41.27—41.28 mm (1.6248—1.6252 in.)	0.013 mm (0.0005 in.)
Rod pin bushing Internal Diameter:		
• Small pin	32.010—32.036 mm (1.2602—1.2612 in.)	
• Medium pin	34.950—34.976 mm (1.376—1.377 in.)	0.05 mm (0.002 in.)
• Large pin	41.300—41.326 mm (1.626—1.627 in.)	0.05 mm (0.002 in.)

(Continued on next page)

*Some piston pin bores are elliptical, the width being 0.038_mm (0.0015_in.) wider than specification given.

CD,3274,G10,33 -19-04JAN99

SPECIFICATIONS - CONTINUED

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Pin-to-bushing oil clearance:		
• Small pin	0.010—0.042 mm (0.0004—0.0016 in.)	
• Medium pin	0.020—0.056 mm (0.0008—0.0022 in.)	
• Large pin	0.007—0.043 mm (0.0003—0.0017 in.)	
Connecting rod bearing (assembled) Internal Diameter:		
3029, 4039, 6059 Engines	69.848—69.898 mm (2.7499—2.7519 in.)	
4045, 6068 Engines	77.847—77.897 mm (3.0648—3.0668 in.)	
Bearing-to-journal clearance	0.023—0.099 mm (0.0009—0.0039 in.)	0.16 mm (0.006 in.)
Connecting rod bore for bearing		
3029, 4039, 6059 Engines	73.660—73.686 mm (2.900—2.901 in.)	
4045, 6068 Engines	82.677—82.703 mm (3.255—3.256 in.)	
Undersize connecting rod bearings available	0.25; 0.51 and 0.76 mm (0.01; 0.02 and 0.03 in.)	
Piston cooling orifice flow (each)	1.5 L/min (1.4 qt/min)	

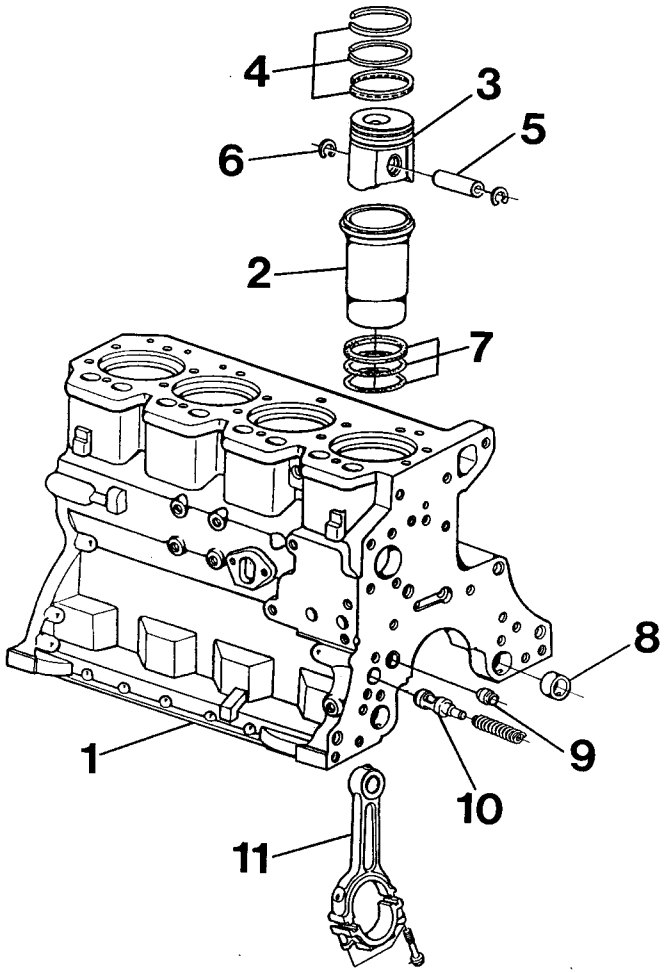
CD,3274,G10,45 -19-04JAN99

TORQUES FOR HARDWARE

Piston cooling orifices into cylinder block	10 Nm (7.5 lb-ft)
Connecting rod cap screws	
3029, 4039, 6059 Engines:	
Initial	56 Nm (40 lb-ft)
Final	Plus 90—100 degrees
4045, 6068 Engines:	
Initial	66 Nm (50 lb-ft)
Final	Plus 90—100 degrees
Cylinder block plug or fitting:	
Coolant drain (1/4“)	17 N·m (13 lb-ft)
Turbocharger oil return (1/2“)	45 N·m (33 lb-ft)
Dipstick tube (1/2 cylindrical)	67 N·m (50 lb-ft)
Oil pressure galleries (1/8“)	17 N·m (13 lb-ft)
Oil gallery (3/8“)	45 N·m (33 lb-ft)
Rear coolant gallery (1“)	45 N·m (33 lb-ft)
Side coolant gallery (1/4“)	17 N·m (13 lb-ft)
Side coolant gallery (1“5/8):	
Sheet metal plug (-379251CD)	60 N·m (44 lb-ft)
Composite material plug (379252CD-)	30 N·m (22 lb-ft)

CD,3274,G10,34 -19-04JAN99

EXPLODED VIEW



CD30383

CD30383 -UN-10MAY95

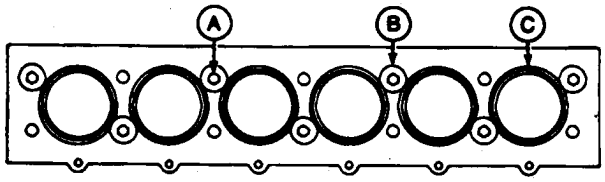
1—Cylinder block
2—Cylinder liner
3—Piston
4—Piston rings
5—Piston pin
6—Snap ring
7—Liner seals
8—Balancer shaft bushing
9—Oil pressure regulating valve seat
10—Oil by-pass valve
11—Connecting rod

CD,3274,G10,46 -19-01FEB94

PISTON AND CONNECTING ROD REMOVAL

Remove cylinder head and oil pan.

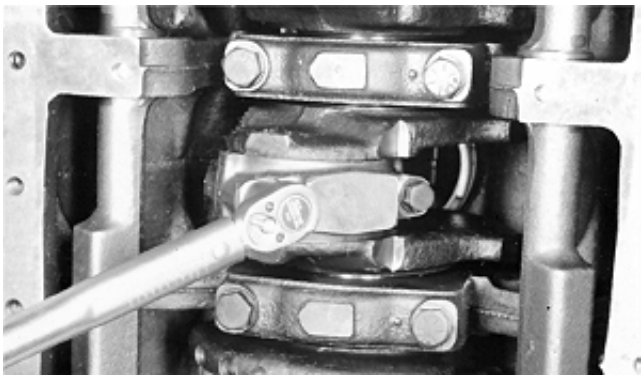
Install large flat washers (B) with cap screws (A) to hold cylinder liners (C) down.



-UN-07DEC88
RG3819

IMPORTANT: After any cylinder head removal, never turn crankshaft until all liners have been secured with screws and washers.

Remove ridge and carbon from cylinder liner with a ridge reamer.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T81615

IMPORTANT: Keep bearing inserts with their respective rods and caps.

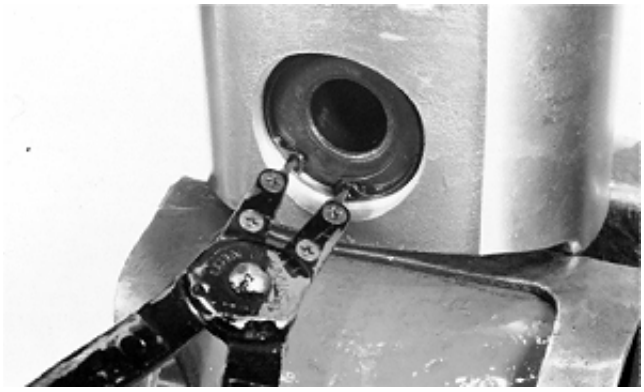
During removal, mark and identify the pistons, connecting rods and caps, as they must be reinstalled in the same cylinder from which they were removed.

Remove rod cap screws and caps.

Remove connecting rod and piston assembly from the cylinder liner.

Remove piston pin snap rings.

Press piston pin out of bore and lift connecting rod out of piston.


-UN-28MAR90
RG5623

CD,3274,G10,2 -19-01FEB94

CYLINDER LINER BORE MEASURE

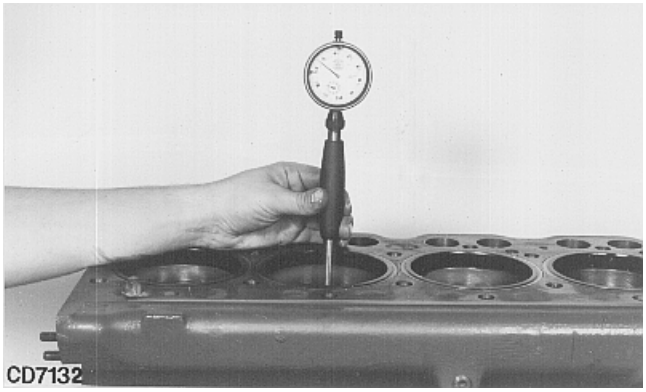
Measure liner bore at four points of ring travel.

CYLINDER LINER BORE SPECIFICATIONS

Cylinder liner ID	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.)

Compare liner measurements with piston skirt diameter. For clearance between piston skirt and liner, see Specifications.

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



CD,3274,G10,18 -19-01FEB94

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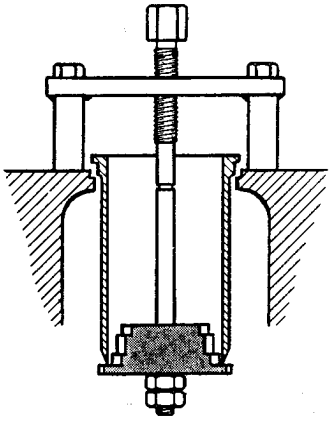
CYLINDER LINER REMOVAL

Pull liners out of cylinder block using KCD10001 puller.



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

CYLINDER LINER DEGLAZING

Place cylinder liners in a suitable clamping device.

Use D17004BR Flex-Hone to deglaze liner. Follow instructions supplied with tool to obtain 45 degree crosshatch pattern.

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.

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

R26164 -UN-13DEC88

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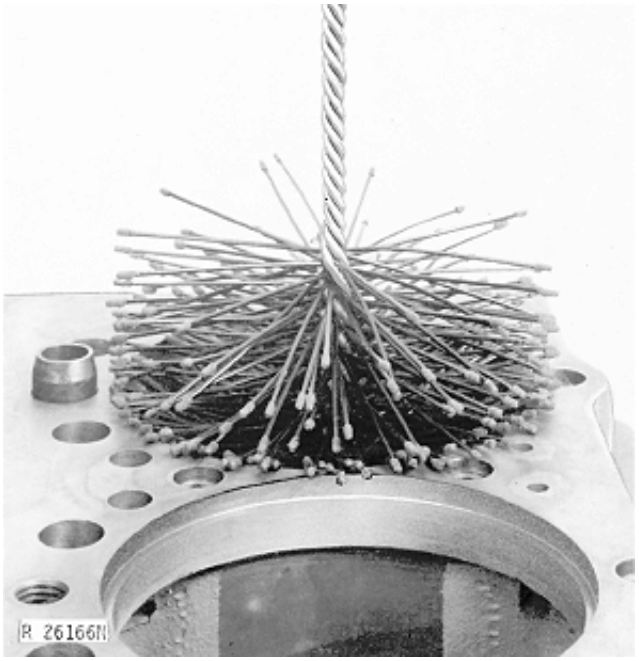
CD,3274,G10,20 -19-18FEB92

CYLINDER BLOCK CLEANING

Remove liner O-rings from cylinder block. Clean block with cleaning solvent or pressure steam.

Make sure all passages and openings are free from sludge, rust and grease.

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



R26166 -UN-13DEC88

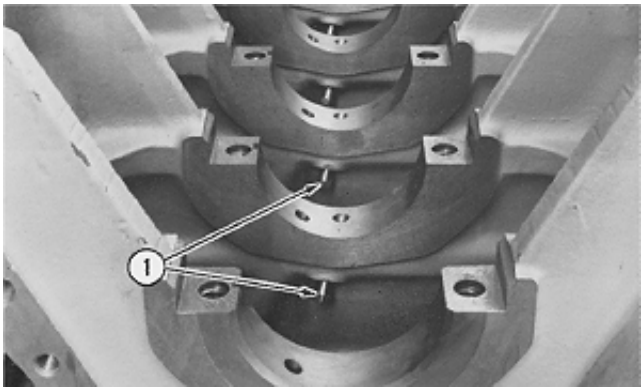
CD,3274,G10,21 -19-18FEB92

CHECKING PISTON COOLING JETS

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

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

Reinstall jets and tighten to 10 N·m (7.5 lb-ft).



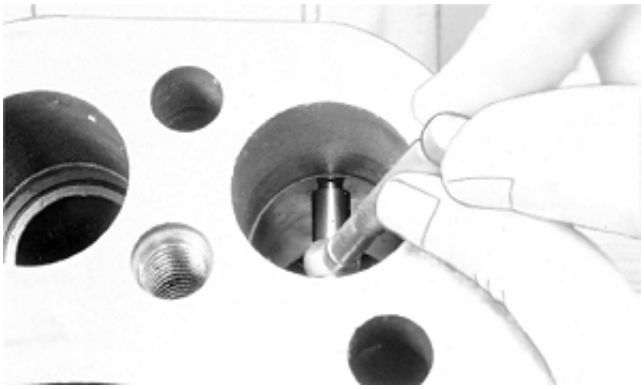
CD,3274,G10,24 -19-18FEB92

CAM FOLLOWER BORE MEASURE

CAM FOLLOWER BORE SPECIFICATIONS

Cam follower bore ID	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.



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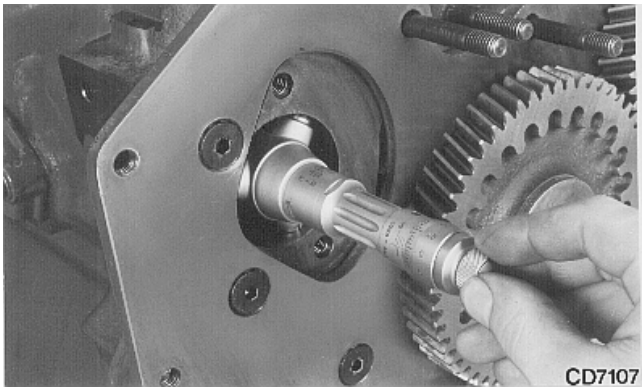
CD,3274,G10,35 -19-18FEB92

CAMSHAFT BORE MEASURE

CAMSHAFT BORE SPECIFICATIONS

Camshaft bore without bushing	55.98—56.01 mm (2.204—2.205 in.)
Camshaft bore with bushing (No. 1 only)	
• cyl. block bore for bushing installation	59.96—59.99 mm (2.361—2.362 in.)
• bushing ID (installed)	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,3274,G10,36 -19-18FEB92

CAMSHAFT BUSHING REPLACEMENT TOOL

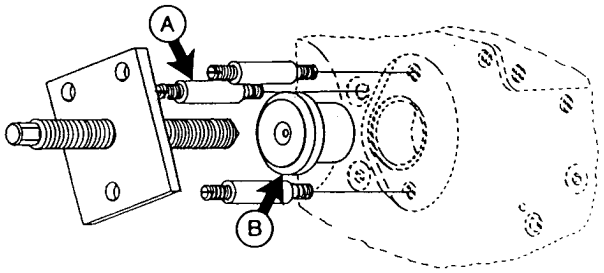
From engine serial number 138541CD on, the camshaft bushing can be replaced either with front plate removed or with front plate in place on engine. In this case, JDG739 Tool must be modified, if not yet done, as follows:

1. Machine an angle of 82° on one threaded spacer (A).

2. Remove material from bushing driver (B) as shown.

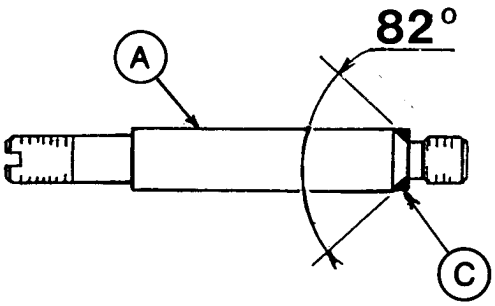
NOTE: With this modification, JDG739 became JDG739A. Then, with the adoption of metric threaded spacers, JDG739A has become JDG739B. Metric threaded spacers are not used on this application.

A—Threaded spacer
B—Bushing driver
C—Material to be removed



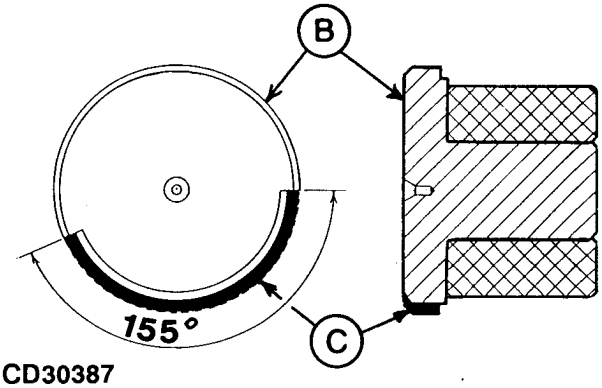
CD30385 -UN-10MAY95

CD30385



CD30386 -UN-10MAY95

CD30386

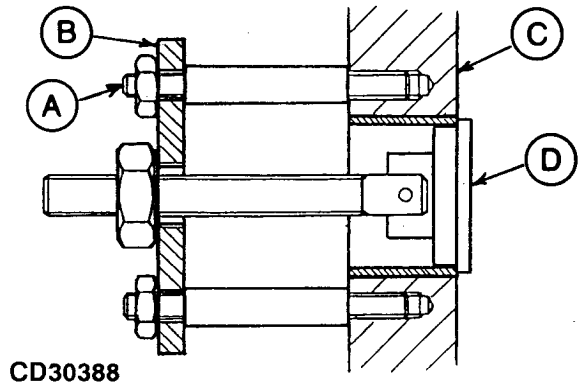


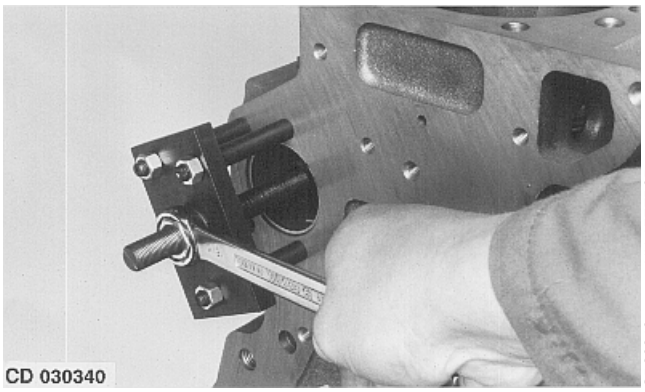
CD30387 -UN-10MAY95

CD30387

CD,3274,G10,47 -19-04JAN99

REMOVE CAMSHAFT BUSHING





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.

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CD,CTM125,051 -19-01DEC97

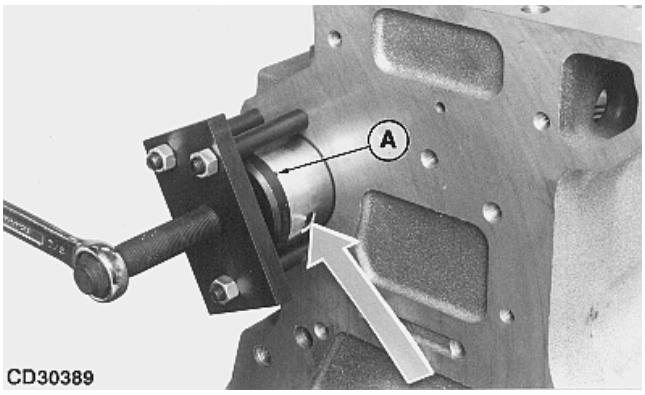
INSTALLING CAMSHAFT BUSHING

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

1. Apply TY6333 grease* 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.

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



Available as service part.

CD,3274,G10,49 -19-01FEB94

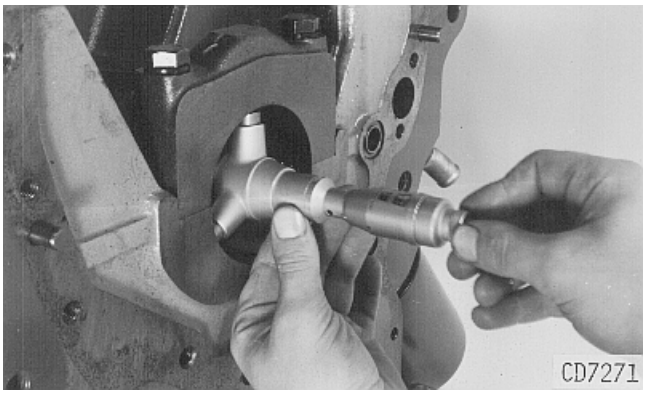
CRANKSHAFT BORE MEASURE

CRANKSHAFT BORE SPECIFICATIONS

Crankshaft bore ID	84.46—84.48 mm (3.325—3.326 in.)

NOTE: Before measuring, the cap screws must be tightened to 120 N·m (85 lb-ft) for engines prior to serial number 135641CD and to 135 N·m (100 lb-ft) for other engines.

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



-UN-07MAR95 CD7271

CD,3274,G10,38 -19-01FEB94

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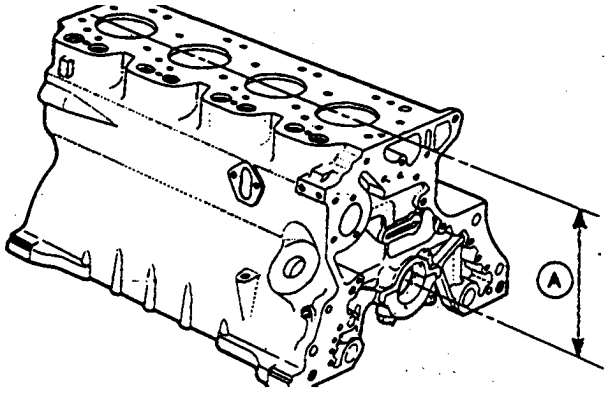
CRANKSHAFT BEARING CAP REPLACEMENT

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

Install replacement cap in block and tighten cap screws to 120 N·m (85 lb-ft) for engines prior to serial number 135641CD and to 135 N·m (100 lb-ft) for other engines.

After having positioned block on a boring machine, bore new bearing caps to 84.45—84.48 mm (3.325—3.326 in.) diameter. Take care to remain within the specified dimension (A) (crankshaft bore center line to block top face).



-UN-14DEC88 RG4788

DISTANCE (A)

3029, 4039, 6059 engines	301.98—302.11 mm (11.889—11.894 in.)
4045, 6068 engines	337.87—338.00 mm (13.302—13.307 in.)

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

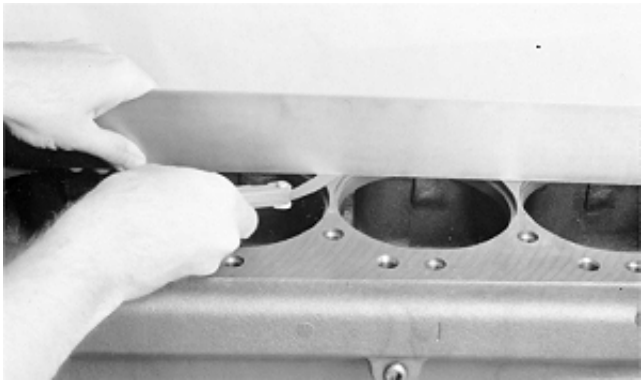
CD,3274,G10,39 -19-01FEB94

CYLINDER BLOCK TOP DESK FLATNESS

Measure cylinder block top desk flatness using a precision straightedge.

TOP DESK OUT-OF-FLAT

for entire length	0.13 mm (0.005 in.)
for every 150 mm (5.90 in.) length or width	0.025 mm (0.001 in.)



If flatness is not as specified, resurface cylinder block.

IMPORTANT: Make sure that the distance between crankshaft centerline and cylinder block top desk is within specifications (see "CRANKSHAFT BEARING CAP REPLACEMENT" in this group). Also measure depth of liner counterbores. Bore depth must be within 5.95—5.99 mm (0.234—0.236 in.).

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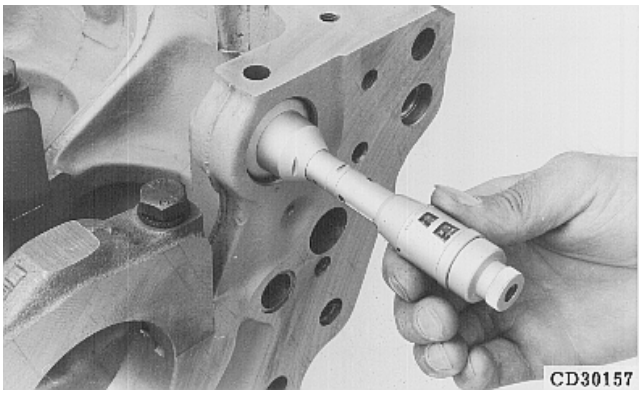
CD,3274,G10,40 -19-18FEB92

BALANCER SHAFT BORE MEASURE

BALANCER SHAFT BORE SPECIFICATIONS

Bore diameter without standard bushing	41.262—41.288 mm (1.6245—1.6255 in.)
Standard or oversize bushing ID	38.177—38.237 mm (1.5030—1.5054 in.)



If diameter with standard bushings is more than specified, replace bushings. If cylinder block bore (without bushing) is damaged or more than specified, install oversize bushings.

CD,3274,G10,22 -19-18FEB92

BALANCER SHAFT BUSHING REPLACEMENT

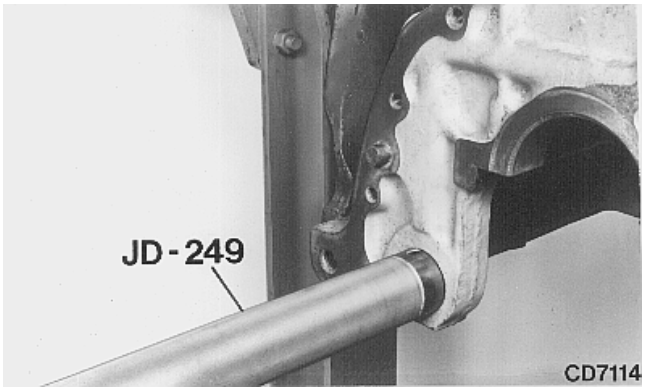
1. Drive unserviceable bushings out of cylinder block using JD-249 bushing driver.

2. Drive new bushings into cylinder block using JD-249 bushing driver.

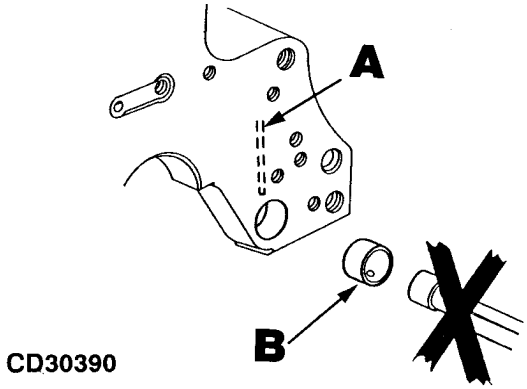
IMPORTANT: Make sure oil holes in bushing and cylinder block are aligned except for engines without balancer shafts where the bushings must be oriented (B) to block the oil galleries (A).

NOTE: Bushing-to-balancer shaft clearance is correct if shaft can be rotated by hand with a slight to moderate drag.

A—Oil gallery
B—Bushing oriented to block oil gallery



-UN-18JAN95 CD7114



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CD,3274,G10,43 -19-01FEB94

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18

OVERSIZE BALANCER SHAFT BUSHING INSTALLATION

IMPORTANT: The use of oversize balancer shaft bushings on 4045 and 4039 engines with bolt-on weights is not recommended due to the rotating mass of bolt-on weights compared to thickness of balancer shaft web.

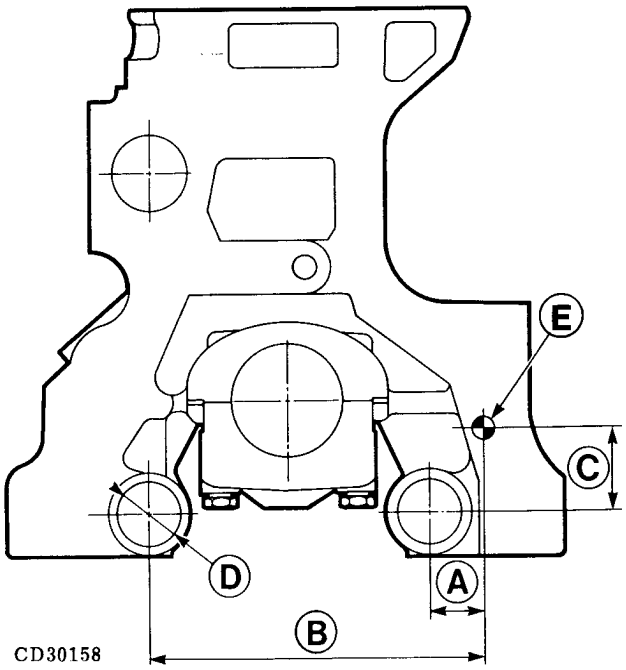
1. Check for cracked or broken cylinder block bosses.

2. Rebore cylinder block to dimensions given.

3. Chamfer front and middle bearing bores by 20-25° towards front of engine and rear bearing bore by 20-25° towards rear of engine to facilitate installation of the bushings.

4. Check bores for smoothness or material defects after machining.

5. Install new oversize bushings.



-UN-08MAR95

CD30158

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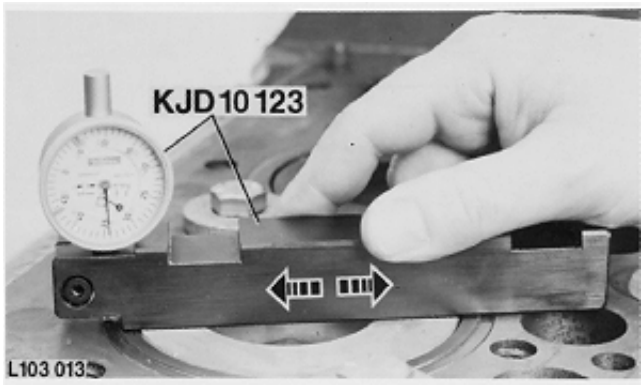
19

A—41.985—42.035 mm (1.653—1.655 in.)
B—257.985—258.035 mm (10.157—10.159 in.)
C—64.986—65.036 mm (2.558—2.560 in.)
D—43.237—43.263 mm (1.7015—1.7025 in.)
E—Reference dowel pin

CD,3274,G10,23 -19-20FEB92

CYLINDER LINER PROTRUSION MEASURE

IMPORTANT: First insert liners into bore without seals to check the liner protrusion. When correctly installed, liners can be smoothly rotated by hand. If, when inserted, the liners cannot be rotated, remove liners and lap the liner bottom pilot diameter until specified free rotation is obtained.



L103013 -UN-09DEC88

1. Install liners without packing or O-rings and secure at four points. Tighten screws to 100 N·m (74 lb-ft).
2. Measure liner protrusion at four points.

LINER PROTRUSION SPECIFICATIONS

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

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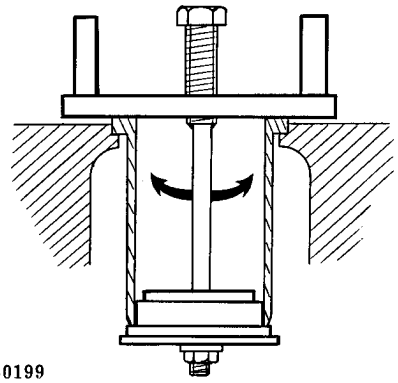
3. If the liner protrusion or permissible difference is outside the specifications, apply lapping compound to liner flange shoulder in the block, then install liner and turn to left and right using KCD10001 special tool to rub off enough material to seat liner as necessary.
4. If protrusion is below specification, install one liner shim under liner flange. Two sizes of shims are available: 0.05 mm (0.002 in.) and 0.10 mm (0.004 in.).



CD30199 -UN-07MAR95

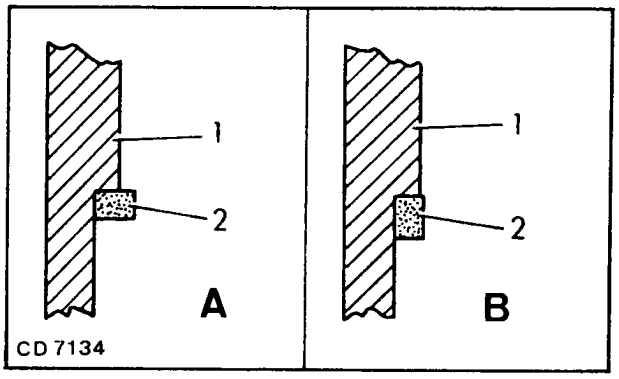
IMPORTANT: ONLY ONE SHIM IS ALLOWED PER CYLINDER. If liner requires more than one shim, install either a new liner or cylinder block.

CD,3274,G10,26 -19-01FEB94

LINER PACKING INSTALLATION

Apply lubricating soap to new packing and install over liner until it contacts liner shoulder. Liner packing must be compressed to a minimum of 0.13 mm (0.005 in.).

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



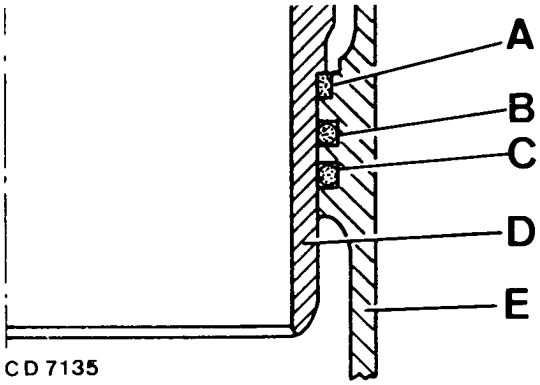
CD7134 -UN-07MAR95

CD,3274,G10,27 -19-18FEB92

LINER O-RING INSTALLATION

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

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



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

CYLINDER LINER INSTALLATION

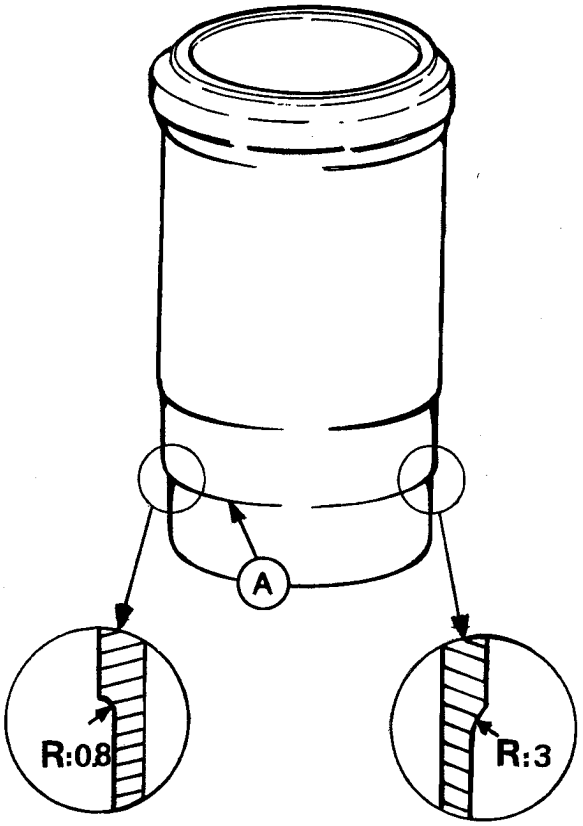
NOTE: Recent cylinder liners are machined with a shoulder on the lower guiding diameter (A). Liners, up to machining code "848M" stamped on the outside have a shoulder radius of 0.8 mm (0.03 in.) which may cause damage to liner seals during installation. The 0.8 mm (0.03 in.) radius has been changed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

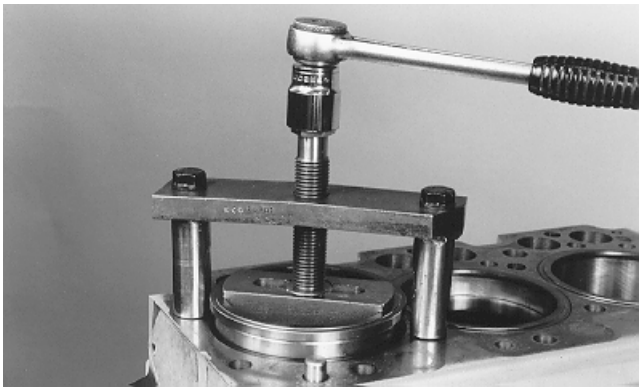
1. On liners with 0.8 mm (0.03 in.) radius blunt the sharp edge with a honing stone or emery cloth.

2. Slide liner together with shim (when needed) and packing into its bore in cylinder block.

3. Seat liners using KCD10001 special tool.

4. Secure liners by means of large washers and cap screws.





Installation with KCD10001

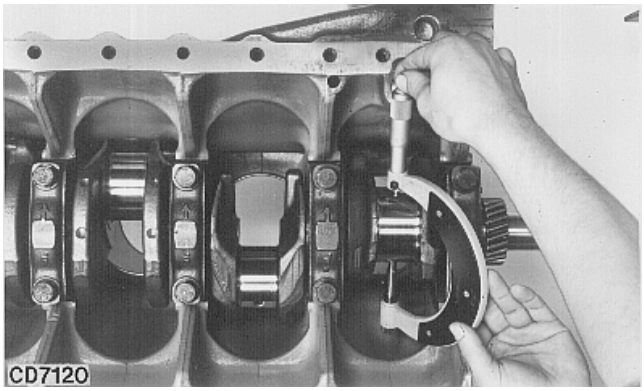
CD,3274,G10,29 -19-04JAN99

CONNECTING ROD BEARING MEASURE

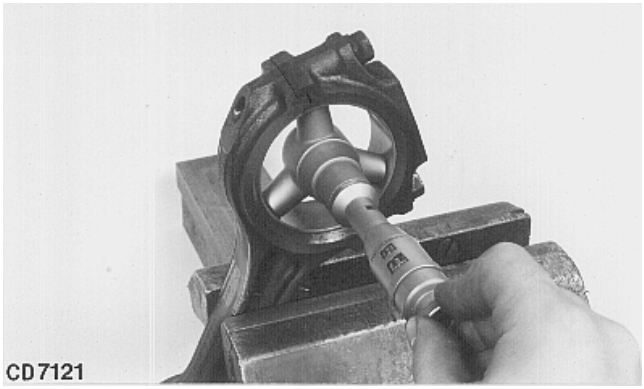
NOTE: Before measuring, the cap screws of connecting rod must be tightened according to specifications.

SPECIFICATIONS

Connecting rod bearing (assembled) ID:	
3029, 4039, 6059 engines	69.848—69.898 mm (2.7499—2.7519 in.)
4045, 6068 engines	77.847—77.897 mm (3.0648—3.0668 in.)
Crankshaft journal OD:	
3029, 4039, 6059 engines	69.799—69.825 mm (2.748—2.749 in.)
4045, 6068 engines	77.798—77.824 mm (3.063—3.064 in.)
Maximum permissible clearance	0.16 mm (0.006 in.)



CD7120 -UN-07MAR95



CD7121 -UN-07MAR95

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If clearance is not within specifications, grind crankshaft journals and select correct undersize bearings. Bearings are available in 0.25, 0.50 and 0.76 mm (0.01, 0.02 and 0.03 in.) undersizes.

NOTE: Crankshafts with rolled grooves (steel and cast iron crankshafts) do not allow any more regrinding operations. Undersized crankshafts will be furnished by factory if available.

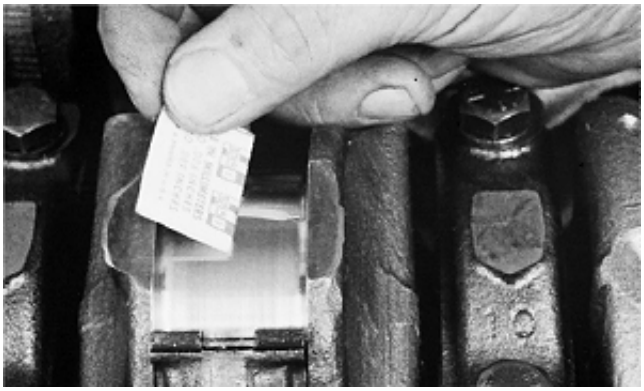
CD,3274,G10,3 -19-01FEB94

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

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

CONNECTING ROD BUSHING

NOTE: Depending on applications, engines may be equipped with straight or tapered pin-end connecting rods.

If diameter or clearance are more than specified below, replace connecting rod/piston pin assembly for engines with 32 mm (1.26 in.) piston pin diameter and replace bushing on all other engines.

SPECIFICATIONS

Rod pin bushing Internal Diameter:

• Small pin	32.010—32.036 mm (1.2602—1.2612 in.)
• Medium pin	34.950—34.976 mm (1.376—1.377 in.)
• Large pin	41.300—41.326 mm (1.626—1.627 in.)

Pin-to-bushing oil clearance:

• Small pin	0.010—0.042 mm (0.0004—0.0016 in.)
• Medium pin	0.020—0.056 mm (0.0008—0.0022 in.)
• Large pin	0.007—0.043 mm (0.0003—0.0017 in.)
Maximum	0.10 mm (0.004 in.)

Straight pin-end

Tapered pin-end

CD,3274,G10,44 -19-04JAN99

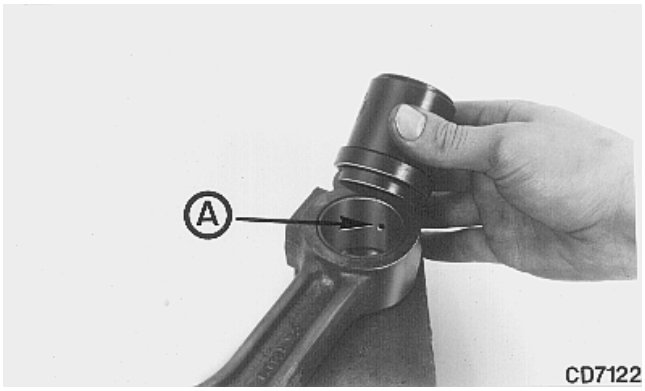
CONNECTING ROD BUSHING REPLACEMENT (STRAIGHT PIN-END CONROD EXCEPT SMALL PIN)

1. Push bushing out of connecting rod using following tools:
   • JD-286 Driver for large pin on engines with straight pin-end
   • JDE88 Driver for medium pin on engines with straight pin-end

2. Install new bushing using same tool as for removal.

IMPORTANT: Oil holes (A) 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.

3. Have the new bushing reamed by a specialized workshop to obtain specified oil clearance with piston pin.



Straight pin-end

CD,3274,G10,4 -19-04JAN99

CONNECTING ROD BUSHING REPLACEMENT (TAPERED PIN-END CONROD)

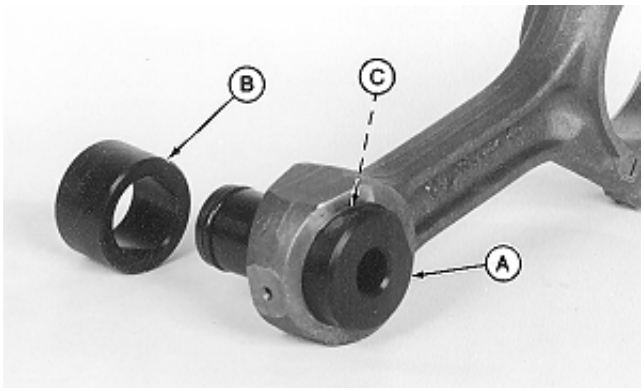
Using JDG738 Connecting Rod Bushing Service Set, proceed as follows.

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.

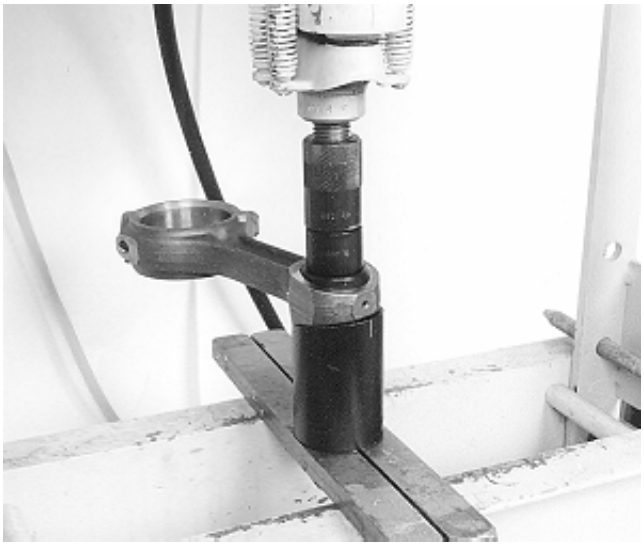
2. Install receiver cup JDG738-3 onto opposite side of rod bushing.

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.

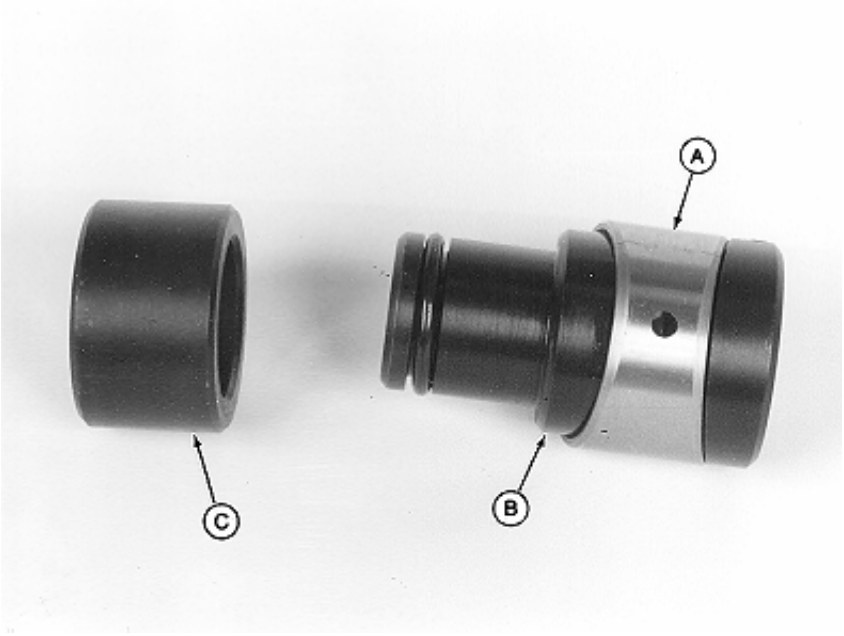


RG7130 -UN-10OCT94



RG7131 -UN-10OCT94

CD,3274,G10,52 -19-04JAN99



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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* to:
- Outside diameter of bushing
- Outside diameter of pilot ring
- Inside diameter of rod pin bore

*Available as service part.

CD,CTM125,079 -19-01DEC97

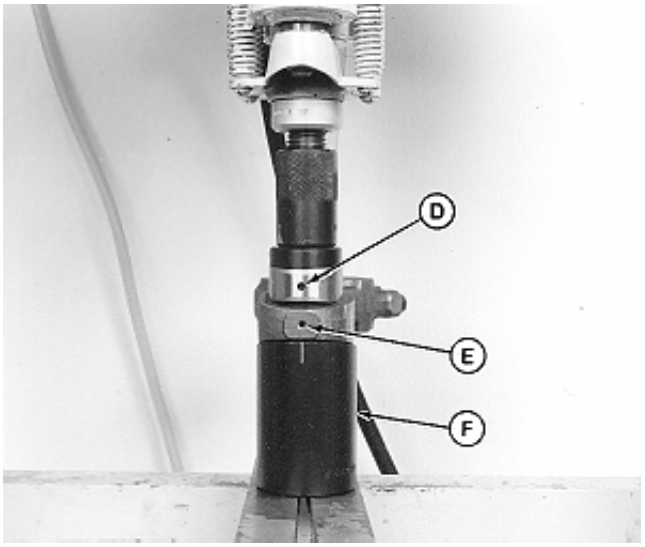
6. Insert driver into rod pin bore so pilot ring pilots in rod bore and bushing taper aligns with taper on driver flange. Align oil hole in bushing (D) with oil hole in end of rod (E).

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.

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 an oil clearance of 0.020 to 0.056 mm (0.0008 to 0.002 in.) with piston pin.



CD,CTM125,063 -19-01DEC97

MEASURE PISTON PIN


T81604 -UN-07NOV88

SPECIFICATIONS

Piston pin outside diameter:
- Small pin . . . . . 31.994—32.000 mm (1.2596—1.2598 in.)
- Medium pin . . . . . 34.92—34.93 mm (1.3748—1.3752 in.)
- Large pin . . . . . 41.27—41.28 mm (1.6248—1.6252 in.)
- Wear tolerance . . . . . 0.013 mm (0.005 in.)

Pin-to-bushing oil clearance:
- Small pin . . . . . 0.010—0.042 mm (0.0004—0.0016 in.)
- Medium pin . . . . . 0.020—0.056 mm (0.0008—0.0022 in.)
- Large pin . . . . . 0.007—0.043 mm (0.0003—0.0017 in.)
- Maximum . . . . . 0.10 mm (0.004 in.)

If diameter is less or clearance is more than specified, replace connecting rod/piston pin assembly for emgines with small piston pin and replace pin or pin/bushing assembly for all other engines.

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CD,3274,G10,11 -19-04JAN99

PISTON CLEANING

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

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.

CD,3274,G10,5 -19-18FEB92

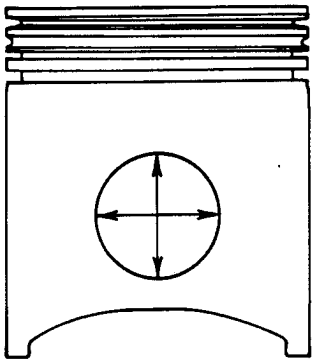
MEASURE PISTON PIN BORE

SPECIFICATIONS

Bore for small pin	32.003—32.013 mm (1.2600—1.2603 in.)
Bore for medium pin	34.933—34.943 mm (1.3753—1.3757 in.)
Bore for large pin	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,3274,G10,50 -19-04JAN99

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PISTON TOP RING GROOVE

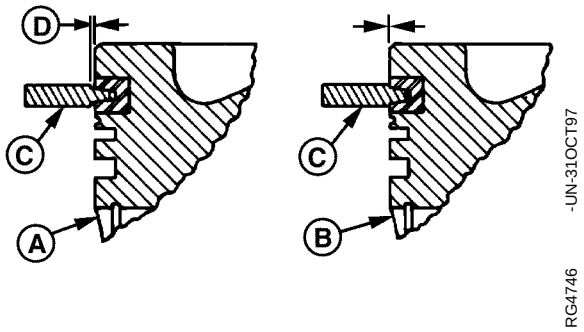
Depending on engine configuration, two wear gauges can be used to check wear of top compression ring groove.

- **Use JDE62 wear gauge (for 15° angle):**

on engines for following applications
3029DF001, DF031
3029TF001, TF031 (-264812CD)
3029DF120, DF160 (-263023CD)
3029TF120, TF160 (-287525CD)
3029TLV01 (-261580CD)
3029DRT65

- **Use JDG957 wear gauge (for 6° angle):**

on all other engines



RG4746 -UN-31OCT97

A—Piston can be used again
B—Discard piston and replace
C—JDG957 or JDE62 Gauge
D—Tool shoulder-to-ring land clearance

CD,3274,G10,6 -19-04JAN99

SECOND AND THIRD PISTON RING GROOVES

Use a new piston ring and feeler gauge. Ring groove clearance must not exceed 0.20 mm (0.008 in.).

If clearance exceeds specification, install a new piston.

CD,3274,G10,7 -19-18FEB92

PISTON HEAD AND SKIRT CHECKING

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

Measure piston diameter 19 mm (0.74 in.) from bottom of skirt and 90° from piston pin.

Compare measurement with “Specifications”.

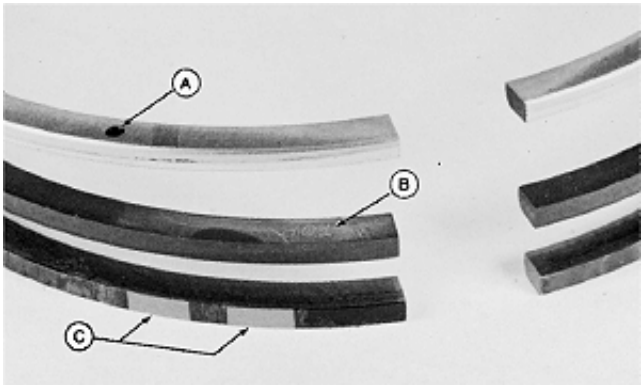
CD,3274,G10,8 -19-01FEB94

PISTON RING IDENTIFICATION

Depending on engine configuration, piston rings no.1 and 2 are different.

• On following engines, compression rings (no.1 and 2) may have either one or two depression marks (A) or a “TOP” mark stamped on the top side of rings.
- 3029DF001..., DF031...
- 3029TF001..., TF031... (-264812CD)
- 3029DF120..., DF160... (-263023CD)
- 3029TF120..., TF160... (-287525CD)
- 3029TLV01 (-261580CD)
- 3029DRT65

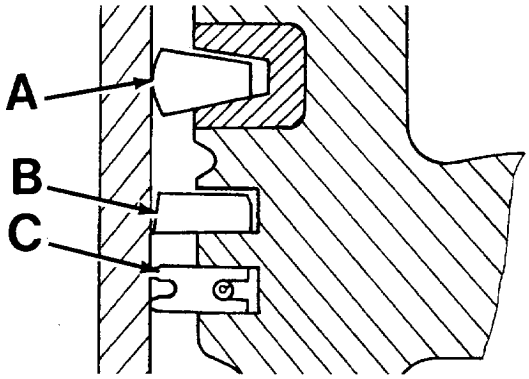
• On all other engines, no.1 compression ring has a blue dye mark (C) and no.2 ring a yellow dye mark on the face of the ring. Dye marks must be on the left side of ring gap as shown.



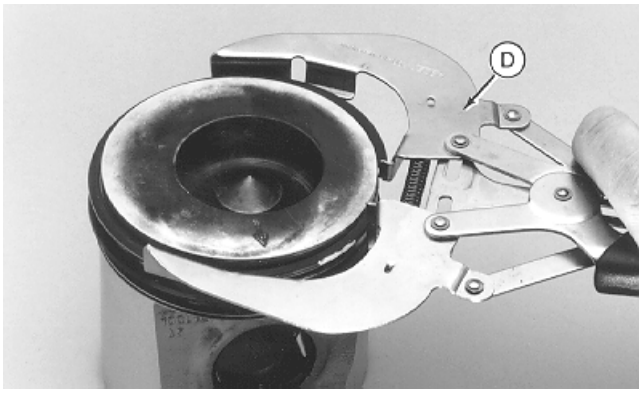
A—Depression marks
B—“TOP” mark
C—Yellow or blue dye mark

CD,3274,G10,53 -19-04JAN99

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.

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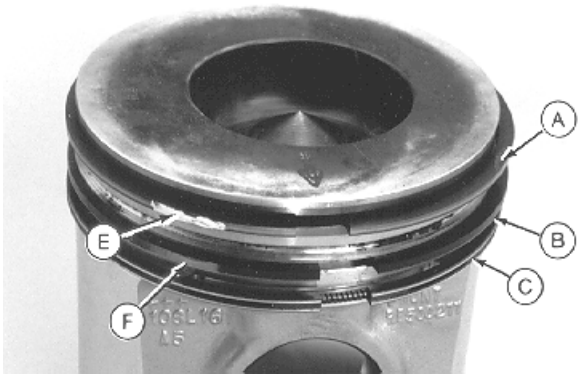
1. Install oil control ring (C) in bottom ring groove over ring expander. Be sure that the ring expander and the wire are correctly fitted.

2. Install second ring (B) in center ring groove according to identification mark. For ring with dye mark, proper installation is obtained when the yellow dye mark (F) is at 7 o'clock when end gap is at 6 o'clock.

3. Install top ring (A) in top ring groove according to identification mark. For ring with dye mark, proper installation is obtained when the blue dye mark (E) is at 7 o'clock when end gap is at 6 o'clock.



CD30570 -UN-04MAY98

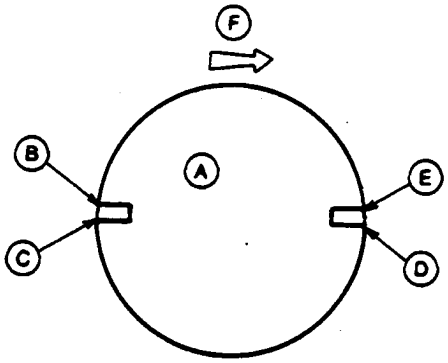
A—Top ring
B—Second ring
C—Oil control ring
D—KJD10140 Piston Ring Expander
E—Blue mark
F—Yellow mark

CD,3274,G10,54 -19-04JAN99

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

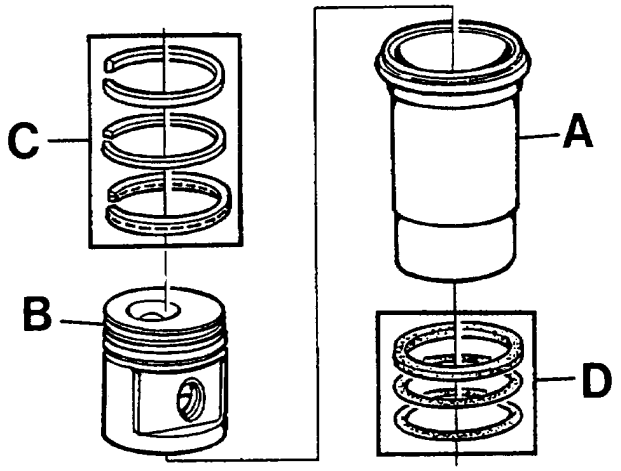
CD,3274,G10,15 -19-18FEB92

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

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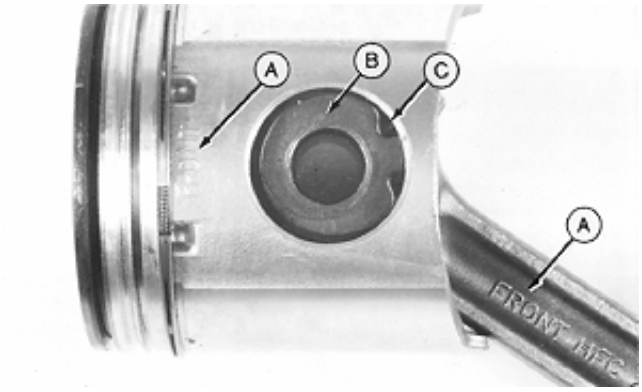
PISTON AND CONNECTING ROD ASSEMBLY

NOTE: Pistons must be installed on connecting rods from which they were removed.

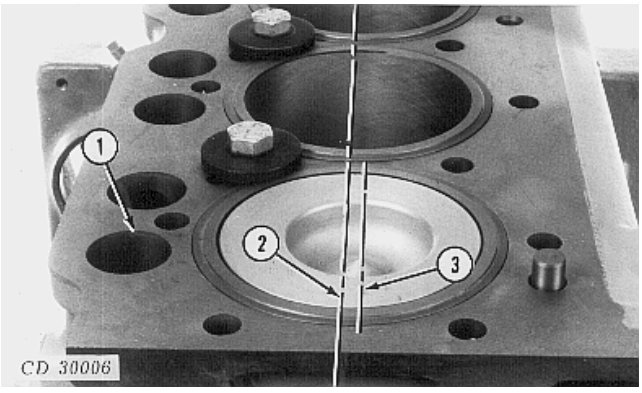
1. Assemble pistons and connecting rods, making sure the word “FRONT” (A) on the side or top of the piston and on the side of the connecting rod are on the same side.

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



RG5627 -UN-28MAR90

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.



CD30006 -UN-18JAN95

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

CD,3274,G10,12 -19-18FEB92

PISTON AND CONNECTING ROD INSTALLATION

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 (A) on the top of each piston faces toward front end of cylinder block.

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

3. Install bearing inserts, making sure small tangs (B) on each half of the inserts fit in recess of rod and cap.

4. Install cap so that large slot in cap (C) fits large tang (D) on connecting rod.

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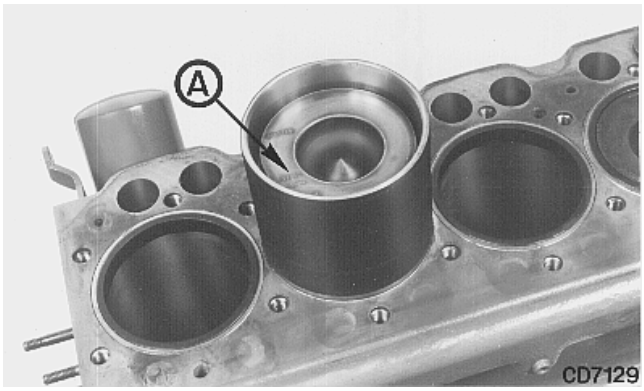
5. Dip NEW connecting rod cap screws in clean oil and tighten them alternately to following torques:

IMPORTANT: NEVER use connecting rod cap screws more than once.

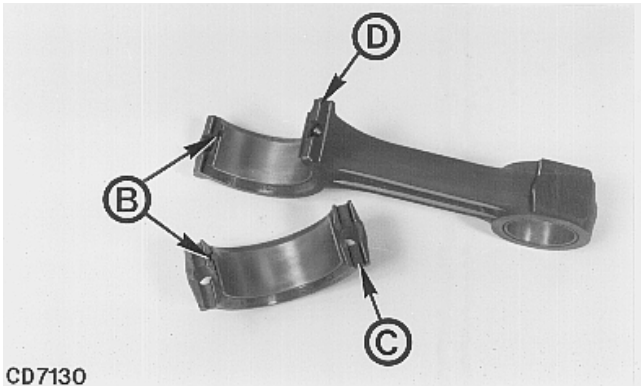
- 3029, 4039 and 6059 engines:
  Initially tighten cap screws to 56 N·m (40 lb-ft)

- 4045 and 6068 engines:
  Initially tighten cap screws to 66 N·m (50 lb-ft)

6. Torque-turn all cap screws 90—100 degrees. (See next module).



-UN-18JAN95
CD7129



-UN-18JAN95
CD7130

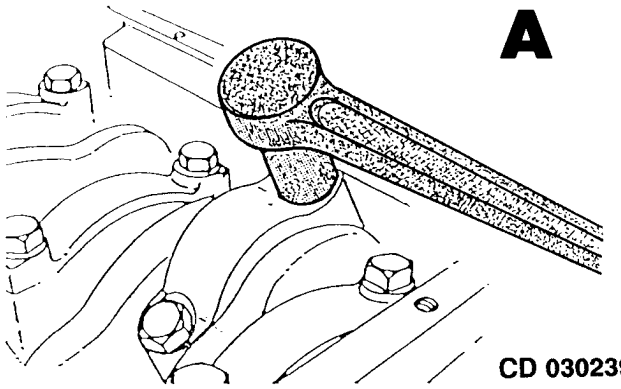
CD,3274,G10,16 -19-20FEB92

TORQUE-TURN METHOD

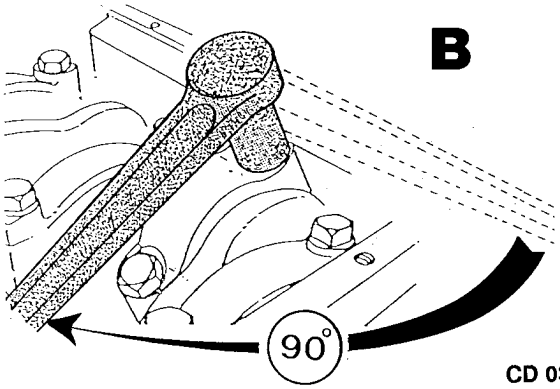
1. Position the wrench parallel to engine axis (A).

2. Tighten until the wrench is perpendicular to engine axis (B).

3. Check for proper side clearance in all rods. Each rod SHOULD HAVE slight side-to-side movement.



CD 030239 -UN-08MAR95



CD 030240 -UN-08MAR95

CD,3274,G10,41 -19-01FEB94

PISTON PROTRUSION MEASURE

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.

NOTE: If KJD10123 Gauge is not available, use a dial indicator. In this case, the piston protrusion should not exceed 0.35 mm (0.014 in.).

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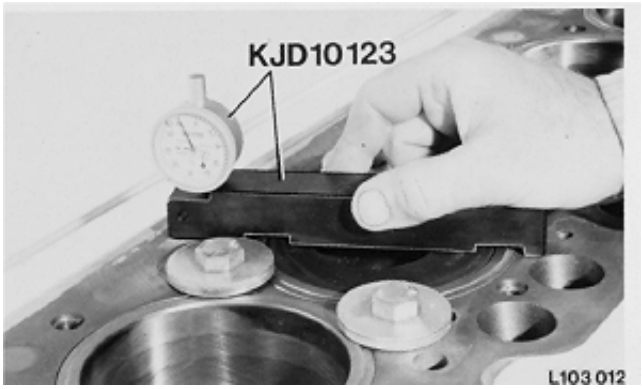
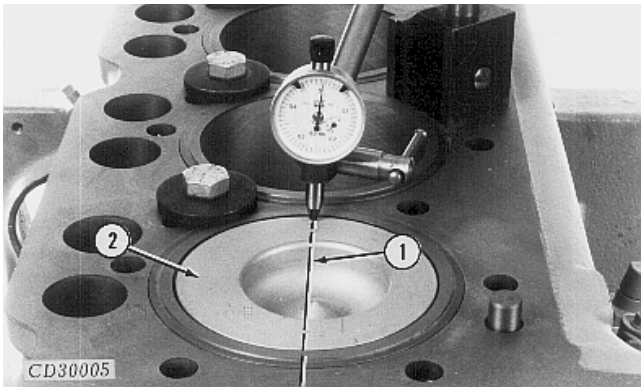
5. If protrusion is out of specifications, check all concerned parts to determine the cause.

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



L103012 -UN-15NOV88



CD30005 -UN-07FEB95

CD,3274,G10,10 -19-01FEB94

FINAL VERIFICATIONS

1. Rotate crankshaft several revolutions to be sure engine rotates without excessive tightness.

2. Check liners for deep scratches which would indicate an improperly installed or broken piston ring.

3. Check for proper side clearance in all rods. Each rod SHOULD HAVE slight side-to-side movement.

CD,3274,G10,30 -19-18FEB92

COMPLETE FINAL ASSEMBLY

1. Re-install all components previously removed. Apply following recommendations then perform engine test as described in “Final Work” in Group 05.

2. Cylinder block has some orifices which are in relation either with the lubrication or cooling 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.

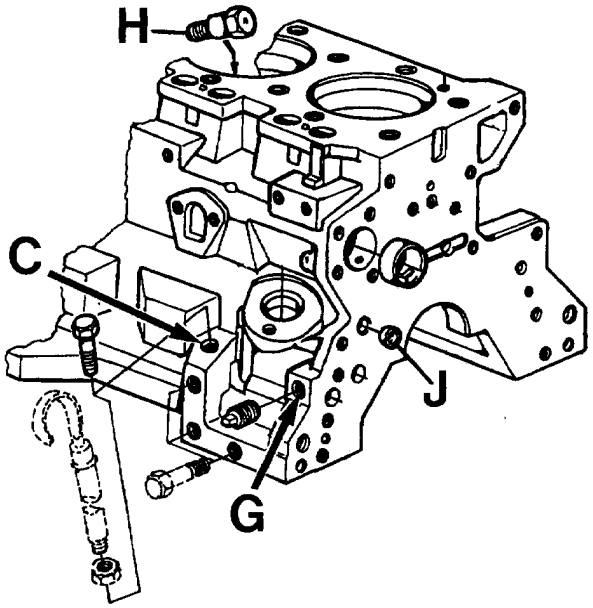
NOTE: From engine serial number (121942CD-), the plugs for oil holes (D) are coated with sealant and can be reused several times without addition of sealing compound.

Plug or fitting torques

A—Coolant drain (1/4“)	17 N·m (13 lb-ft)
B—Turbocharger oil return (1/2“)	45 N·m (33 lb-ft)
C—1/2“ cyl. for dipstick tube	67 N·m (50 lb-ft)
D—Oil galleries (1/8“)	17 N·m (13 lb-ft)
E—1/4“ Coolant gallery (side)	17 N·m (13 lb-ft)
F—Rear Coolant gallery (1“)	45 N·m (33 lb-ft)
G—Oil gallery (3/8“)	45 N·m (33 lb-ft)
K—1-5/8“ coolant gallery (side):	
• Steel plug (-379251CD)	60 N·m (44 lb-ft)
• Composite material plug (379252CD-)	30 N·m (22 lb-ft)

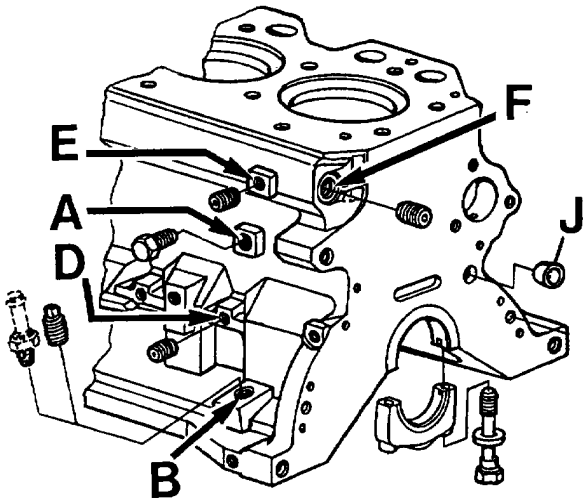
NOTE: If during the tightening phase the composite material plug (K) is broken, it can be removed using lock-pliers after having applied two flat faces on opposite sides of it.

3. Be sure that piston cooling jets (H) and, when needed, oil gallery steel caps (J) are installed.



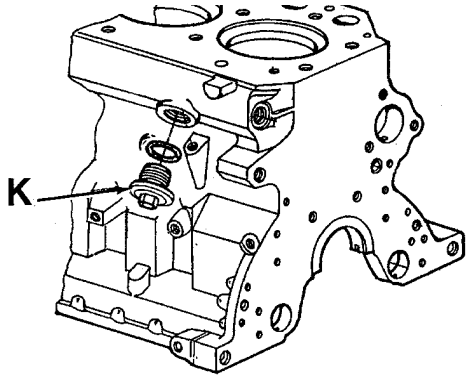
CD30576 -UN-16JUN98

Front right view (3 cyl. shown)



CD30577 -UN-16JUN98

Rear left view (3 cyl. shown)



CD30708 -UN-22FEB99

CD,3274,G10,51 -19-04JAN99

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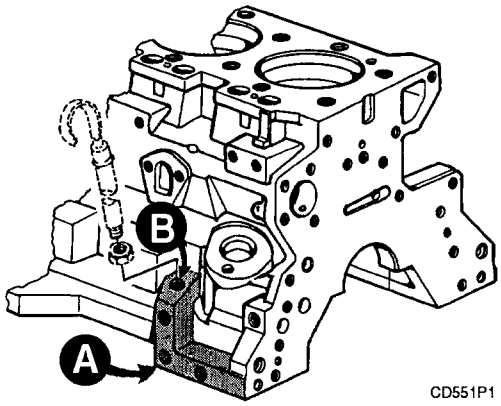
4. Service cylinder block may have additional side mounting bosses (A). In case where these bosses interfere with the chassis or other machine components, grind concerned area.

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



-UN-10DEC96
CD551P1

CD,CTM125,076 -19-01DEC97

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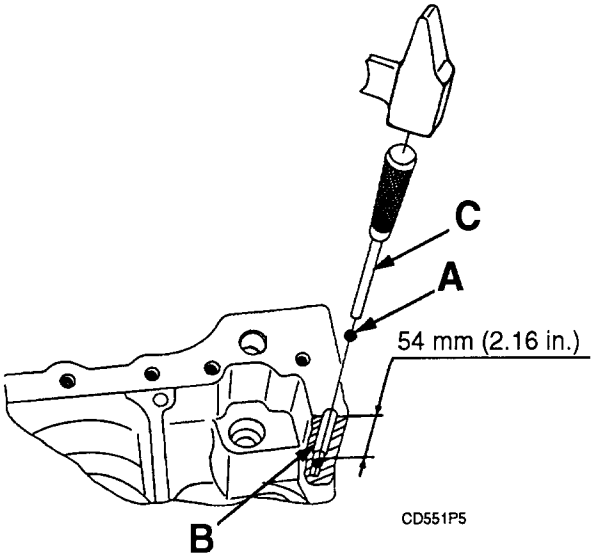
5. Oil gallery ball (A) is provided with service cylinder block, but may not be installed. In this case, proceed as follows:
- Put ball (A) in oil passage (B).
- Drive in ball using an appropriate driver (C) until ball bottoms.
- Check for proper installation. The distance between pan rail and top of ball should be approximatively 54 mm (2.16 in.).



-UN-07NOV96
CD551P5

CD,CTM125,077 -19-01DEC97

SPECIAL OR ESSENTIAL TOOLS

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

DX,TOOLS -19-20JUL95

Dial indicator FKM10103
(Part of KJD10123 Piston/Liner height gauge)

To be used with a magnetic base.

ES107506 -UN-07MAR95

CD,FKM10103 -19-01FEB94

Slide hammer seal puller JDG22

Used to remove seal.

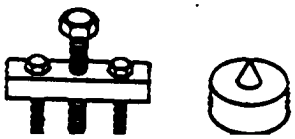
RG5109 -UN-23AUG88

CD,JDG22 -19-01MAR92

Vibration Damper Puller Set JDG410

Remove vibration damper and pulley.

RG5112 -UN-06APR89

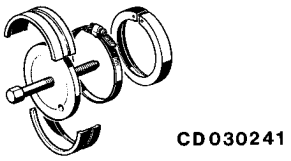


JDG410 -19-09APR92

Rear crankshaft wear sleeve puller JDG645E

Remove wear sleeve from rear crankshaft flange.

CD30241 -UN-08MAR95



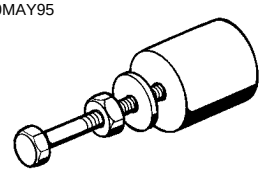
CD,JDG645E -19-01MAR92

Crankshaft gear driver JDG794A
(Formerly JDH7 or JDG794)

Install gear on crankshaft.

NOTE: JDG794A consists of JDG794 and JDG794A-1 longer screw.

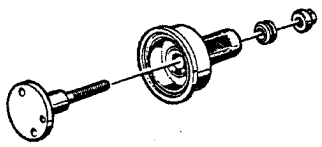
JDG794 -UN-10MAY95



CD,JDG794A -19-04JAN99

CD30709 -UN-22FEB99

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

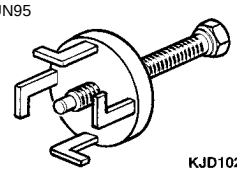


Install rear crankshaft oil seal/wear sleeve assembly.

CD,KCD10002A -19-04JAN99

KJD10206 -UN-19JUN95

Crankshaft pulley puller KJD10206



KJD10206

Remove crankshaft pulley without threaded holes on 6000-Series tractors.

NOTE: This tool can be also self-manufactured (see drawing in this group).

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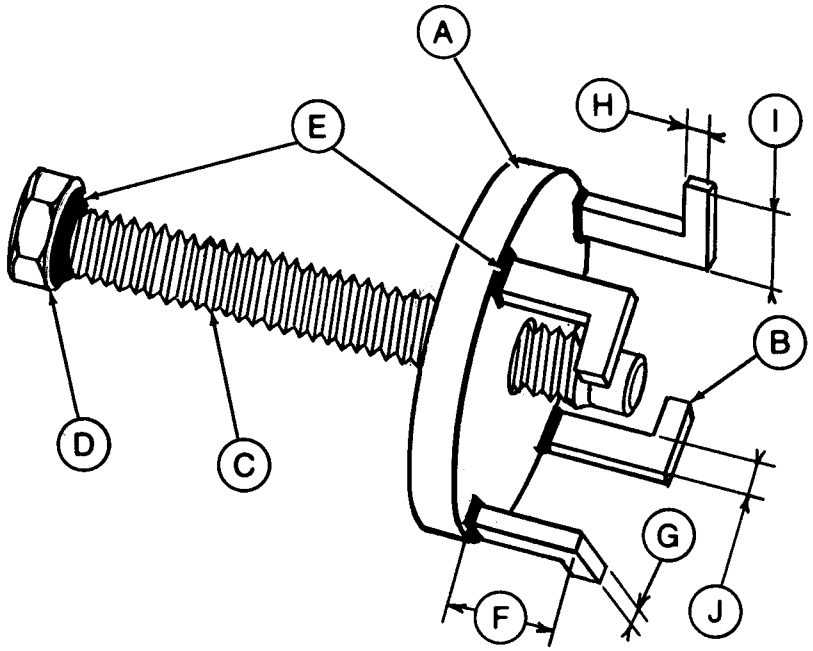
CD,KJD10206 -19-01FEB94

SELF-MANUFACTURED TOOL
PULLER FOR CRANKSHAFT PULLEY W/O THREADED HOLES



CD30434

A—Steel plate dia. 110 mm (4.33 in.), 15 mm (0.59 in.) thick
B—Steel hook (4 used)
C—M20 Threaded rod, 200 mm (7.87 in.) length
D—M20 Nut
E—Weld
F—38 mm (1.50 in.)
G—8 mm (0.31 in.)
H—8 mm (0.31 in.)
I—30 mm (1.18 in.)
J—15 mm (0.59 in.)

CD30434 -UN-10MAY95

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3

CD,3274,G15,40 -19-01FEB94

SPECIFICATIONS

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Max. vibration damper radial run-out		1.50 mm (0.06 in.)
Max. vibration damper wobble (outer ring)		1.50 mm (0.06 in.)
Max. vibration damper wobble (inner ring) (engine with front PTO)		0.50 mm (0.02 in.)
Max. pulley wobble (engine with front PTO)		0.50 mm (0.02 in.)
Crankshaft end play:		
• Engine with 2-piece thrust bearing	0.13—0.40 mm (0.005—0.016 in.)	0.50 mm (0.02 in.)
• Engine with 5/6-piece thrust bearing*	0.03—0.35 mm (0.001—0.014 in.)	0.50 mm (0.02 in.)
Oversize thrust washers available	0.18 mm (0.007 in.)	
Crankshaft main journals OD (Std.)	79.324—79.350 mm (3.123—3.124 in.)	
• Taper	0.013 mm (0.0005 in.)	0.03 mm (0.0012 in.)
• Out-of-roundness	0.013 mm (0.0005 in.)	0.075 mm (0.003 in.)
Main bearings assembled ID (Std.)	79.396—79.440 mm (3.126—3.127 in.)	
Crankshaft to main bearing clearance	0.046—0.116 mm (0.0018—0.0046 in.)	0.15 mm (0.006 in.)
Undersize bearing available	0.25, 0.50 and 0.76 mm (0.01, 0.02 and 0.03 in.)	

(Continued on next page)

**Standard thrust washer sets for service contain now 4 thrust washers instead of 3 currently installed by the factory and previously included in service sets.*

CD,3274,G15,29 -19-01FEB94

SPECIFICATIONS - CONTINUED

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Crankshaft conrod OD (Std.)		
• 3029, 4039, 6059 engines	69.799—69.825 mm (2.748—2.749 in.)	
• 4045, 6068 engines	77.798—77.824 mm (3.063—3.064 in.)	
• Taper	0.013 mm (0.0005 in.)	0.03 mm (0.0012 in.)
• Out-of-roundness	0.013 mm (0.0005 in.)	0.075 mm (0.003 in.)
Crankshaft OD for front pulley	37.988—38.014 mm (1.4956—1.4966 in.)	
Specifications for grinding purposes:		
• Crankshaft fillet radii		
— on main journals (all engines)	3.7—4.0 mm (0.146—0.156 in.)	
— on rod journals (3029,4039,6059)	4.2—4.4 mm (0.165—0.175 in.)	
(4045, 6068 engines)	3.7—4.0 mm (0.146—0.156 in.)	
• Grinding surface finish (C.L.A.*)		
— Main and connecting rod journals	0.2 micron (8 micro-in.)	
— Thrust faces	0.4 micron (16 micro-in.)	

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* *C.L.A. (Center Line Average) corresponds to a measure of surface texture.*

CD,3274,G15,30 -19-01MAR92

TORQUES FOR HARDWARE

Main bearing caps	
• (—135640)	120 N·m (85 lb-ft)
• (135641—)	135 N·m (100 lb-ft)
Damper/pulley to crankshaft (engine without crankshaft gear-driven aux. drive):	
—45 mm (1.77 in.) bolt length	150 N·m (110 lb-ft)
—112 mm (4.41 in.) bolt length (lubricated)	150 N·m (110 lb-ft) plus 60° angle
Damper/pulley to crankshaft (engine with crankshaft gear-driven aux. drive):	
—45 mm (1.77 in.) bolt length	180 N·m (135 lb-ft)
—112 mm (4.41 in.) bolt length (lubricated)	150 N·m (110 lb-ft) plus 60° angle
Collet to crankshaft (engine with front PTO):	
—45 mm (1.77 in.) bolt length	150 N·m (110 lb-ft)
—112 mm (4.41 in.) bolt length (lubricated)	150 N·m (110 lb-ft) plus 60° angle
Damper/pulley to collet (engine with front PTO)	35 N·m (25 lb-ft)
Flywheel to crankshaft	160 N·m (120 lb-ft)
Flywheel housing to block:	
• 3/8 in. cap screws on 3000/3010-Series tractors:	
—(-244461CD)	
1st stage	30 N·m (23 lb-ft)
2nd stage	50 N·m (35 lb-ft)
—(244462CD-) Cap screws lubricated	70 N·m (50 lb-ft)
• 3/8 in. cap screws on other applications:	
1st stage	30 N·m (23 lb-ft)
2nd stage	50 N·m (35 lb-ft)
• 5/8 in. cap screws on 3000/3010 Series tractors:	
—(-244461CD)	320 N·m (235 lb-ft)
—(244462CD-) Cap screws lubricated	200 N·m (150 lb-ft) Plus 45° angle
• 5/8 in. cap screws on other applications	230 N·m (170 lb-ft)

CD,3274,G15,31 -19-04JAN99

VIBRATION DAMPER CHECKING (ENGINE WITHOUT FRONT PTO)

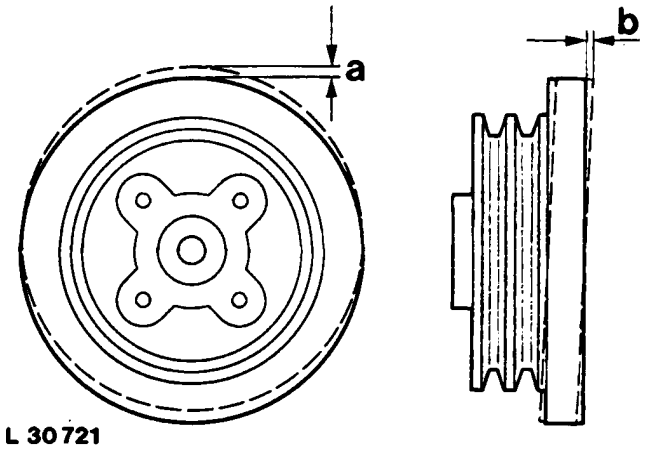
NOTE: When cleaning torsion damper never soak in a cleaning solvent. Use a steam cleaner, soap solution or water only.

1. Measure total run-out (a) and wobble (b) of torsion damper outer ring. Compare with specifications.

2. Replace torsion damper if total run-out or wobble exceeds specifications, or if outer ring has slipped relative to rubber member or drive hub.

3. Grasp torsion damper and attempt to turn in both directions (clockwise and counter-clockwise). If rotation is felt, replace damper.

IMPORTANT: Replace torsion damper after 4500 hours of operation or every five years, whichever occurs first.



-UN-24APR89
L30721

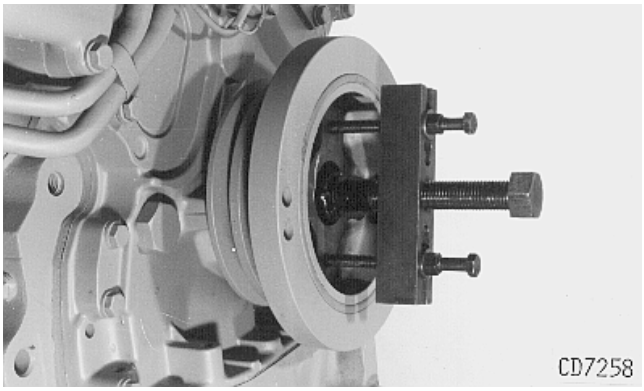
CD,3274,G15,1 -19-01FEB94

PULLEY OR VIBRATION DAMPER REMOVAL

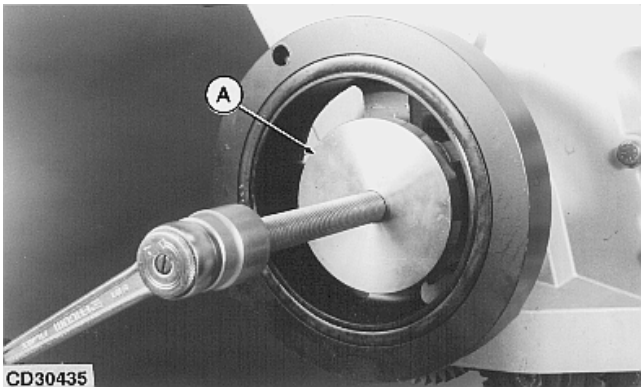
IMPORTANT: Handle damper with care. Never apply thrust to outer ring of damper. Damper is sensitive to such impacts as being dropped or struck with a hammer. Such impact damage can impair damper function.

1. Remove pulley/vibration damper attaching cap screw.

2. Using JDG410 Puller or KJD10206 (A) for pulley without threaded holes, remove vibration damper or pulley from crankshaft.



-UN-23MAY95
CD7258



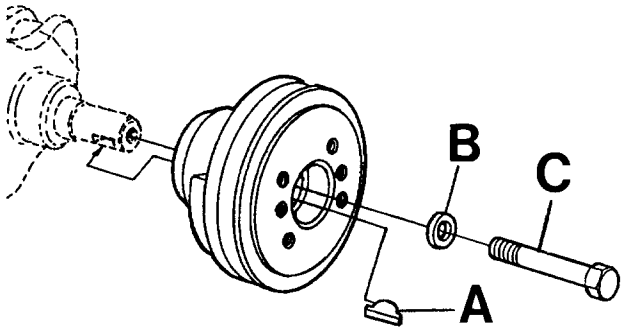
-UN-10MAY95
CD30435

Pulling with KJD10206

CD,3274,G15,2 -19-04JAN99

PULLEY OR VIBRATION DAMPER INSTALLATION

NOTE: 3 cylinder crankshaft pulleys and flywheels are unbalanced and therefore are not interchangeable with 4 or 6 cyl. engine parts. Several unbalance values are used, take care not to mix parts. Refer to relevant Parts Catalogs to order appropriate parts.



1. Install shaft key (A) on crankshaft.

2. Position pulley or vibration damper on crankshaft nose with washer (B) and cap screw (C).

2. Tighten as follows:

TORQUE SPECIFICATIONS

—45 mm (1.77 in.) bolt length (dry)	150 N·m (110 lb-ft)
—112 mm (4.41 in.) bolt length (lubricated)	150 N·m (110 lb-ft) plus 60° angle

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CD,3274,G15,3 -19-04JAN99

VIBRATION DAMPER OR PULLEY CHECKING (ENGINE WITH FRONT PTO)

NOTE: When cleaning torsion damper, never soak in a cleaning solvent. Use a steam cleaner, soap solution or water only.

1. Prior to disassembly, check the following specifications:

SPECIFICATIONS

Vibration damper only
— Max. total run-out (A) . . . . . 1.50 mm (0.06 in.)
— Max. wobble (B) . . . . . 1.50 mm (0.06 in.)

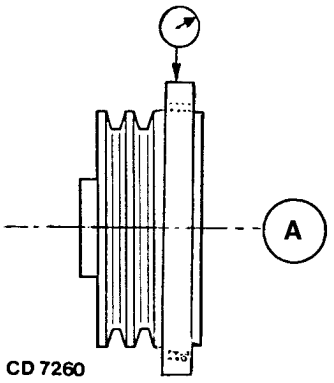
Vibration damper or pulley
— Max. wobble (C) . . . . . 0.5 mm (0.02 in.)

2. Replace torsion damper if total run-out (A) or wobble (B) exceeds specifications, or if outer ring has slipped relative to rubber member or drive hub.

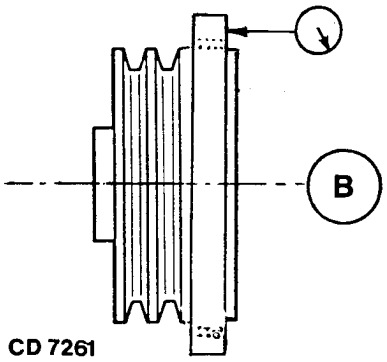
3. Grasp torsion damper and attempt to turn in both directions (clockwise and counter-clockwise). If rotation is felt, replace damper.

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

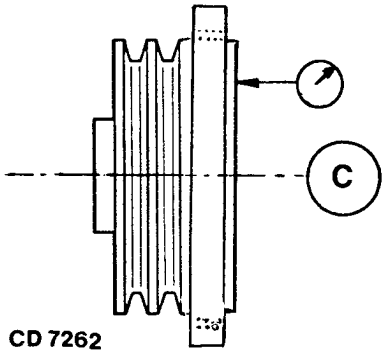
IMPORTANT: Replace torsion damper after 4500 hours or every five years, whichever occurs fist.



CD 7260 -UN-07MAR95



CD 7261 -UN-07MAR95



CD 7262 -UN-07MAR95

CD,3274,G15,4 -19-01MAR92

VIBRATION DAMPER OR PULLEY REMOVAL (ENGINE WITH FRONT PTO)

1. Remove the eight cap screws (A) attaching damper or pulley to collet.

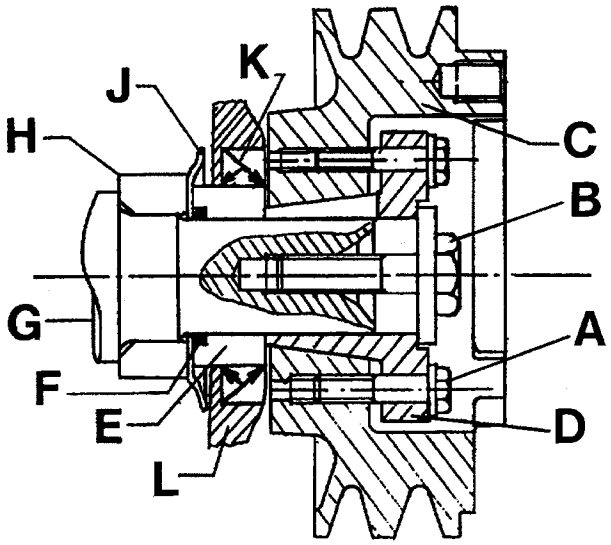
2. Using a wooden block and a hammer, tap on inner damper ring or pulley until it loosens from conical seat of collet.

IMPORTANT: Never tap or apply thrust to outer ring of torsion damper.

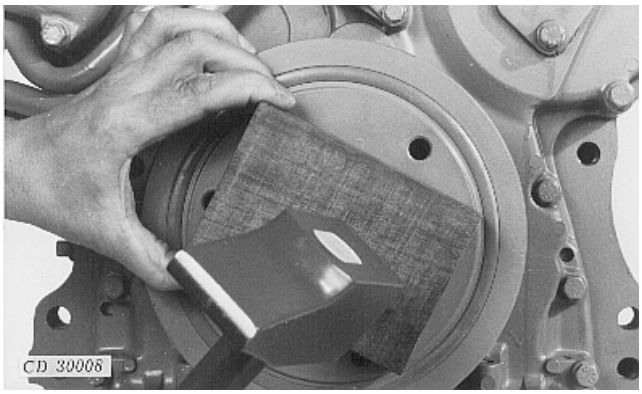
3. Remove collet attaching cap screw (B).

4. Remove collet and damper or pulley.

A—Cap screw (Qty: 8)
B—Cap screw
C—Pulley
D—Collet drive
E—Wear sleeve
F—O-ring
G—Crankshaft
H—Gear
J—Oil deflector
K—Front oil seal
L—Timing gear cover



CD30710 -UN-22FEB99



CD30008 -UN-05OCT94

CD,3274,G15,5 -19-04JAN99

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VIBRATION DAMPER OR PULLEY INSTALLATION (ENGINE WITH FRONT PTO)

1. Lightly oil tapered surfaces of collet and damper or pulley.

2. Position collet in damper or pulley. Install both cap screws (A) 180° apart to keep collet with the damper or pulley.

3. Install collet/damper or collet/pulley assembly on the crankshaft with washer and cap screw (B).

4. **For 3-cylinder engines only**, 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 follows:

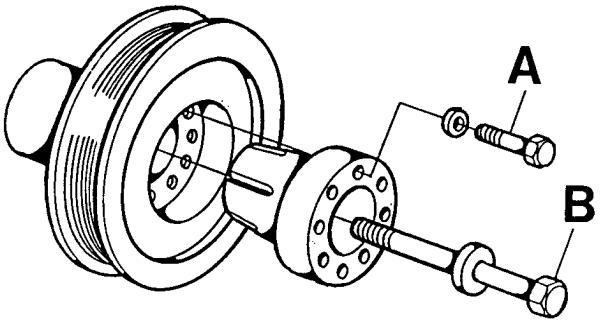
—45 mm (1.77 in.) bolt length (dry)	150 N·m (110 lb-ft)
—112 mm (4.41 in.) bolt length (lubricated)	150 N·m (110 lb-ft) plus 60° angle

6. Tighten the two collet cap screws (A) alternately and evenly to a final torque of 35 N·m (25 lb-ft).

7. Install remaining six collet cap screws. Again alternately and evenly tighten the two cap screws 90° from the first two cap screws to 35 N·m (25 lb-ft). Tighten the remaining cap screws to 35 N·m (25 lb-ft). Always tighten collet cap screws in pairs opposite each other.

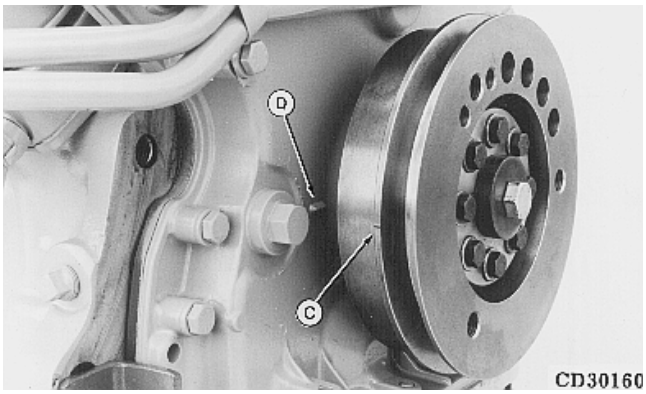
8. Repeat the collet cap screw tightening sequence until all the cap screws have been tightened to the specified torque of 35 N·m (25 lb-ft).

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



CD30395 -UN-10MAY95

CD30395



CD30160 -UN-05OCT94

CD30160

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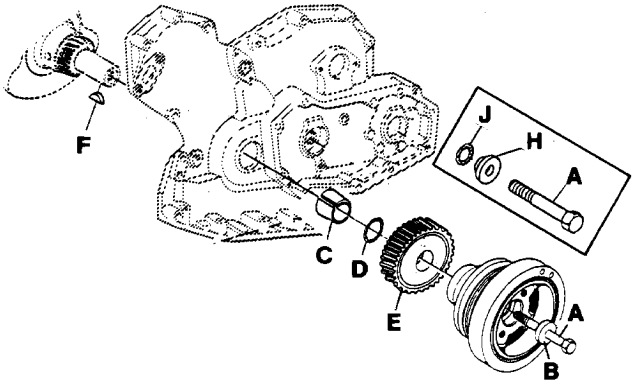
CD,3274,G15,6 -19-04JAN99

INSTALL VIBRATION DAMPER OR PULLEY (ENGINE WITH CRANKSHAFT-GEAR-DRIVEN AUX. DRIVE)



CD630P3 -UN-13MAY98

1. Install shaft key (F) in crankshaft.

2. Clean and lubricate crankshaft nose and bore of pulley/damper.

3. Install pulley/damper on crankshaft. Place washer (B), with flat side toward engine, and cap screws.

NOTE: Depending on equipment, the special washer (H) may be used along with O-ring (J). In this case, O-ring (D) is not needed.

4. Tighten cap screw as follows:

—45 mm (1.77 in.) bolt length (dry)	180 N·m (135 lb-ft)
—112 mm (4.41 in.) bolt length (lubricated)	150 N·m (110 lb-ft) plus 60° angle

A—Cap screw
B—Washer
C—Collet
D—O-Ring
E—Auxiliary drive gear
F—Shaft key
H—Special washer
J—O-ring

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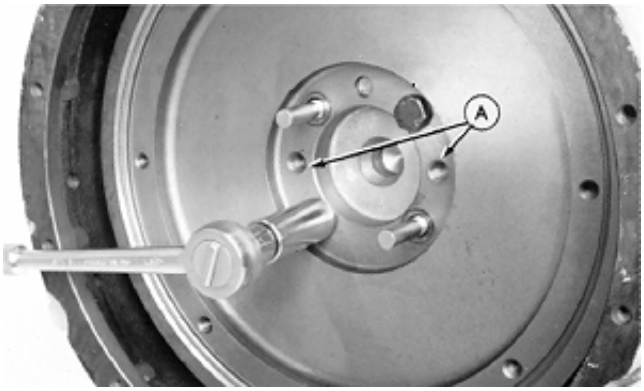
CD,3274,G15,41 -19-04JAN99

FLYWHEEL REMOVAL

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



RG5632 -UN-02APR90

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

FLYWHEEL RING GEAR REPLACEMENT

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

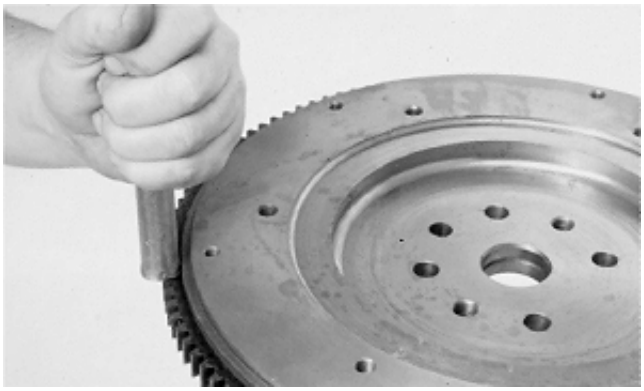
2. Heat new ring gear to 150˚C (300˚F) using either heated oil, oven heat, or flame heat.

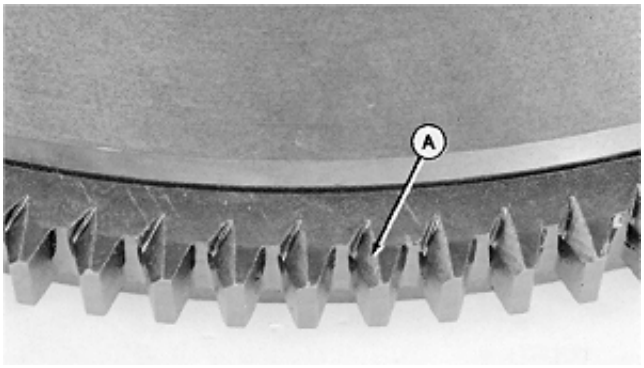
CAUTION: Oil fumes or oil can ignite above 190˚ C (380˚F). When heating ring gear, use a thermometer and do not exceed 180˚C (360˚F). Heat the oil in a well ventilated area. Plan a safe handling procedure to avoid burns.

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

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

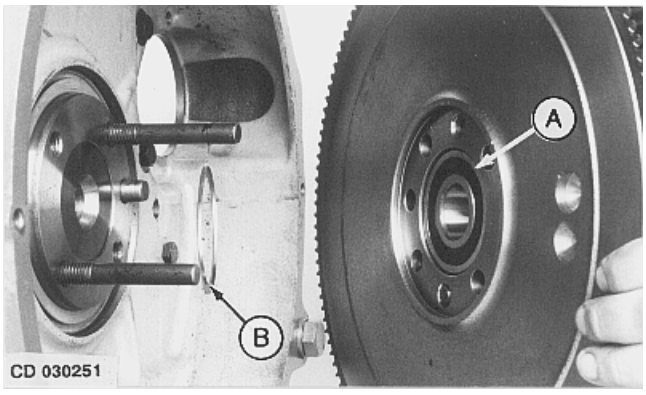
BALL BEARING INSTALLATION

Some flywheels may have a ball bearing (A) and possibly a positioning shim (B) to be installed with flywheel removed from engine.

1. Press ball bearing into flywheel until it bottoms.

2. If required, install the positioning shim against ball bearing.

NOTE: The positioning shim must be installed between ball bearing and crankshaft flange.



CD030251 -UN-05OCT94

CD,3274,G15,35 -19-01MAR92

FLYWHEEL INSTALLATION

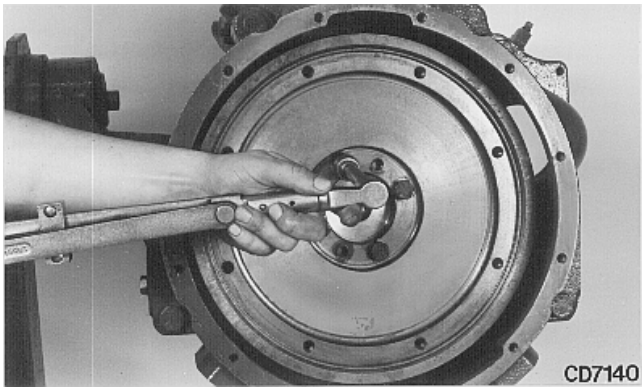
NOTE: 3 cylinder flywheels and crankshaft pulleys are unbalanced and therefore are not interchangeable with 4 or 6 cyl. engine parts. Several unbalance values are used, take care not to mix parts. Refer to relevant Parts Catalogs to order appropriate parts.

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 tighten crosswise to 160 N·m (120 lb-ft).



-UN-07MAR95 CD7140

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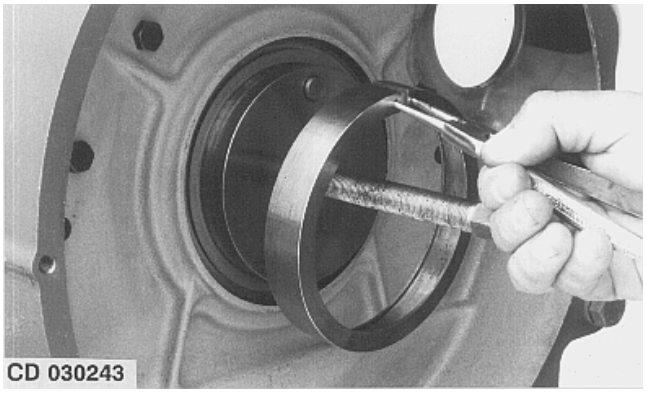
CD,3274,G15,9 -19-04JAN99

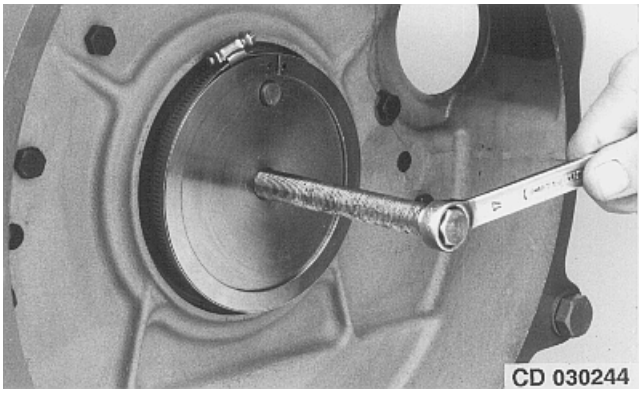
CRANKSHAFT WEAR SLEEVE REMOVAL

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.



-UN-06MAR95 CD30243



-UN-06MAR95 CD30244

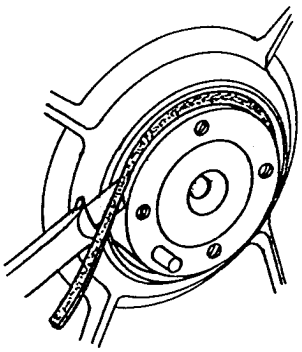
CD,3274,G15,11 -19-01MAR92

CRANKSHAFT WEAR SLEEVE REMOVAL (CONT'D)

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.

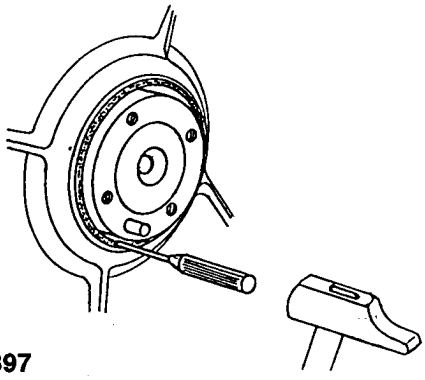
5. Using JDG22 Slide Hammer Puller, extract seal case.



CD30396

-UN-10MAY95

CD30396



CD30397

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CD30397

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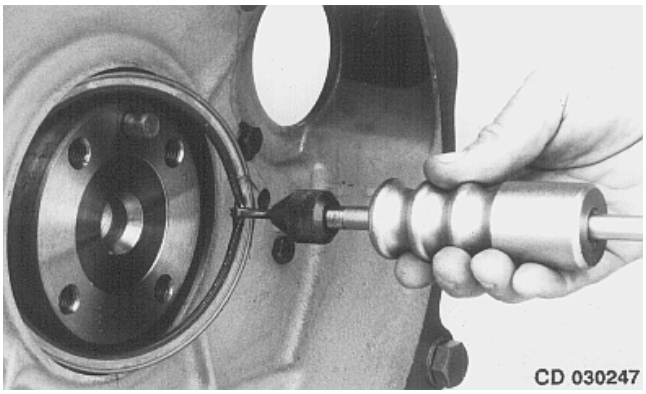


-UN-06MAR95

CD30247

CD,3274,G15,32 -19-01FEB94

FLYWHEEL HOUSING REPLACEMENT

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

1. Remove flywheel and oil pan.

2. Remove the eight 3/8 in. cap screws (A) and the four 5/8 in. cap screws, then remove flywheel housing.

3. Clean mating surfaces and install new gasket (C).

4. Install flywheel housing with the eight 3/8 in. cap screws (A). Tighten as follows:
• 3000/3010-Series tractors with engines
(-244461CD):

—1st stage . . . . . 30 N·m (23 lb-ft)
—2nd stage . . . . . 50 N·m (35 lb-ft)

• 3000/3010-Series tractors with engines
(244462CD-):

Cap screws lubricated . . . . . 70 N·m (50 lb-ft)

• Other applications:

—1st stage . . . . . 30 N·m (23 lb-ft)
—2nd stage . . . . . 50 N·m (35 lb-ft)

5. Install the four 5/8 in. cap screws (B) then tighten as follows:
• 3000/3010-Series tractors with engines
(-244461CD):

Cap screws dry . . . . . 320 N·m (235 lb-ft)

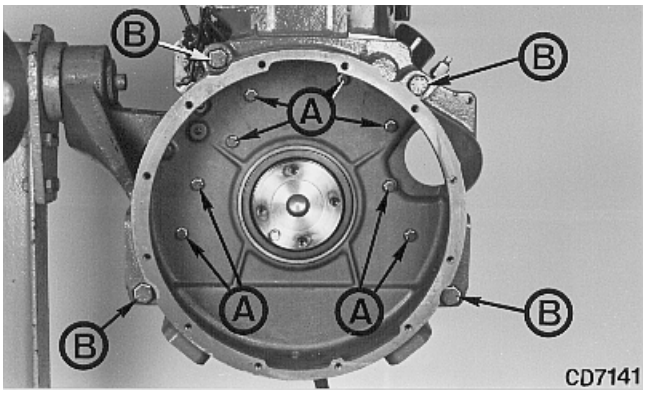
• 3000/3010-Series tractors with engines
(244462CD-):

Cap screws lubricated . . . . . 200 N·m (150 lb-ft) plus 45° angle

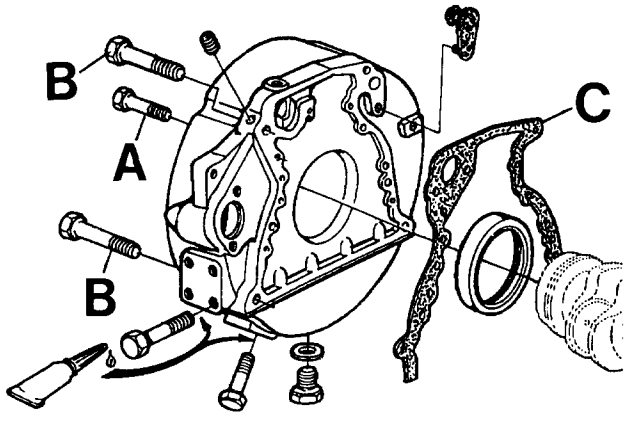
• Other applications:

Cap screws dry . . . . . 230 N·m (170 lb-ft)

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



-UN-23MAY95 CD7141



-UN-16JUN98 CD30585

CD,3274,G15,12 -19-04JAN99

OIL SEAL/WEAR SLEEVE INSTALLATION

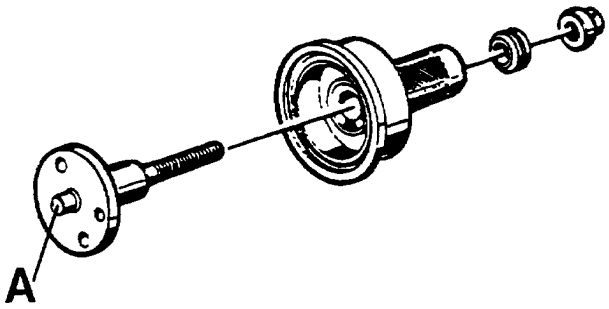
NOTE: Due to a diameter change of the crankshaft bore, it may be necessary to suppress the pilot pin (A) from KCD10002 tool. With this modification KCD10002 becomes KCD10002A.

1. Apply a light coating of sealant compound (Loctite 609 or equivalent) on crankshaft end.

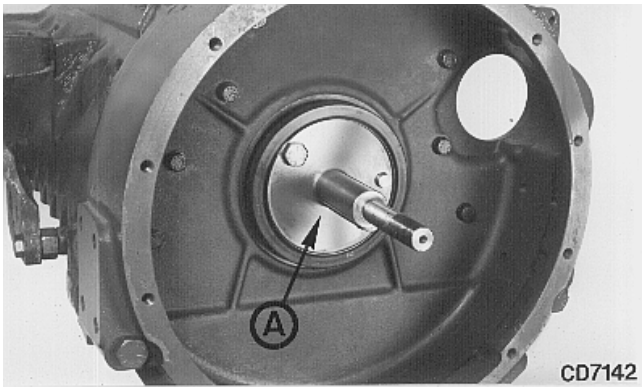
2. Position the guide plate (A) from KCD10002A tool set over dowel with two cap screws. Finger tighten both cap screws until they contact the pilot.

3. Using the oil seal/wear sleeve assembly with open side toward engine, center the guide plate and tighten the two cap screws.

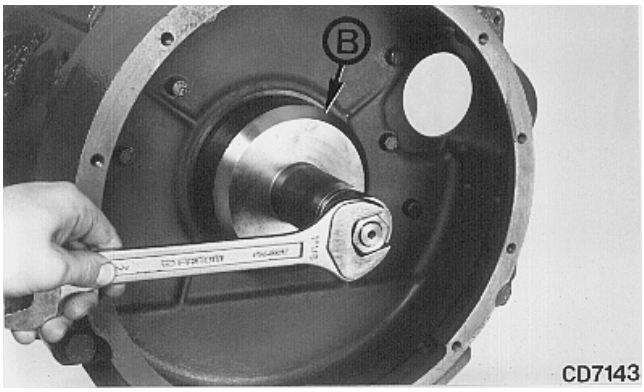
4. Slide driver (B) onto guide and gradually tighten nut until driver bottoms.



CD30586 -UN-16JUN98



CD7142 -UN-18JAN95



CD7143 -UN-18JAN95

CD,3274,G15,14 -19-04JAN99

CRANKSHAFT END PLAY MEASURE

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

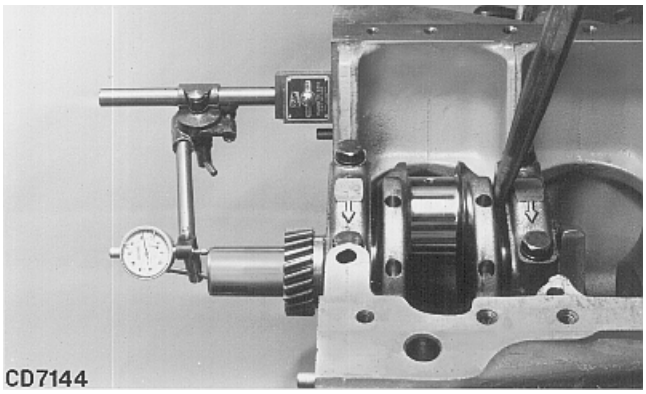
Check crankshaft end play using a dial indicator and compare with specifications.

IMPORTANT: Do not apply too much pressure with bar as this could damage bearing inserts.

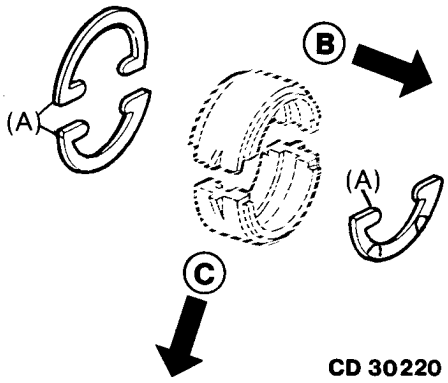
If end play is still not within specification with new standard 2-piece or 5/6-piece thrust bearings*, install a 5-piece thrust bearing with oversized thrust washers.

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

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



-UN-07MAR95
CD7144



-UN-07MAR95
CD30220

**Standard thrust washer sets for service contain now 4 thrust washers instead of 3 currently installed by the factory and previously included in service sets.*

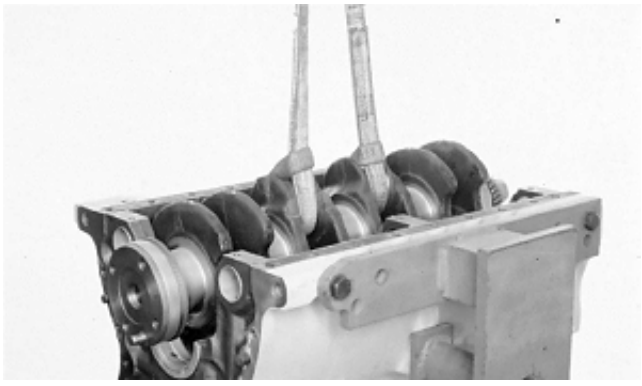
CD,3274,G15,15 -19-01FEB94

CRANKSHAFT REMOVAL

1. Identify main bearing caps to assure correct placement during reassembly.

2. Attach nylon slings (or other suitable lifting slings) to journals of crankshaft or to cap screws installed on both ends of crankshaft.

3. Carefully lift crankshaft out of cylinder block.



-UN-01NOV88
T81184

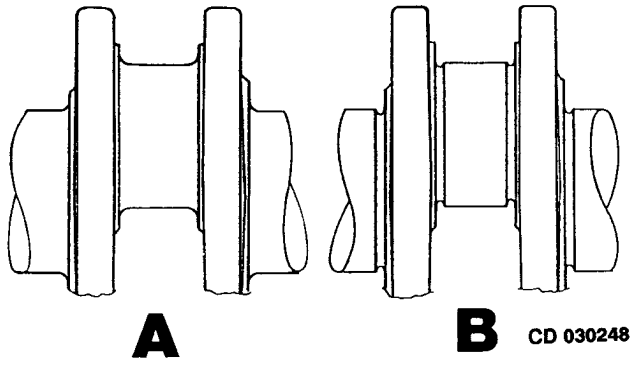
CD,3274,G15,18 -19-01FEB94

CRANKSHAFT IDENTIFICATION

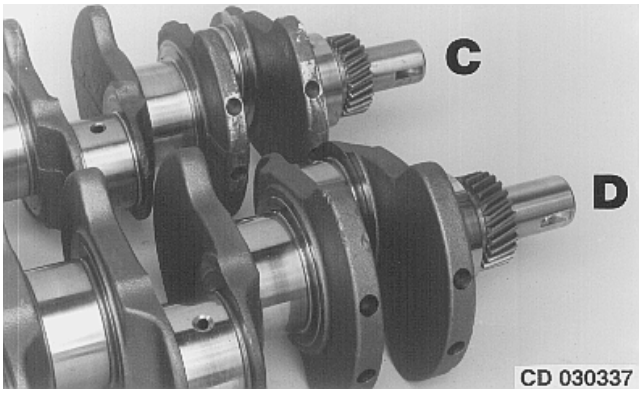
Crankshafts can be made of steel (C) or cast iron (D).

Cast iron crankshafts have rolled grooves (B) while steel crankshafts may have machined fillet radii (A) or rolled grooves.

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



-UN-08MAR95
CD30248



-UN-17FEB95
CD30337

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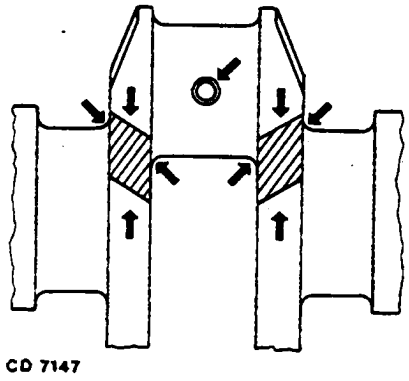
CD,3274,G15,36 -19-01FEB94

CRANKSHAFT INSPECTION

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

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

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



-UN-23FEB89
CD7147

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

JOURNAL OD CHECK

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

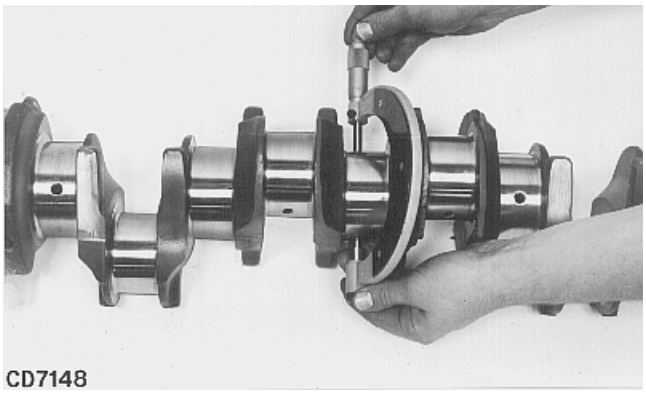
CRANKSHAFT JOURNAL OD SPECIFICATIONS

Main journal OD (Std.) . . . . . 79.324—79.350 mm (3.123—3.124 in.)

Rod journal OD (Std.)
- 3029, 4039, 6059 engines . . . . . 69.799—69.825 mm (2.748—2.749 in.)
- 4045, 6068 engines . . . . . 77.798—77.824 mm (3.063—3.064 in.)

Maximum wear
- Taper . . . . . 0.03 mm (0.0012 in.)
- Out-of-roundness . . . . . 0.075 mm (0.003 in.)

If journal OD is not within specifications regrind or replace crankshaft.



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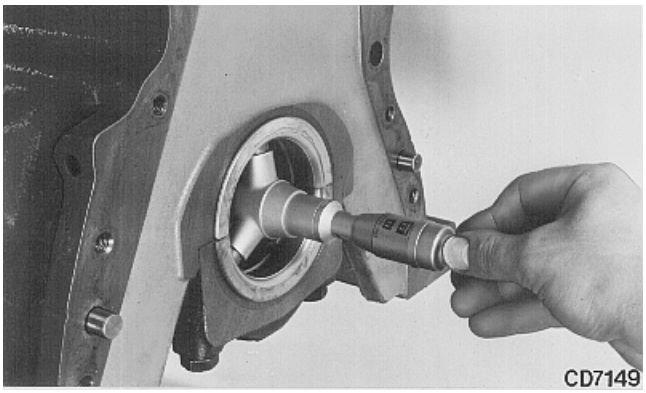
CD,3274,G15,20 -19-01MAR92

MAIN BEARING CLEARANCE



-UN-07MAR95
CD7149

1. Install main bearing inserts and caps then tighten cap screws to 120 N·m (85 lb-ft) for engines prior to serial number 135641CD and to 135 N·m (100 lb-ft) for other engines.

2. Measure I.D. of main bearing (assembled) and compare with specification.

MAIN BEARINGS (ASSEMBLED) ID SPECIFICATIONS

Main bearings assembled	
ID (Standard)	79.396—79.440 mm (3.126—3.127 in.)
Clearance	0.046—0.116 mm (0.0018—0.0046 in.)
Maximum wear	0.15 mm (0.006 in.)

3. If main bearings (assembled) ID or clearance are not within specifications, regrind or replace crankshaft.

NOTE: This clearance can also be determined using "PLASTIGAGE".
If engine had a previous major overhaul and undersized bearing inserts were used, I.D. and O.D. dimensions listed above may not be the same as those recorded. However, the bearing clearance should be within specifications.

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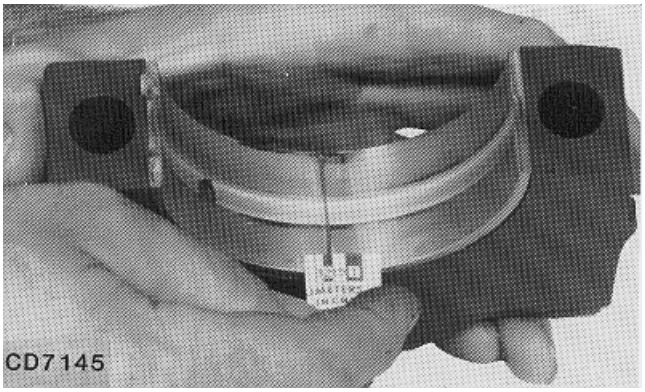
CD,3274,G15,23 -19-01FEB94

DETERMINE CRANKSHAFT MAIN BEARING CLEARANCE USING "PLASTIGAGE"



-UN-23MAY95
CD7145

1. Place a strip of "PLASTIGAGE" in the center of the bearing.

2. Install cap and tighten cap screws to 120 N·m (85 lb-ft) for engines prior to serial number 135641CD and to 135 N·m (100 lb-ft) for other engines.

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 in.).

CD,3274,G15,17 -19-01FEB94

CRANKSHAFT REGRINDING

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

Undersize bearing inserts available: 0.25, 0.50, 0.76 mm (0.01, 0.02, 0.03 in.).

NOTE: To avoid damaging steel crankshafts with rolled grooves, only regrind them once to 0.25 mm (0.01 in.) under standard size specified.

Regrind cast iron crankshafts only once as well to 0.25 mm (0.10 in.) under standard size. These crankshafts must be lapped afterwards according to the micro-finishing specifications given in this group.

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

CD,3274,G15,21 -19-01MAR92

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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. All journal fillets radii must be free of any sharp grind marks or scratches. The fillet must blend smoothly into the journal and crank cheek. The radius may be checked with a fillet gauge.

4. 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.

5. Polish or lap (clockwise) the ground surfaces to the specified finish except for cast iron crankshafts (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.

6. If the thrust surfaces of the crankshaft are worn or grooved excessively, they must be reground and polished. Care must be taken to maintain the specified radius between each thrust surface and the bearing journal. An oversize thrust washer set is available.

7. Stone the edge of all oil holes in the journal surfaces smooth to provide a radius of approximately 1.50 mm (0.060 in.).

8. 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.

9. De-magnetize the crankshaft.

10. Thoroughly clean the crankshaft and oil passages with solvent. Dry with compressed air.

CD,3274,G15,33 -19-01MAR92

MICRO-FINISHING SPECIFICATIONS

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

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
- 0.22 micron (8.8 micro-in.) depth . . . . . Tp more than 20 %
- 0.38 micron (15.2 micro-in.) depth . . . . . Tp more than 80 %
- 0.64 micron (25.6 micro-in.) depth . . . . . 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 -19-01MAR92

CRANKSHAFT GEAR REPLACEMENT

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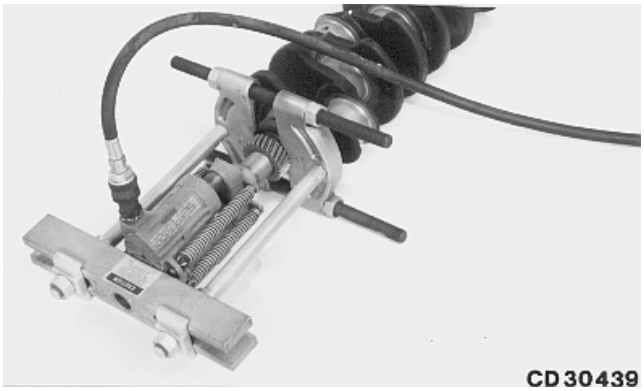
24

1. Pull gear using a suitable commercial puller
2. Remove Woodruff key from crankshaft and remove any burrs from gear journal.
3. Install a new Woodruff key in crankshaft keyway.
4. Heat new gear to 180˚C (360˚F).

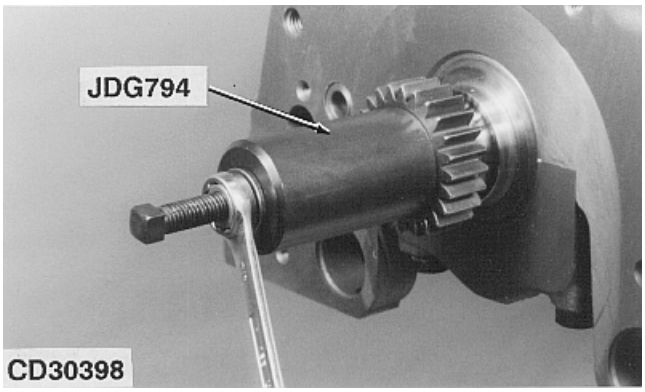
CAUTION: Oil fumes or oil can ignite above 190˚C (380˚F). Use a thermometer to ensure that a temperature of 180˚C (360˚F) is not exceeded. Do not allow a flame or heating element to come into direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid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

5. Drive gear onto crankshaft using JDG794A driver (formerly JDH7 or JDG794).

NOTE: JDG794A driver must be used to install the gear while crankshaft is in place in engine block.



-UN-13JUN95
CD30439



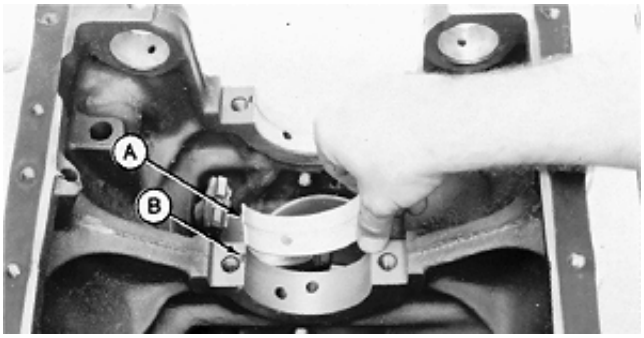
-UN-10MAY95
CD30398

CD,3274,G15,22 -19-04JAN99

MAIN BEARING INSERTS INSTALLATION

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

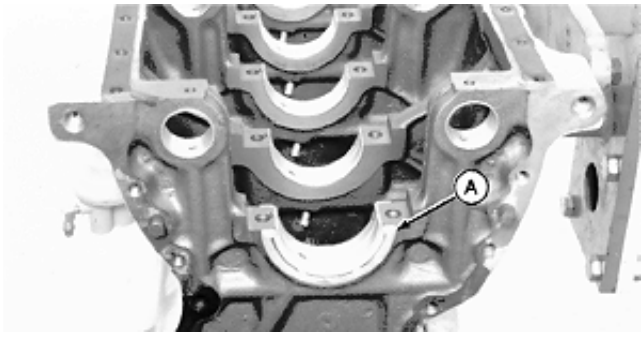


T88555 -UN-14OCT88

CD,3274,G15,26 -19-01FEB94

2-PIECE THRUST BEARING INSTALLATION

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



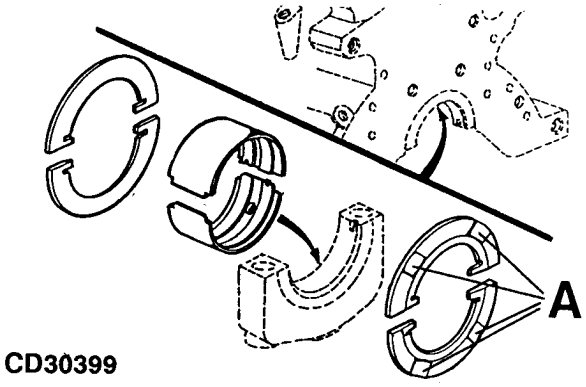
T88556 -UN-14OCT88

CD,3274,G15,38 -19-01FEB94

5/6-PIECE THRUST BEARING INSTALLATION*

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

NOTE: If previous 5-piece thrust bearing set is to be used, reassemble engine with two thrust washers on the cap and the third one on the rear face of the block even if the engine was originally built with two thrust washers in the block and one on cap.*



CD30399 -UN-10MAY95

A—Oil grooves

**Standard thrust washer sets for service contain now 4 thrust washers instead of 3 currently installed by the factory and previously included in service sets.*

CD,3274,G15,39 -19-01FEB94

CRANKSHAFT INSTALLATION

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.

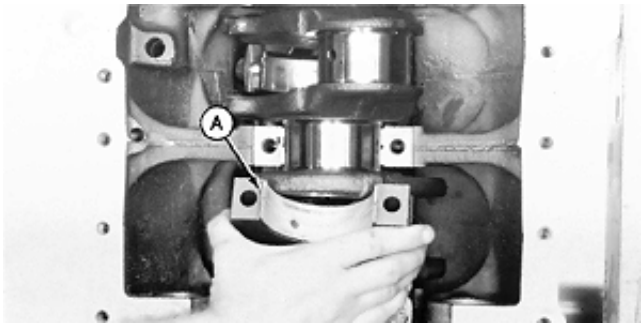
4. Apply a first torque not exceeding 20 N·m (14 lb-ft).

5. Using a soft-face hammer, move crankshaft first towards the rear and then towards the front to align the rear thrust washers.

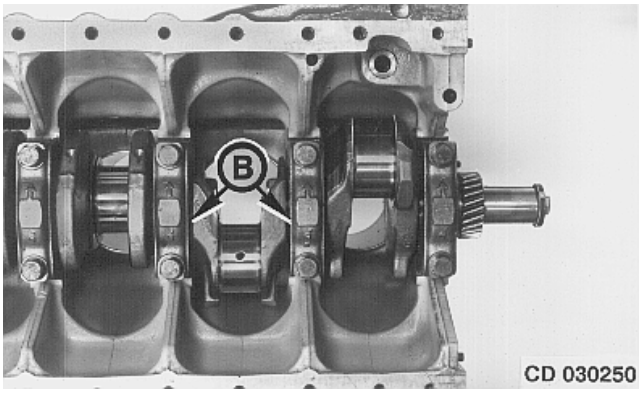
IMPORTANT: Before tightening rear cap screws, ensure that rear thrust washer of cap is aligned with rear thrust washer of block.

6. Tighten all cap screws to 120 N·m (85 lb-ft) on engines prior to serial number 135641CD and to 135 N·m (100 lb-ft) on other engines.

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



T88557 -UN-14OCT88



CD030250 -UN-06MAR95

CD,3274,G15,34 -19-01FEB94

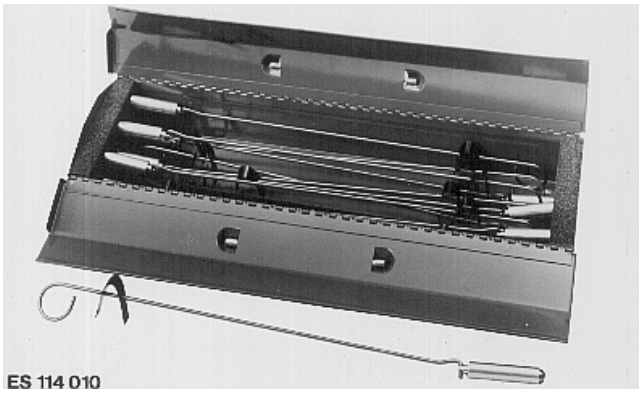
SPECIAL OR ESSENTIAL TOOLS

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

DX,TOOLS -19-20JUL95

Magnetic follower holder kit D15001NU

Hold cam followers when removing and installing camshaft.



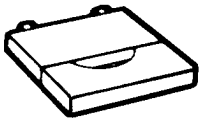
ES114010 -UN-07MAR95

CD,D15001NU -19-12NOV92

CD30253 -UN-08MAR95

Balancer shaft holding tool JD-247

Used to hold balancer shaft when installing drive gear.



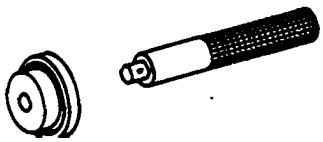
CD 030253

CD,JD247 -19-04AUG92

RG5111 -UN-23AUG88

Front crankshaft oil seal driver JD-250
Handle JDG537

Install front crankshaft oil seal in aluminium timing gear cover.

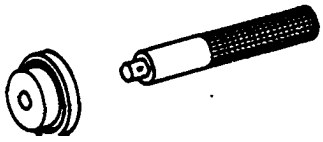


CD,JD250 -19-04AUG92

RG5111 -UN-23AUG88

Idler gear bushing driver JD-252
Handle JDG537

Install idler gear bushings.

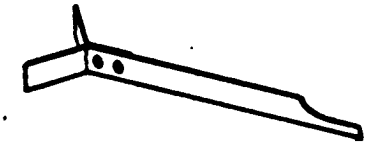


CD,JD252 -19-04AUG92

RG5118 -UN-23AUG88

Gear timing tool JD-254A
(Formerly JD-254)

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

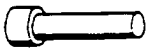


CD,JD254 -19-04JAN99

RG5068 -UN-23AUG88

Timing Pin JDE81-4

Lock engine at TDC when timing valve train. Use with JDE81-1 or JDE83 Flywheel Turning Tool.



RG,JDE814L -19-02APR90

RG4950 -UN-23AUG88

Flywheel Turning Tool JDE83
or JDG820 (formerly JDE81-1)

Rotate engine flywheel. Use with JDE81-4 Timing Pin.

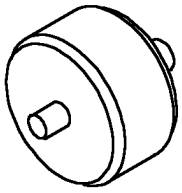
NOTE: Use JDE83 on engines with a 142 tooth flywheel ring gear and a flywheel housing tool guide bore of 26.5 mm (1.04 in.) diameter.

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.

CD,JDE83 -19-01FEB94

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.

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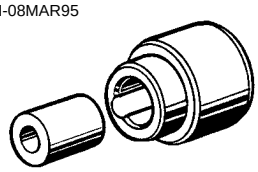
CD,JDG791A -19-04JAN99

CD30252 -UN-08MAR95

Front crankshaft oil seal driver KJD10164

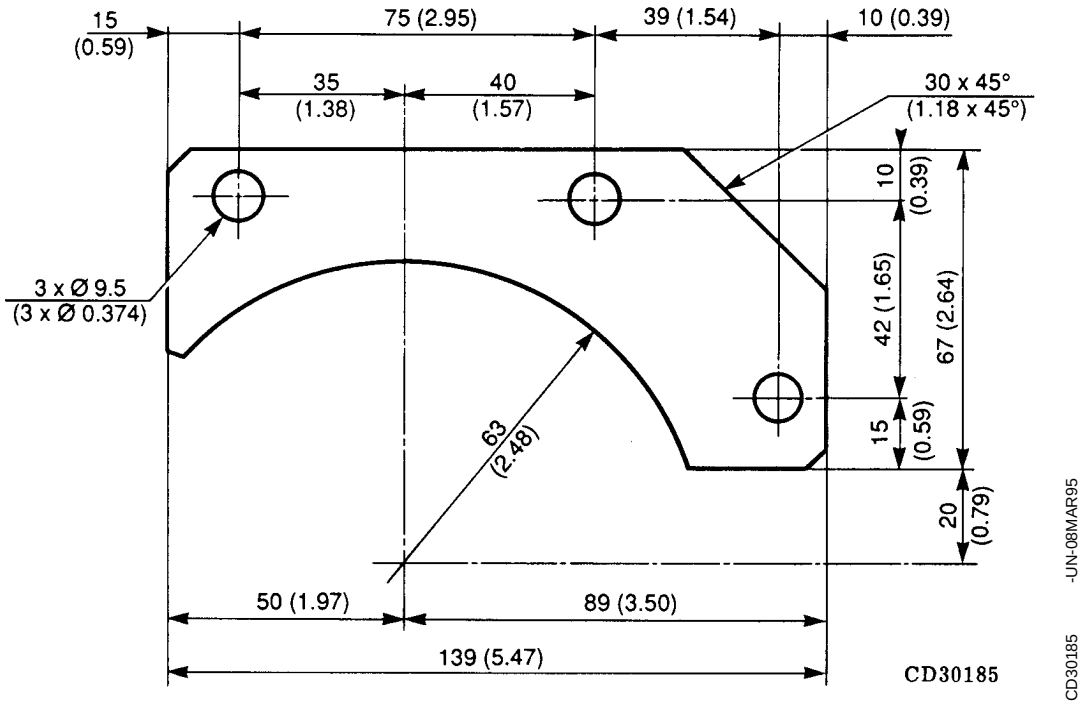


CD 030252

Install front crankshaft oil seal on composite material timing gear cover.

CD,KJD10164 -19-10MAR92

SELF-MANUFACTURED TOOL
TEMPLATE FOR FRONT PLATE REPLACEMENT



CD,3274,G40,1 -19-27APR92

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3

SPECIFICATIONS

	DIMENSIONS OF NEW PARTS	WEAR LIMIT
Camshaft journal OD	55.872—55.898 mm (2.1997—2.2007 in.)	55.85 mm (2.199 in.)
Camshaft bore to journal clearance	0.10—0.15 mm (0.004—0.006 in.)	0.18 mm (0.007 in.)
Camshaft end play	0.08—0.23 mm (0.003—0.009 in.)	0.38 mm (0.015 in.)
Camshaft thrust plate thickness	3.935—3.985 mm (0.155—0.157 in.)	3.8 mm (0.15 in.)
Cam follower OD	31.62—31.64 mm (1.245—1.246 in.)	
Cam follower to bore clearance	0.06—0.13 mm (0.002—0.005 in.)	
Camshaft lobe height:		
• Intake lobe	6.93—7.42 mm (0.273—0.292 in.)	6.68 mm (0.263 in.)
• Exhaust lobe	6.76—7.26 mm (0.266—0.286 in.)	6.50 mm (0.256 in.)
Balancer shaft journal OD	38.135—38.161 mm (1.5014—1.5024 in.)	
Balancer shaft bushing ID (installed)	38.185—38.235 mm (1.5033—1.5053 in.)	
Bushing to journal clearance	0.024—0.100 mm (0.001—0.004 in.)	0.15 mm (0.006 in.)
Balancer shaft thrust plate thickness	2.975—3.025 mm (0.117—0.119 in.)	
Balancer shaft end play	0.05—0.26 mm (0.002—0.010 in.)	0.38 mm (0.015 in.)
Helical timing gear backlash between:		
• Upper idler/crankshaft gear	0.07—0.30 mm (0.003—0.012 in.)	0.40 mm (0.016 in.)
• Upper idler/camshaft gear	0.07—0.35 mm (0.003—0.014 in.)	0.51 mm (0.020 in.)
• Upper idler/injection pump gear	0.07—0.35 mm (0.003—0.014 in.)	0.51 mm (0.020 in.)
• Lower idler/crankshaft gear	0.07—0.35 mm (0.003—0.014 in.)	0.51 mm (0.020 in.)
• Lower idler/oil pump gear	0.04—0.38 mm (0.0016—0.015 in.)	0.40 mm (0.016 in.)
• Lower idler/balancer shaft gear	0.05—0.40 mm (0.002—0.016 in.)	0.51 mm (0.020 in.)
• Oil pump/balancer shaft gear	0.05—0.36 mm (0.002—0.014 in.)	0.51 mm (0.020 in.)

(Continued on next page)

SPECIFICATIONS - CONTINUED

Spur timing gear backlash: 5300/5300N Tractors with engines (-242551CD) All other 3 cyl. engines (-270818CD) 4 cyl. engines (-286631CD)	DIMENSIONS OF NEW PARTS	WEAR LIMIT
• Upper idler/crankshaft gear	0.04—0.35 mm (0.0016—0.014 in.)	0.60 mm (0.024 in.)
• Upper idler/camshaft gear	0.08—0.45 mm (0.003—0.018 in.)	0.85 mm (0.033 in.)
• Upper idler/injection pump gear	0.08—0.45 mm (0.003—0.018 in.)	0.85 mm (0.033 in.)
• Lower idler/crankshaft gear	0.04—0.35 mm (0.0016—0.014 in.)	0.65 mm (0.025 in.)
• Lower idler/oil pump gear	0.08—0.40 mm (0.003—0.016 in.)	0.75 mm (0.030 in.)
• Camshaft gear/aux. drive gear	0.09—1.24 mm (0.0035—0.049 in.)	1.34 mm (0.053 in.)

Spur timing gear backlash: 5300/5300N Tractors with engines (242552CD-) All other 3 cyl. engines (270819CD-) 4 cyl. engines (286632CD-)	DIMENSIONS OF NEW PARTS	WEAR LIMIT
• Upper idler/crankshaft gear	0.01—0.49 mm (0.0004—0.019 in.)	
• Upper idler/camshaft gear	0.01—0.52 mm (0.0004—0.020 in.)	
• Upper idler/injection pump gear	0.01—0.52 mm (0.0004—0.020 in.)	
• Lower idler/crankshaft gear	0.01—0.46 mm (0.0004—0.018 in.)	
• Lower idler/oil pump gear	0.01—0.49 mm (0.0004—0.019 in.)	
• Camshaft gear/aux. drive gear	0.01—0.54 mm (0.0004—0.021 in.)	1.34 mm (0.053 in.)
• Balancer shaft/oil pump gear	0.01—0.47 mm (0.0004—0.018 in.)	
• Balancer shaft/lower idler gear	0.01—0.54 mm (0.0004—0.021 in.)	

CD,3274,G20,46 -19-04JAN99

SPECIFICATIONS - CONTINUED

	DIMENSIONS OF NEW PARTS	WEAR LIMIT
Idler gear shaft OD		
• Upper with helical gear and lower with helical or spur gear	44.437—44.463 mm (1.7495—1.7505 in.)	44.41 mm (1.748 in.)
• Upper with spur gear	69.759—69.775 mm (2.7464—2.747 in.)	
Idler gear bushing ID		
• Upper with helical gear and lower with helical or spur gear	44.501—44.527 mm (1.752—1.753 in.)	44.55 mm (1.754 in.)
• Upper with spur gear	69.827—69.857 mm (2.7491—2.7503 in.)	
Idler gear/bushing clearance		
• Upper with helical gear and lower with helical or spur gear	0.038—0.09 mm (0.0015—0.0035 in.)	0.15 mm (0.006 in.)
• Upper with spur gear	0.052—0.098 mm (0.002—0.0038) in.)	
Hub width of idler gear	21.975—22.025 mm (0.865—0.867 in.)	21.93 mm (0.863 in.)
Width of idler shaft	22.17—22.27 mm (0.873—0.877 in.)	
End play of idler gear	0.14—0.29 mm (0.006—0.012 in.)	0.40 mm (0.016 in.)
Spring pins protrude from shaft:		
• On lower idler gear by	6.5—7 mm (0.256—0.275 in.)	
• On upper idler gear by		
—Helical gear	4—4.5 mm (0.157—0.177 in.)	
—Spur gear	7.5—8.5 mm (0.295—0.335 in.)	

CD,3274,G20,02 -19-04JAN99

AUXILIARY GEAR DRIVE SPECIFICATIONS (37 KW)

	DIMENSIONS OF NEW PARTS	WEAR LIMIT
Drive ratio (output gear / crankshaft gear)	0.97 : 1	
Crankshaft O.D. for collet	37.988—38.014 mm (1.4956—1.4966 in.)	
Collet I.D.	38.013—38.063 mm (1.496—1.498 in.)	
Drive gear (crankshaft, 34-tooth):		
• I.D. at front face	46.192 mm (1.818 in.)	
I.D. of idler gear (49-tooth)	39.936—39.962 mm (1.572—1.573 in.)	
O.D. of idler shaft for gear	39.987—40.013 mm (1.574—1.575 in.)	
O.D. of idler shaft for bearings	34.970—34.986 mm (1.376—1.377 in.)	
O.D. of output gear (35-tooth) for bearings	34.970—34.986 mm (1.376—1.377 in.)	
Machined bore in gear covers:		
• For idler shaft bearing	79.92—79.96 mm (3.146—3.148 in.)	
• For output shaft bearing	71.93—71.97 mm (2.832—2.833 in.)	
Idler shaft bearing:		
• O.D.	79.987—80.000 mm (3.149—3.150 in.)	
• I.D.	34.987—35.000 mm (1.377—1.378 in.)	
Output shaft bearing:		
• O.D.	71.987—72.000 mm (2.834—2.835 in.)	
• I.D.	34.987—35.000 mm (1.377—1.378 in.)	
Dowel pin protrusion above front face of timing gear cover	11.0—12.0 mm (0.430—0.470 in.)	
Set screws in unused threaded holes	0—1.0 mm (0—0.004 in.) recess from flange surface	

CD,3274,G20,3 -19-01FEB94

TORQUES FOR HARDWARE

Front plate to cylinder block, special screws	35 N·m (25 lb-ft)
Drive gear on oil pump shaft, hex. nut (staked)	75 N·m (55 lb-ft)
Upper idler gear, cap screw	110 N·m (81 lb-ft)
Lower idler gear, nut	110 N·m (81 lb-ft)
Timing gear cover to cylinder block and front plate, cap screws	45 N·m (33 lb-ft)
Fuel injection pump gear:	
• Stanadyne (model DB2)	
—with 8 mm (0.315 in.) thick nut (chrome finish)	60 N·m (45 lb-ft)
—with 10 mm (0.394 in.) thick nut (black finish)	125 N·m (92 lb-ft)
• Stanadyne (model DB4)	200 N·m (147 lb-ft)
• Stanadyne (model DM4)	200 N·m (147 lb-ft)
• Lucas-CAV	80 N·m (60 lb-ft)
• MICO in-line pump	85 N·m (63 lb-ft)
Camshaft thrust plate, cap screws	50 N·m (35 lb-ft)
Balancer shaft thrust plate, cap screw	50 N·m (35 lb-ft)
Oil filler neck, cap screws:	
• Aluminium neck	50 N·m (35 lb-ft)
• Composite material neck	30 N·m (22 lb-ft)
Auxiliary gear cover to cylinder block and front plate, cap screws	50 N·m (35 lb-ft)
Pulley or damper/pulley to crankshaft (engines with crankshaft-gear-driven aux. drive):	
• 45 mm (1.77 in.) bolt length (dry)	180 N·m (135 lb-ft)
• 112 mm (4.41 in.) bolt length (lubricated)	150 N·m (110 lb-ft) plus 60° angle

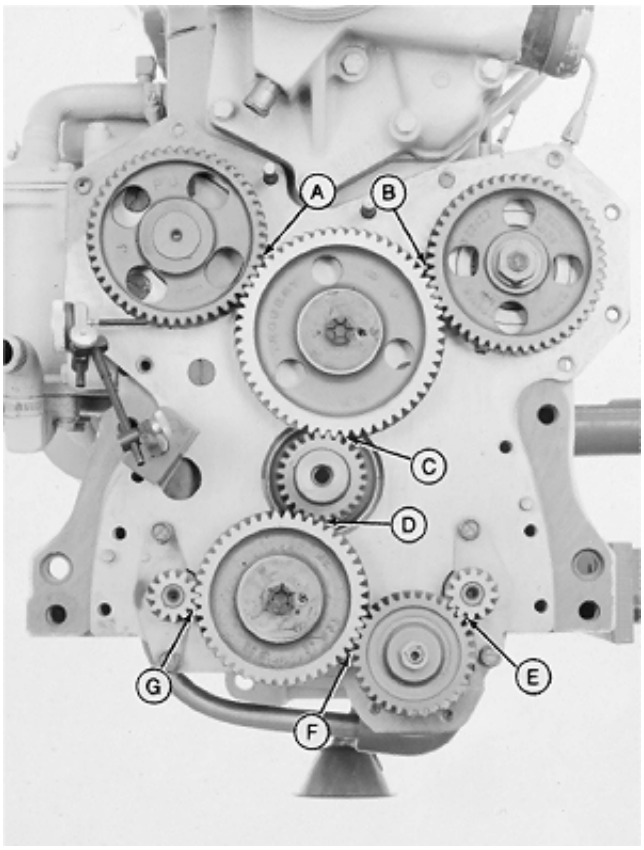
CD,3274,G20,4 -19-04JAN99

TIMING GEAR BACKLASH MEASURE

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

If backlash is not correct, install new gears.

A—Camshaft/upper idler gear
B—Injection pump/upper idler gear
C—Upper idler/crankshaft gear
D—Crankshaft/lower idler gear
E—Balancer shaft/oil pump gear
F—Oil pump/lower idler gear
G—Lower idler/balancer shaft gear



T94704 -UN-28OCT88

CD,3274,G20,5 -19-10MAR92

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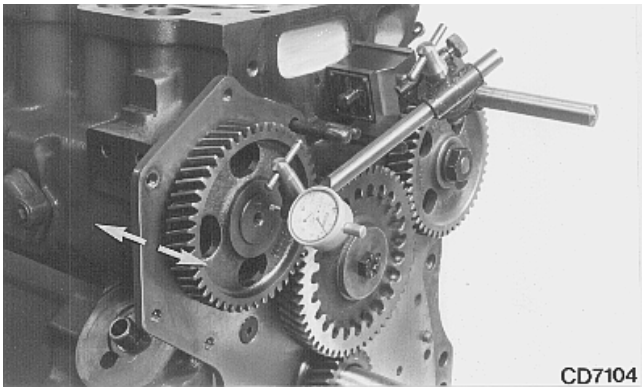
9

CAMSHAFT END PLAY MEASURE

Using a dial indicator, check camshaft end play.

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.)



CD7104 -UN-07MAR95

NOTE: If end play exceeds specifications then check thickness of thrust plate as this determines end play.

CD,3274,G20,6 -19-01FEB94

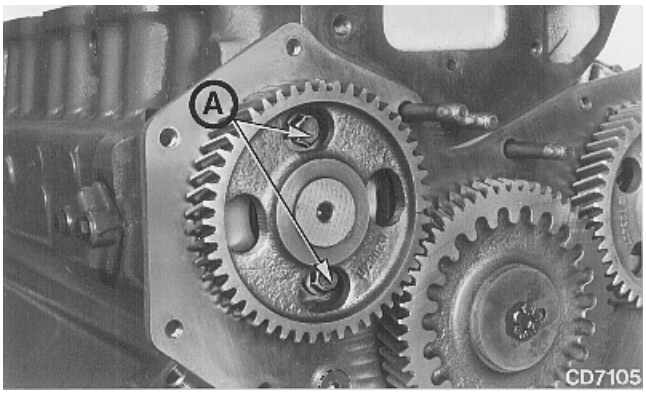
REMOVING CAMSHAFT

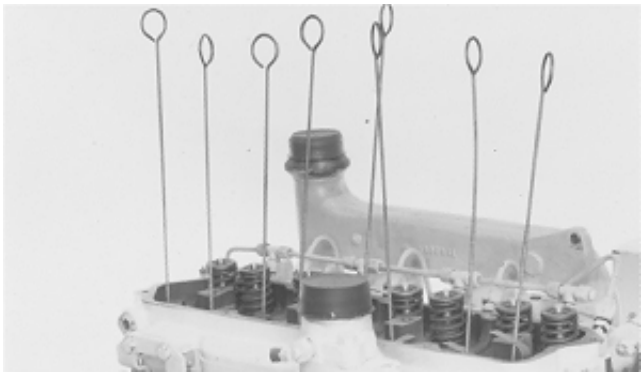
NOTE: Mark parts so that they can be reinstalled in their original positions.

Remove cylinder head, cam followers and fuel pump. 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.





CD,3274,G20,7 -19-10MAR92

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10

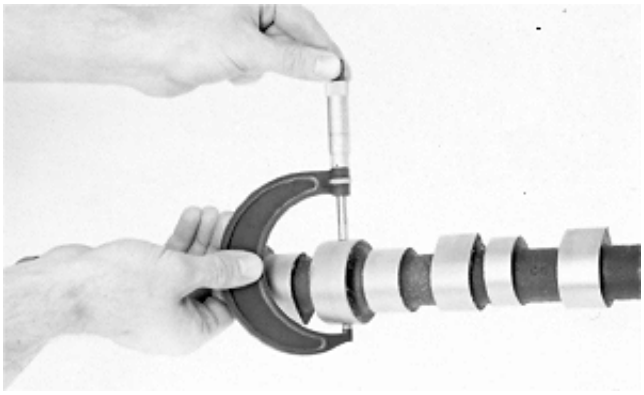
CAMSHAFT JOURNAL MEASURE

CAMSHAFT JOURNAL SPECIFICATIONS

Camshaft journal OD	55.872—55.898 mm (2.1997—2.2007 in.)
Maximum wear	55.85 mm (2.199 in.)
Max. clearance between bore and camshaft journal	0.18 mm (0.007 in.)

If diameter or clearance are more than specified, replace camshaft.

IMPORTANT: To keep the initial working condition between cam lobes and cam followers, always replace cam followers when installing a new camshaft.



CD,3274,G20,8 -19-01FEB94

MEASURE HEIGHT OF CAM LOBE

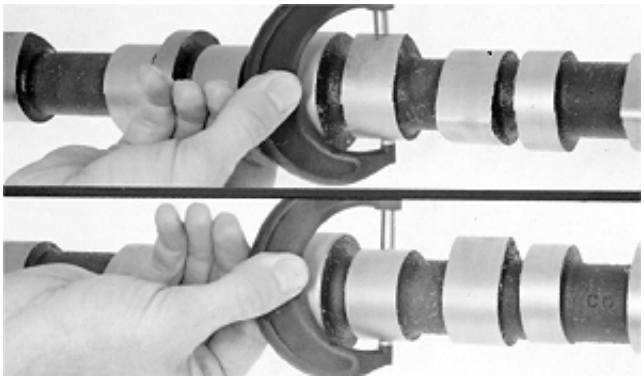
Measure longest and shortest diameter of each cam. Subtract shorter diameter from longer diameter to find the height of the cam lobe. If any lobe is not of the correct height, install a new camshaft.

CAMSHAFT LOBE HEIGHT SPECIFICATIONS

Intake lobe . . . . . 6.93—7.42 mm (0.273—0.292 in.)
Maximum wear . . . . . 6.68 mm (0.263 in.)

Exhaust lobe . . . . . 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 -19-10MAR92

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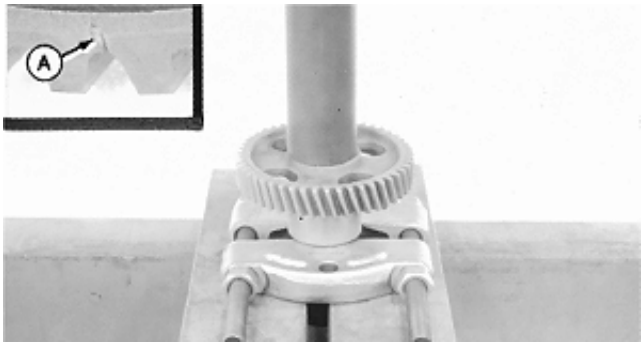
11

CAMSHAFT GEAR REPLACEMENT

1. Remove gear from camshaft using a press.

2. Install gear with timing mark (A) away from camshaft.

3. Press gear on shaft until flush with shoulder on camshaft.

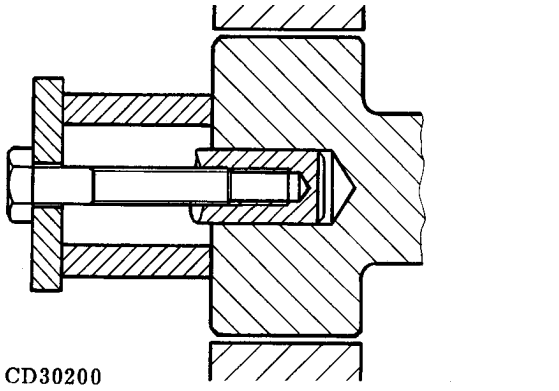


CD,3274,G20,10 -19-10MAR92

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.

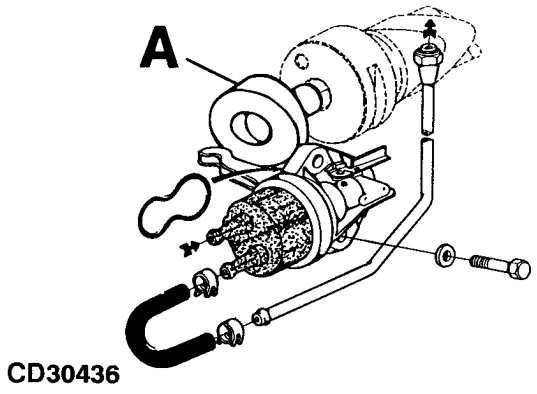
2. Using a self-made puller (spacer, washer, screw), pull out the tachometer pick-up pin.



CD,3274,G20,11 -19-10MAR92

FUEL SUPPLY PUMP REAR CAM INSTALLATION

Some engine models have the fuel supply pump actuated by a cam (A) fitted at the rear of camshaft. When ordering a new camshaft, also order the fuel supply pump rear cam. Install the cam using a press.



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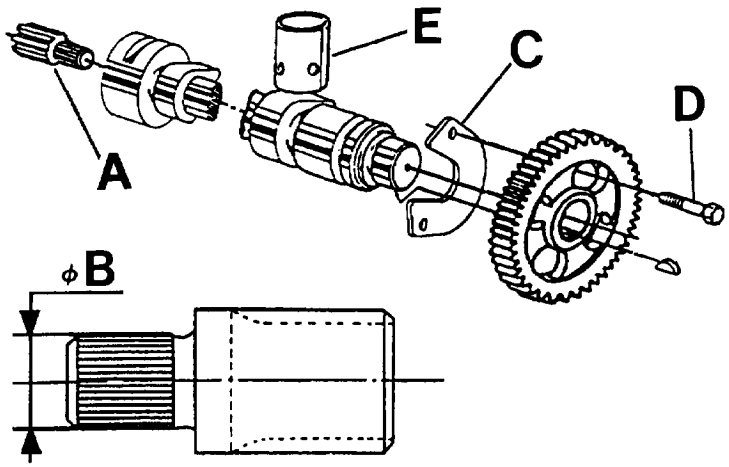
CD30436

CD,3274,G20,45 -19-01FEB94

INSTALL CAMSHAFT



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CD30596

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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* grease.

3. Install camshaft and thrust plate (C) in cylinder block.

4. Install cap screws (D) and tighten to 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.

**Available as service part.*

CD,CTM125,116 -19-01DEC97

CAM FOLLOWER CHECKING

Measure cam follower OD and compare with specifications.

CAM FOLLOWER SPECIFICATIONS

Cam follower OD	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,3274,G20,13 -19-10MAR92

BALANCER SHAFT IDENTIFICATION (4-CYLINDER ENGINES)

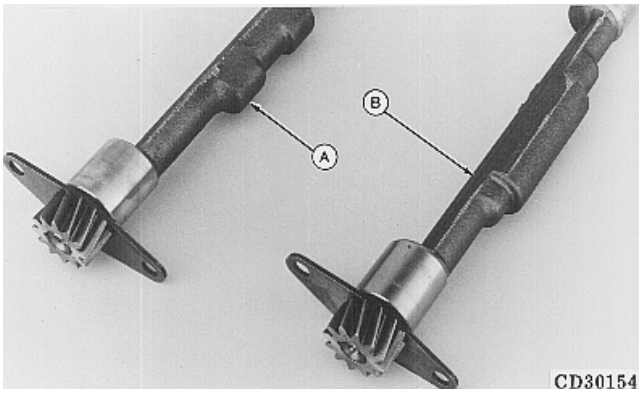
Three types of balancer shafts are used:

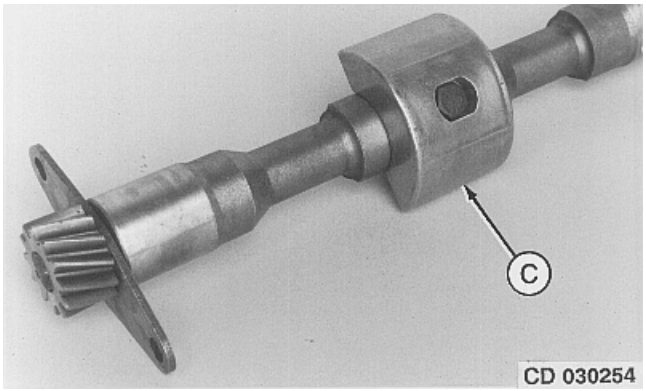
A- Integral shaft in light version for 4039D engines

B- Integral shaft in heavy-duty version for 4039T engines

C- Shaft with bolt-on weights for 4045D and 4045T engines

IMPORTANT: Make sure that the balancer shafts used on any engine are of the same design. Refer to appropriate machine or engine parts catalog for correct parts acquisition.





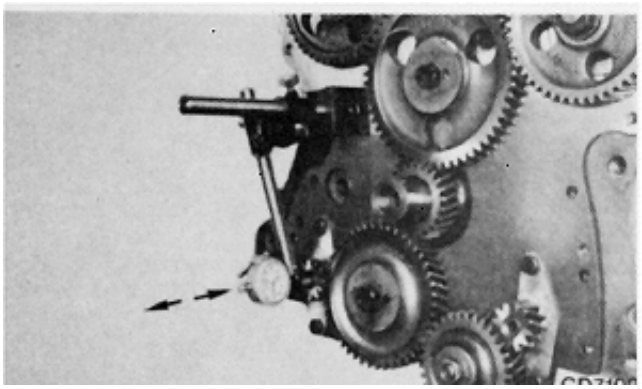
CD,3274,G20,14 -19-10MAR92

BALANCER SHAFT END PLAY MEASURE

Using a dial indicator, check balancer shaft end play.

Balancer shaft end play	0.05—0.26 mm (0.002—0.010 in.)
Maximum wear	0.38 mm (0.015 in.)
Thrust plate thickness	2.975—3.025 mm (0.117—0.119 in.)

NOTE: If end play exceeds specifications, check also thickness of thrust plate.



CD,3274,G20,15 -19-10MAR92

BALANCER SHAFT REMOVAL

IMPORTANT: During removal, identify left and right balancer shafts to ensure correct reassembly.
Journals are lapped for one direction of rotation. Interchanging shaft locations could therefore cause premature wear on shafts and bushings.

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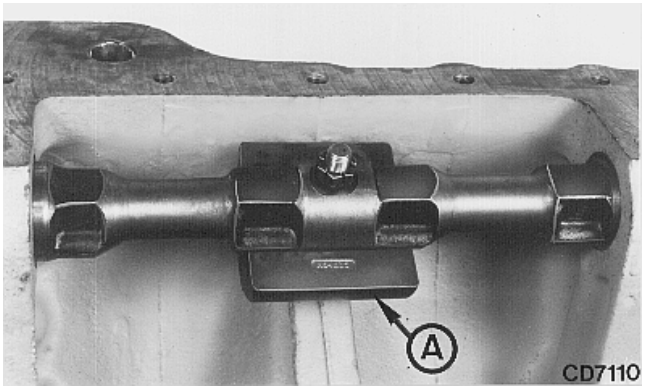
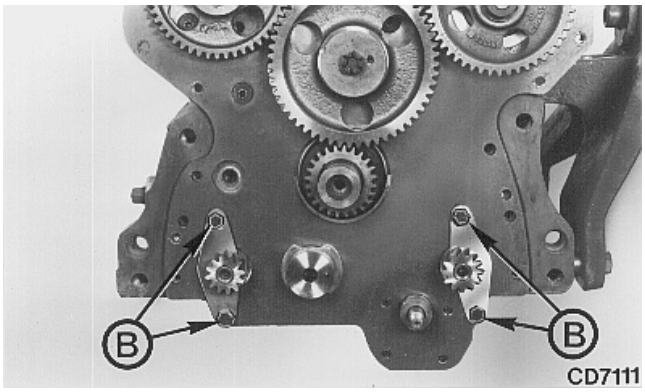
1. Remove lower idler gear and oil pump gear.

2. Remove balancer shaft weights (A), if equipped.

3. Loosen cap screws (B) and pull balancer shafts out of cylinder block.

NOTE: Take care when removing balancer shafts that neither shaft journals nor bushings in cylinder block are damaged.





CD,3274,G20,16 -19-10MAR92

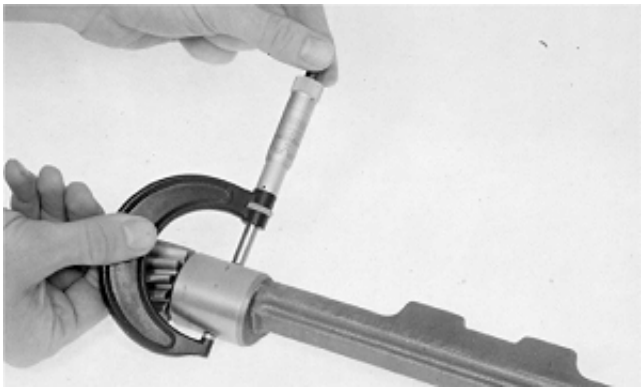
BALANCER SHAFT JOURNAL MEASURE

BALANCER SHAFT JOURNAL SPECIFICATIONS

Balancer shaft journal OD . . . . . 38.135—38.161 mm (1.5014—1.5024 in.)

Balancer shaft journal to bushing
- Clearance . . . . . 0.024—0.100 mm (0.001—0.004 in.)
- Maximum wear . . . . . 0.15 mm (0.006 in.)

If diameter or clearance are not within specifications, replace balancer shaft.



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CD,3274,G20,17 -19-10MAR92

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BALANCER SHAFT GEAR REPLACEMENT

NOTE: Service balancer shafts can be delivered without gear. To identify proper shafts a letter is stamped at the rear as follows:
*•**"R"** for right-hand side shaft*
*•**"L"** for left-hand side shaft*
Be sure when installing the gear that the timing mark (E) corresponds to the proper shaft.

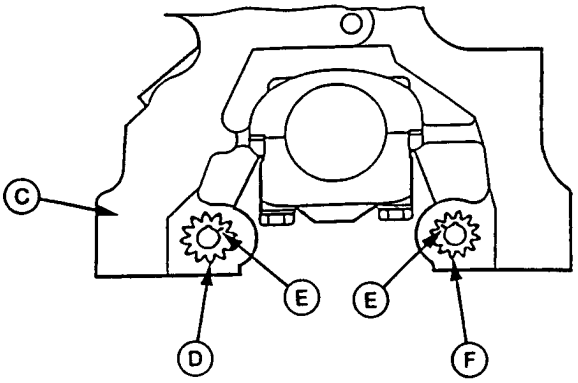
1. Remove gear from balancer shaft using a press.

2. Inspect the gear, woodruff key and thrust plate for cracks or wear. Replace if necessary.

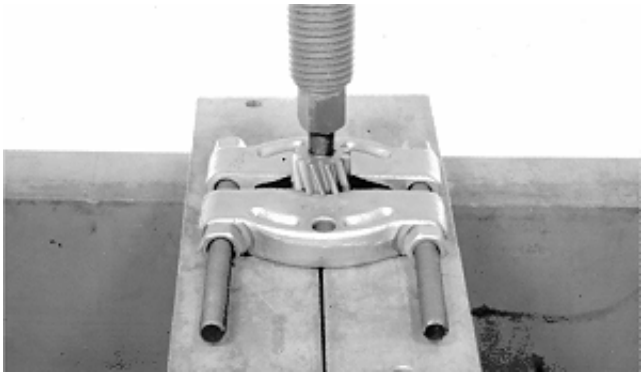
3. Position balancer shaft in JD-247 Holding Tool (A) then install thrust plate and appropriate gear on the shaft. Be sure timing mark on the gear faces away from the balancer shaft.

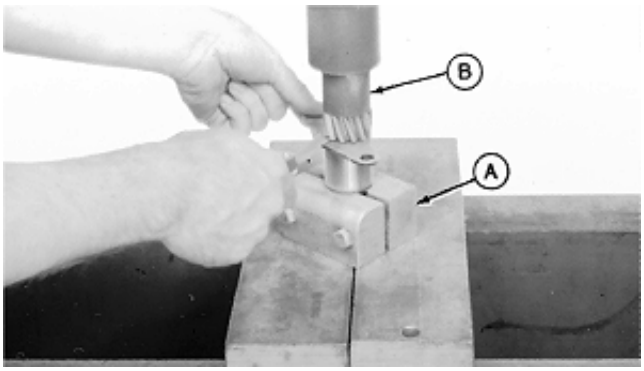
4. Using tube driver (B), press gear onto shaft until 0.05 to 0.20 mm (0.002 to 0.008 in.) clearance is obtained between thrust plate and gear.

A—JD-247 Holding Tool
B—Tube driver
C—Engine front face
D—Right-hand side balancer shaft (letter "R")
E—Timing marks
F—Left-hand side balancer shaft (letter "L")



CD30400 -UN-25OCT94


T88842 -UN-07NOV88



T88840 -UN-07NOV88

CD,3274,G20,18 -19-01FEB94

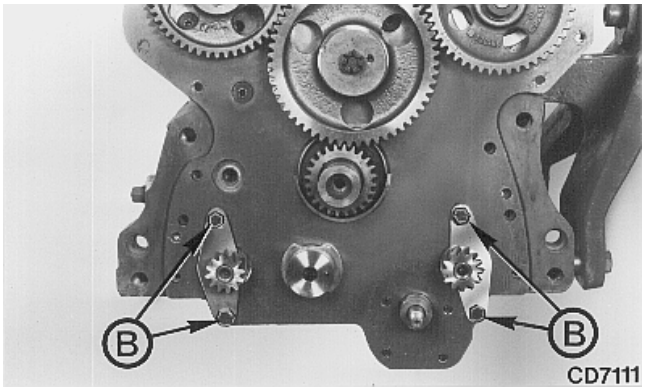
INSTALL BALANCER SHAFTS

1. Apply clean engine oil to bushings in cylinder block and to balancer shaft journals.

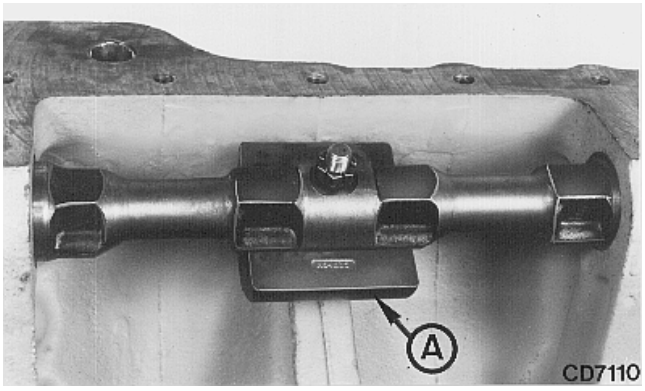
IMPORTANT: Do not mix up shafts. If the gears are removed from shafts during disassembly and possibly mixed up, install new shaft bushings.

2. Install balancer shafts and thrust plates. Tighten cap screws (B) to 50 N·m (35 lb-ft).

3. On engines equipped with bolt-on shaft weights (A), install weights on shafts so that they are positioned opposite the spot facings provided for the attaching nuts. Tighten nuts to 65 N·m (48 lb-ft).



-UN-02NOV94 CD7111



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CD,3274,G20,19 -19-10MAR92

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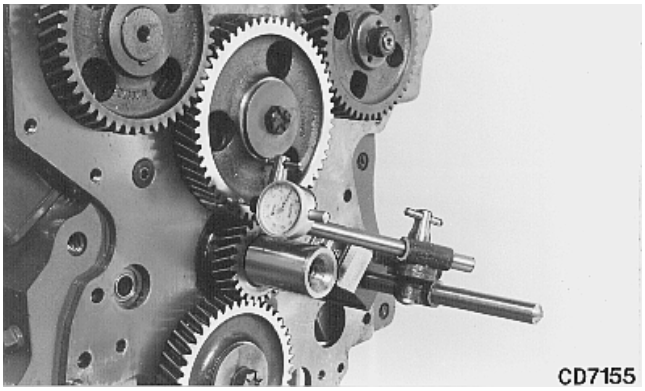
IDLER GEAR END PLAY MEASURE

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

End play . . . . . 0.14—0.29 mm (0.006—0.012 in.)

Maximum wear . . . . . 0.40 mm (0.016 in.)



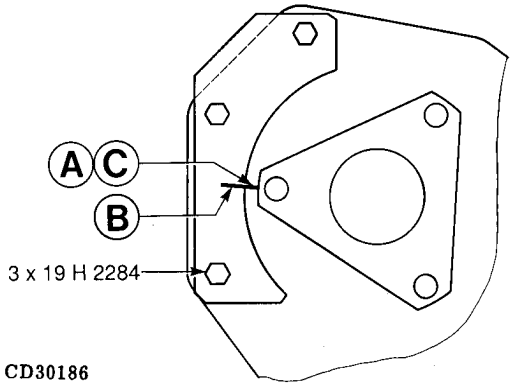
-UN-23MAY95 CD7155

CD,3274,G20,20 -19-11MAR92

REMOVE FRONT PLATE

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

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



-UN-07MAR95
CD30186

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

• 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.

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

CD,CTM125,194 -19-01DEC97

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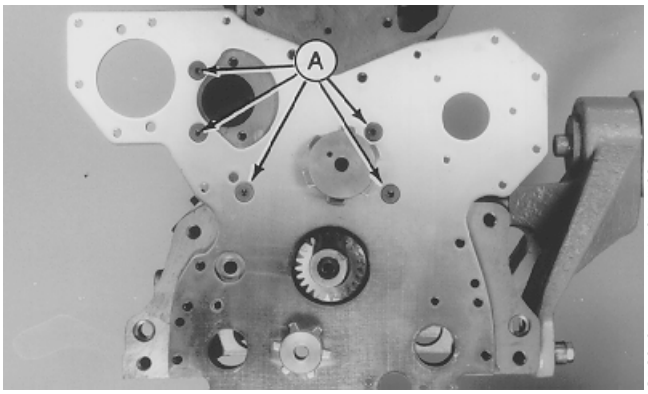
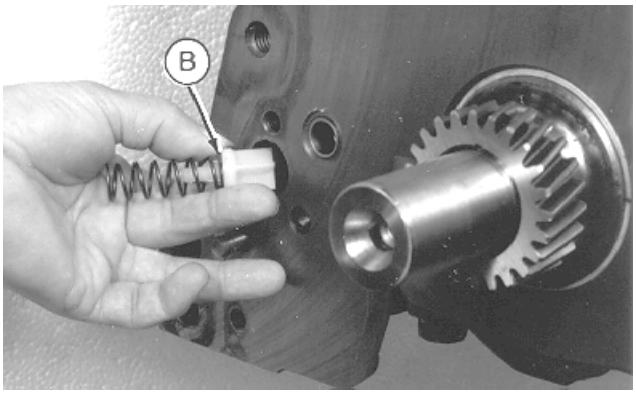


-UN-19MAY98
CD30597



-UN-04MAY98
CD30598

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 -19-01DEC97

IDLER GEAR BUSHING AND SHAFT MEASURE

IDLER GEAR SPECIFICATIONS

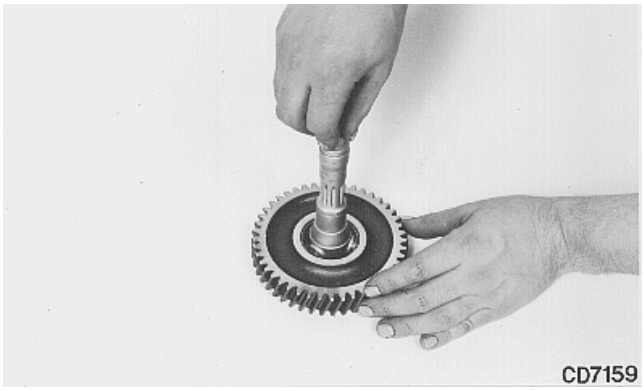
Idler gear shaft OD
- Upper with helical gear and lower with helical or spur gear . . . . . 44.437—44.463 mm (1.7495—1.7505 in.)
- Upper with spur gear . . . . . 69.759—69.775 mm (2.7464—2.747 in.)

Idler gear bushing ID
- Upper with helical gear and lower with helical or spur gear . . . . . 44.501—44.527 mm (1.752—1.753 in.)
- Upper with spur gear . . . . . 69.827—69.857 mm (2.7491—2.7503 in.)

Idler gear/bushing clearance
- Upper with helical gear and lower with helical or spur gear . . . . . 0.038—0.09 mm (0.0015—0.0035 in.)
- Upper with spur gear . . . . . 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.



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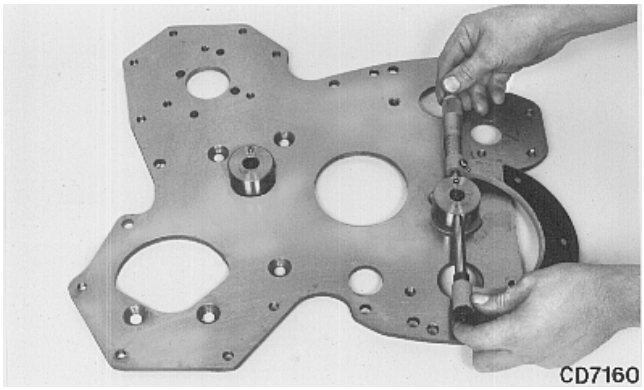

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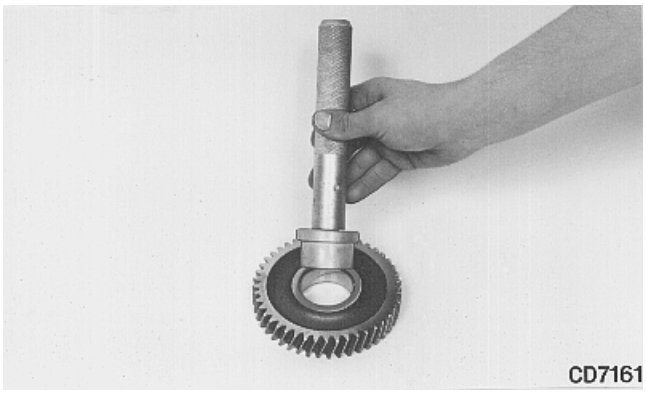
CD,3274,G20,22 -19-01FEB94

IDLER GEAR BUSHING REPLACEMENT



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 -19-01FEB94

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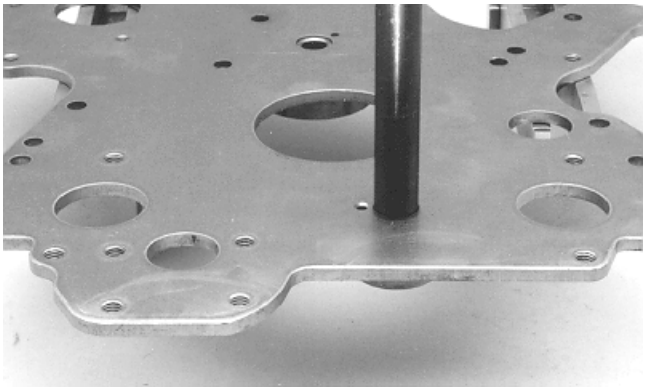
REMOVE IDLER SHAFT

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



CD,CTM125,119 -19-01DEC97

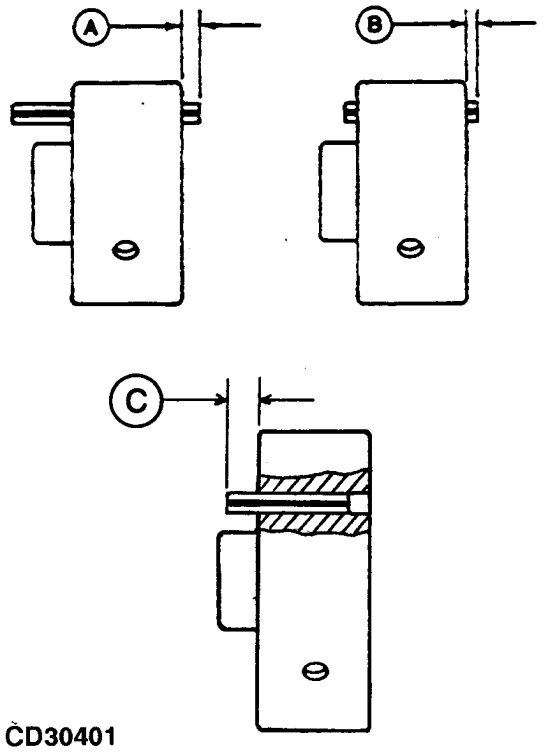
SPRING PIN INSTALLATION (IF EQUIPPED)

Install spring pin in shaft with end of pin protruding by:

Lower shaft pin protrusion (A) . . . . . 6.5—7 mm
(0.256—0.275 in.)

Upper shaft pin protrusion
• Helical gear (B) . . . . . 4—4.5 mm
(0.157—0.177 in.)

• Spur gear (C) . . . . . 7.5—8.5 mm
(0.295—0.335 in.)



CD30401

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CD30401

CD,3274,G20,25 -19-01FEB94

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UPPER IDLER SHAFT INSTALLATION

IMPORTANT: Oil bores in idler shaft must be properly indexed to provide adequate lubrication to idler gear bushing.

• Engines with helical gears:

1. Install thrust washer (A) and upper idler shaft with oil hole oriented between 10 and 11 o'clock positions.

2. Press shaft into front plate until thrust washer is fully seated. Spring pin (B, if equipped) must be located in notch (C).

• Engines with spur gears:

IMPORTANT: Thrust washer ears (D) must not interfere with countersunk front plate screw.

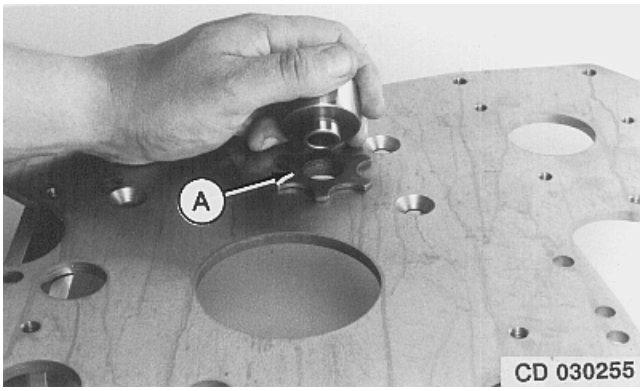
If equipped with spring pin, press shaft with thrust washer into plate until thrust washer is fully seated. Otherwise proceed as follows:

1. Install shaft/thrust washer assembly into plate with ears (D) located to either side of front plate screw (E) and oil bores (F) oriented at 12 and 3 o'clock positions.

2. Press shaft until thrust washer is fully seated.

NOTE: Shaft is secured to front plate when idler gear cap screw is threaded into cylinder block.

A—Thrust washer
B—Spring pin
C—Notch
D—Thrust washer ears
E—Front plate screw
F—Oil bores



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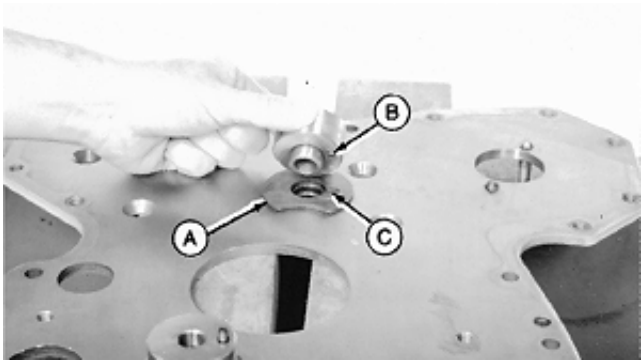
CD30255



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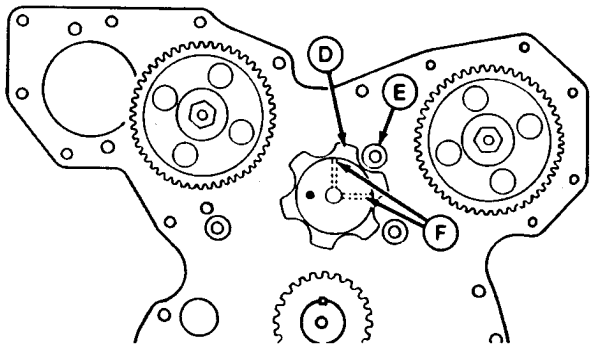
T88706



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RG6459

CD,3274,G20,26 -19-01FEB94

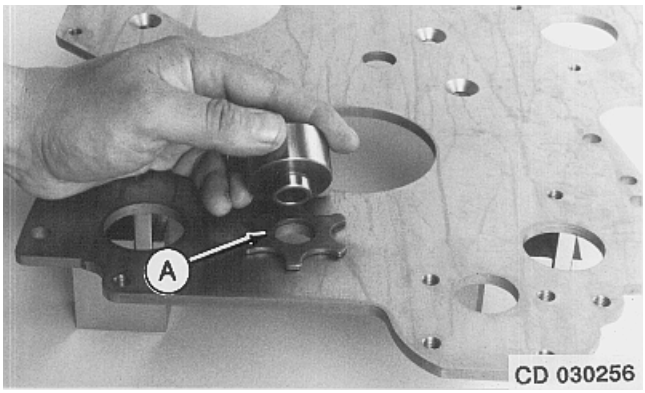
LOWER IDLER SHAFT INSTALLATION

1. Install thrust washer (A) and lower idler shaft.

NOTE: In case of shaft with spring pin, position spring pin (B) in thrust washer (A) and front plate (C).

2. Drive shaft into plate until thrust washer is fully seated.

NOTE: Shaft is secured to front plate when idler gear bolt and nut are tightened.



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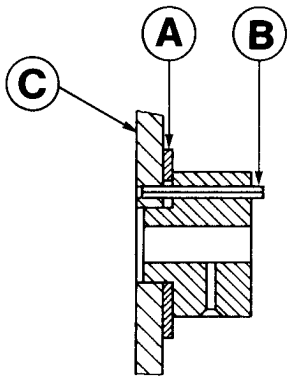
CD30256



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CD,3274,G20,27 -19-10MAR92

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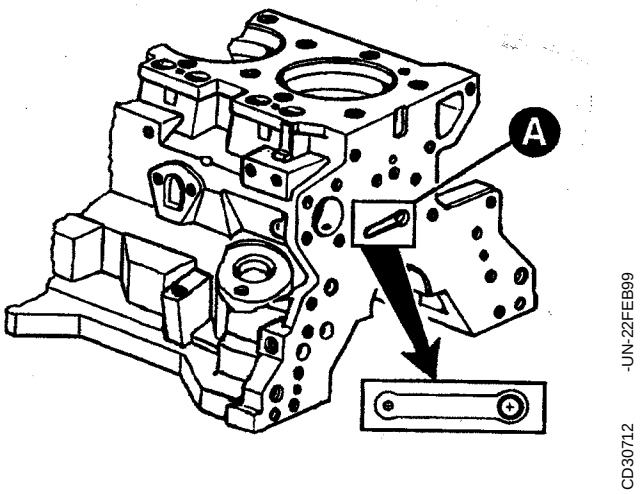
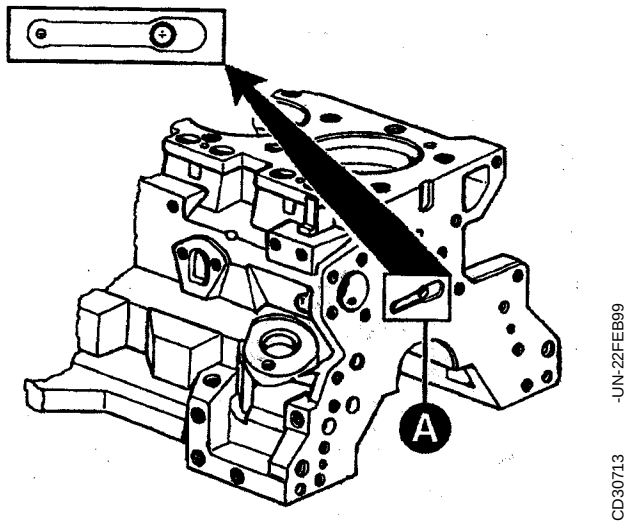
FRONT PLATE GASKET

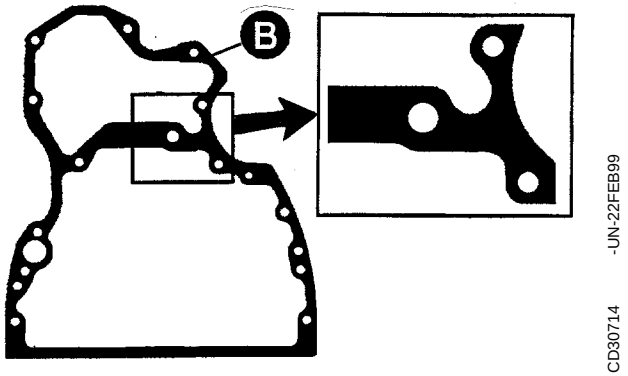


Earlier engines (-291260CD)

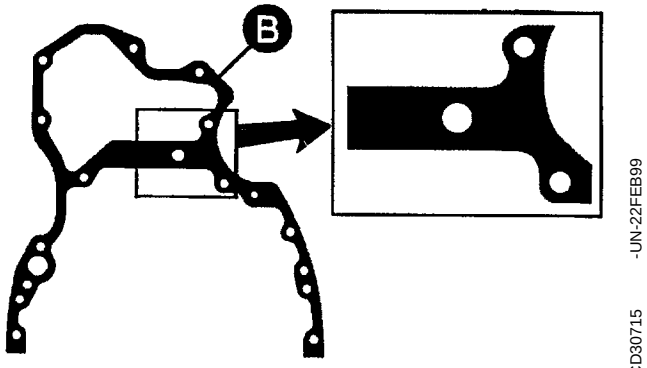


Later engines (291261CD-)

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



Gasket for engines (-291260CD)



Gasket for ALL engines

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.

CD,3274,G20,47 -19-04JAN99

FRONT PLATE INSTALLATION

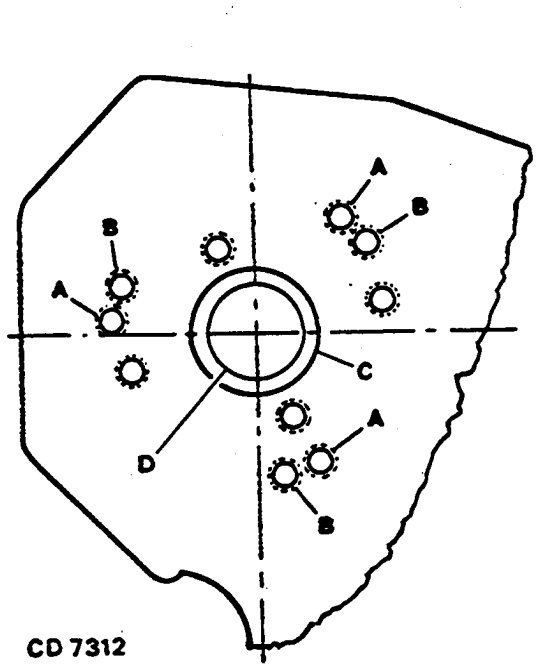
1. The standard front plate (without auxiliary drive extension) for service has several injection pump stud locations as indicated below:

—**A**—Threaded bores applicable for attaching Lucas CAV fuel injection pump on 3 and 6 cyl. engines as well as on 4 cyl. applications listed below (*)

—**B**—Threaded bores applicable for attaching Lucas CAV fuel injection pump on 4 cyl. engines except for 4 cyl. applications listed below (*)

—**C**—Fuel injection pump pilot bore

—**D**—Bushing applicable for fuel injection pump with 46 mm (1.81 in.) pilot diameter (not used on this application)



CD7312 -UN-09DEC88

** 6100, 6200, 6300, 6400 Tractors and all engines with a Lucas DP200 or DP201 injection pump.*

CD,3274,G20,48 -19-04JAN99

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2. Using Loctite® 271 Thread Lock, install injection pump studs (F) on front plate.

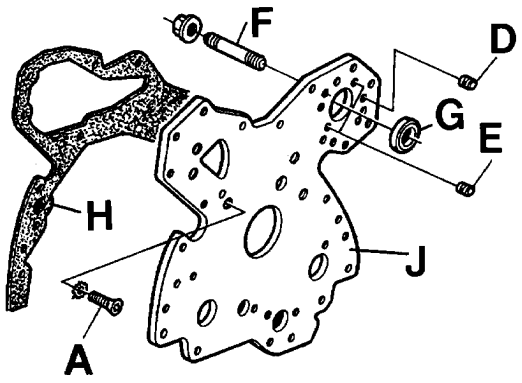
3. On standard front plate only, install the 5/16“ plugs (D) and the 3/8” plugs (E) as shown. Bushing (G) is not required for this application.

4. Install oil by-pass valve (B) and spring in cylinder block. (See also LUBRICATION SYSTEM.)

5. Install gasket (H) and front plate. Place new external tooth washers onto countersunk screws (A) then tighten to 35 N·m (25 lb-ft).

6. Cut off protruding edge of gasket when timing gear cover is tightened.

A—Countersunk screw
B—Oil by-pass valve
D—AT21191 Plug (5/16“) - Qty: 6
E—AT22919 Plug (3/8“) - Qty: 2
F—Stud
G—R79854 Bushing (not required for this application)
H—Gasket
J—Front plate



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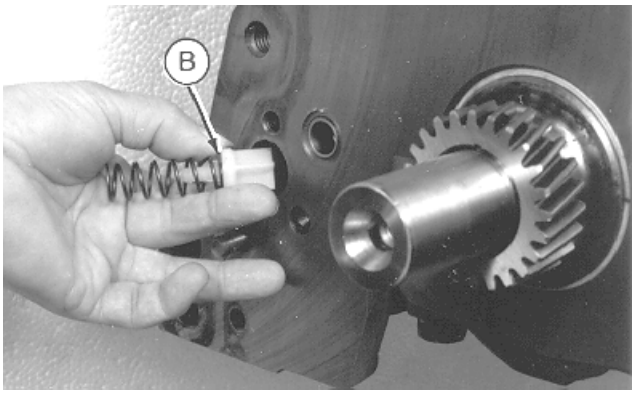
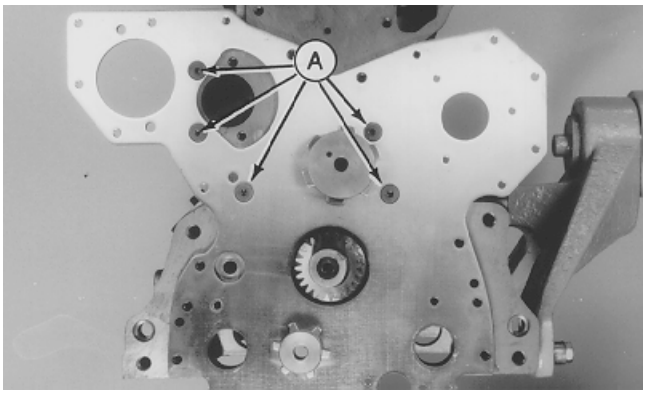


CD30598 -UN-04MAY98



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CD,3274,G20,49 -19-04JAN99

UPPER TIMING GEAR TRAIN INSTALLATION

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

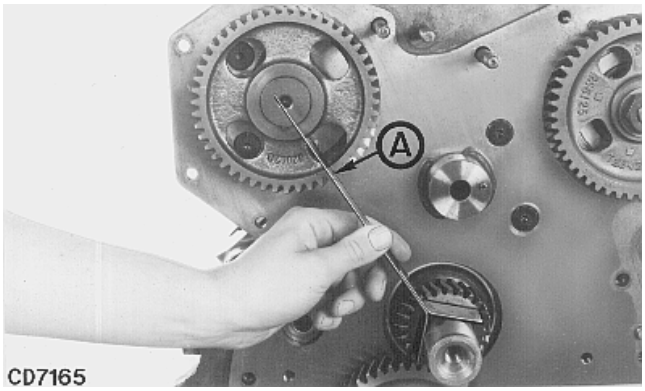
2. Install camshaft and fuel injection pump.

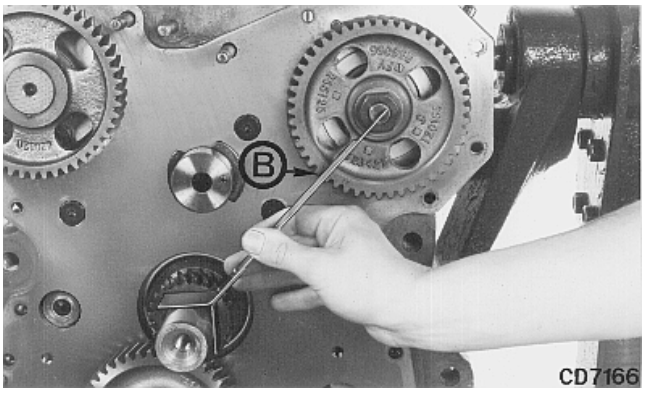
3. Turn camshaft until timing mark (A) is under JD-254A Timing Tool.

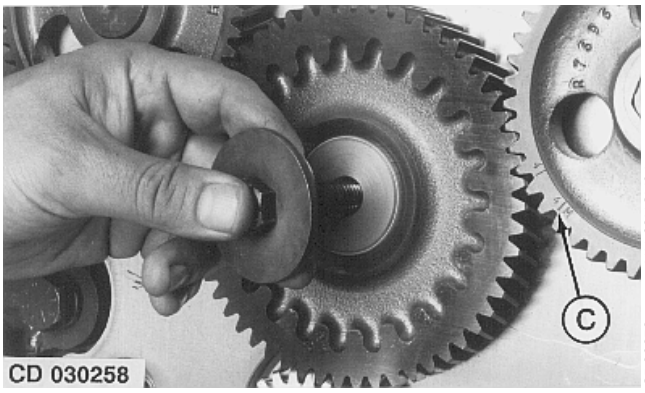
4. Using JD-254A Timing Tool, align timing mark on fuel injection pump gear (B) with the timing tool.

IMPORTANT: Use timing mark corresponding to the number of cylinders.

NOTE: Use "4M" timing mark (C) on following applications:
- *6100, 6200, 6300, 6400 Tractors*
- *All 4 cyl. engines with Lucas DP200 or DP201 injection pumps*







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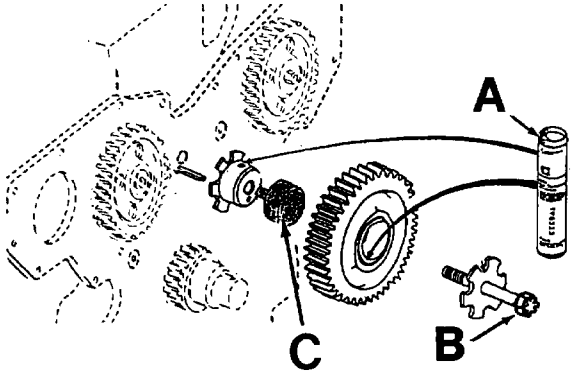

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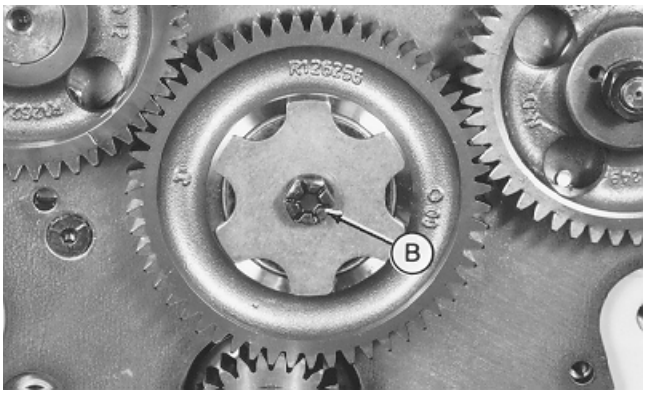

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5. Lubricate shaft and gear bushing with TY6333 grease* (A).

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 110 N·m (80 lb-ft).

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

**Available as service part.*

CD,CTM125,123 -19-01DEC97

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LOWER TIMING GEAR TRAIN INSTALLATION

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

2. Install oil pump and balancer shafts (if equipped).

3. On 4-cylinder engines with balancer shafts, turn the right-hand shaft so that timing mark (A) is under JD-254A timing tool.

4. Install lower idler gear without turning balancer shaft.

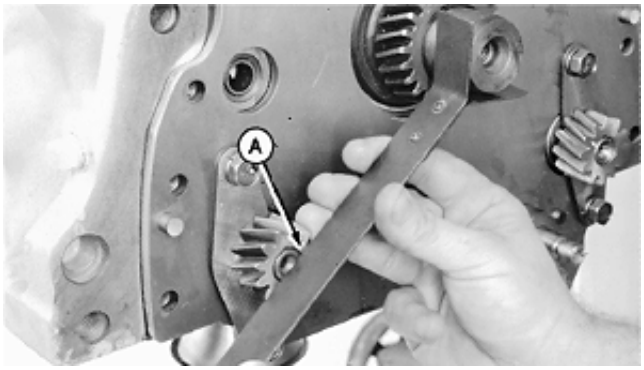
5. Install new bolt with washer (B) from oil pump side and new nut on front plate gear side. Tighten nut to 110 N·m (80 lb-ft).

6. Turn left-hand balancer shaft until timing mark (C) is under JD-254A timing tool.

7. Install oil pump gear on pump shaft, tighten hex. nut to 75 N·m (55 lb-ft) and secure with three center punch marks.

8. Recheck gear timing for both balancer shafts.

IMPORTANT: Keyway in each balancer shaft must be in the 12 o'clock position and timing marks must be directed toward crankshaft when shafts are correctly timed.



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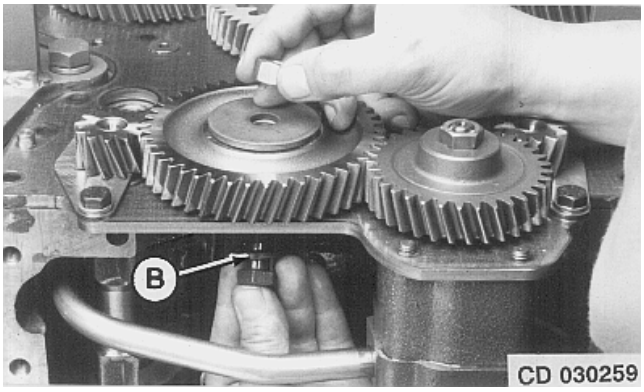

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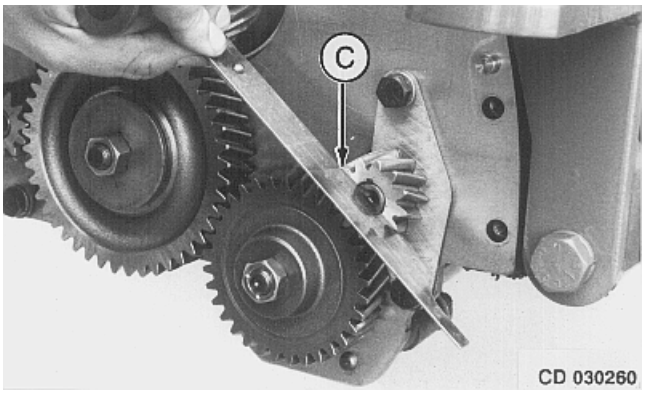


CD30260 -UN-06MAR95

CD,3274,G20,30 -19-04JAN99

AUXILIARY DRIVE GEAR INSTALLATION (37 KW)

NOTE: Oil deflector is not used on engines with 37 kW auxiliary gear drive.

1. Lubricate outer and inner circumferences of collet (A) with engine oil. Slide collet onto crankshaft with large end toward crankshaft gear (B). Position collet against the gear.

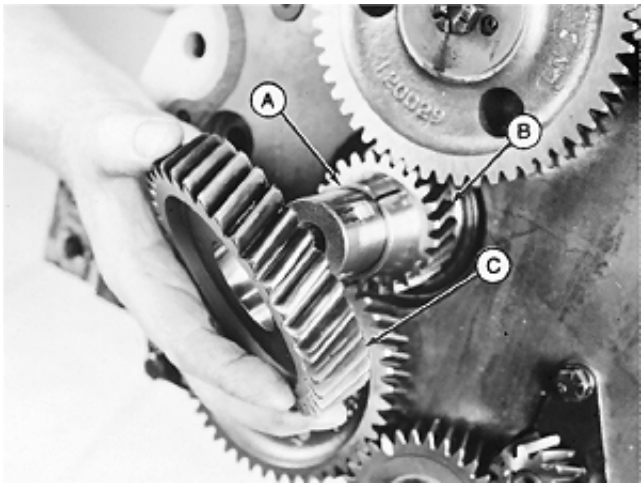
2. If equipped, slip rubber O-ring onto crankshaft and position against front edge of collet.

NOTE: O-ring was previously installed against collet. On more recent engines the O-ring (D) is installed on the special washer (E).

3. Lubricate inner circumference of the auxiliary drive gear (C) with engine oil and place on collet (with recessed side of gear toward crankshaft pulley).

4. Using JDG794 tool, push drive gear onto collet by tightening the nut of special tool to 150 N·m (110 lb-ft) to seat the gear.

A—Collet
B—Crankshaft gear
C—Auxiliary drive gear
D—O-ring (to be installed on washer)
E—Special washer



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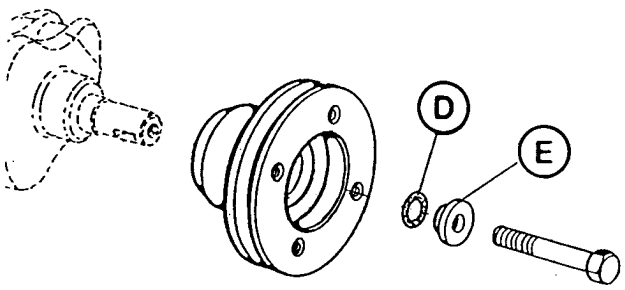

CD30403 -UN-10MAY95

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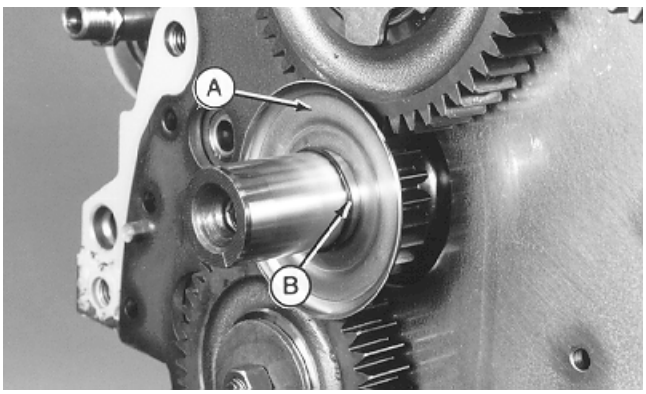
CD,3274,G20,39 -19-04JAN99

OIL DEFLECTOR INSTALLATION

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

NOTE: Oil deflector is not used on engine with crankshaft-gear-driven (37 kW) auxiliary drive option.



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CD,3274,G20,32 -19-04JAN99

TIMING GEAR COVER IDENTIFICATION

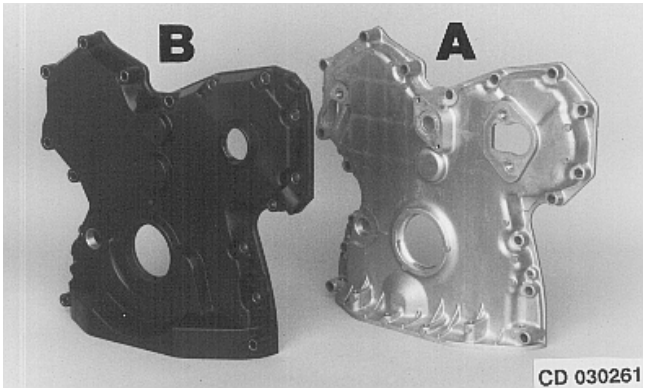
Four types of timing gear covers are used:

A—Standard aluminium cover.

B—Composite material cover. Aluminium cover may have also this shape.

C—Aluminium cover for 37 kW auxiliary drive option located on left-hand side of engine.

D—Aluminium cover for 19 kW auxiliary drive option (camshaft-gear-driven) located on right-hand side of engine.



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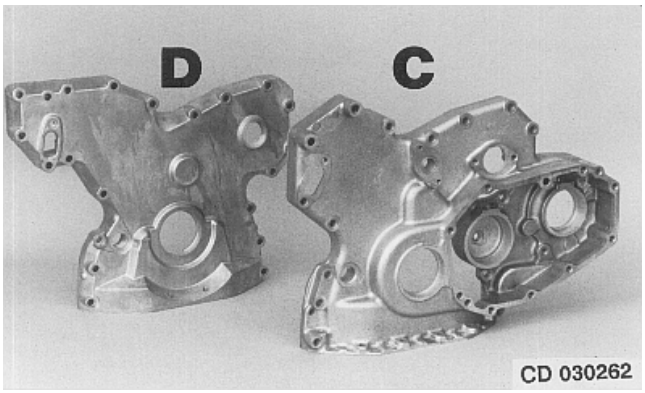

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CD30262

CD,3274,G20,31 -19-01FEB94

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INSTALL COMPOSITE MATERIAL TIMING GEAR COVER

1. Check for cracks around inserts. Replace cover if defective.

2. The sealing ring is reusable. When replacement is needed, proceed as follows:

— Remove previous sealing ring from cover (do not use any cutting tool to avoid cover damage).
— Clean groove with acetone (follow recommended precautions and safe operating practices) then dry with compressed air.

CAUTION: Do not use any other industrial solvent which might be not compatible with composite material.

— Install the new sealing ring starting at one edge of the cover. Place the thinner area of the sealing ring toward the cover.
— If properly installed, the sealing ring may protrude up to 30 mm (1.18 in.) at the other edge (A). If NOT, restart procedure.
— Cut away excess sealing ring.

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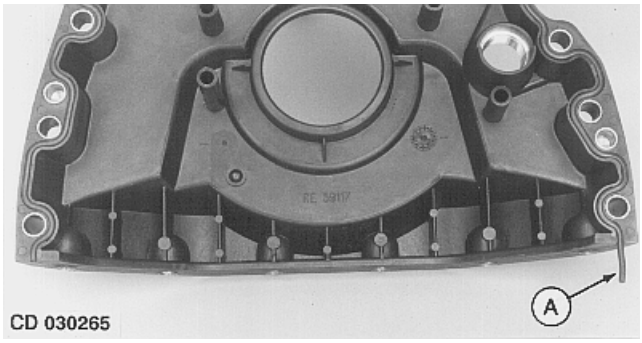
3. Apply a generous bead of Loctite® 515 Sealant on bottom face (B) which is in contact with oil pan.

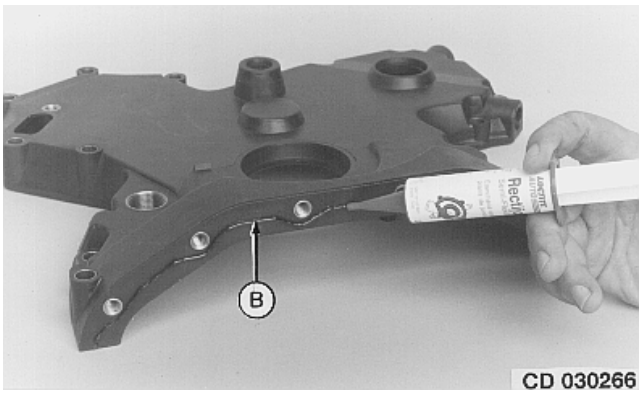
NOTE: A tube of Loctite® 515 Sealant is provided with overhaul gasket set. This tube is also available under part number DD15664.

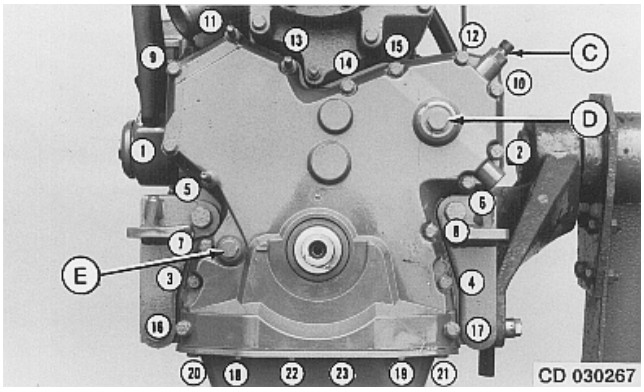
4. Coat the oil pan gasket top face with engine oil where the timing gear cover will be installed.

5. Install cover and apply following torques and the sequence shown:

— Magnetic pick-up (C): 15 N·m (11 lb-ft)
— Plug to access injection pump drive gear nut (D): 30 N·m (22 lb-ft)
— Oil pan to timing gear cover, cap screws (18—23): 30 N·m (22 lb-ft)
— Timing gear cover to front plate, cap screws (1—17): 45 N·m (33 lb-ft)
— Oil pressure regulating valve plug (E): 30 N·m (22 lb-ft)







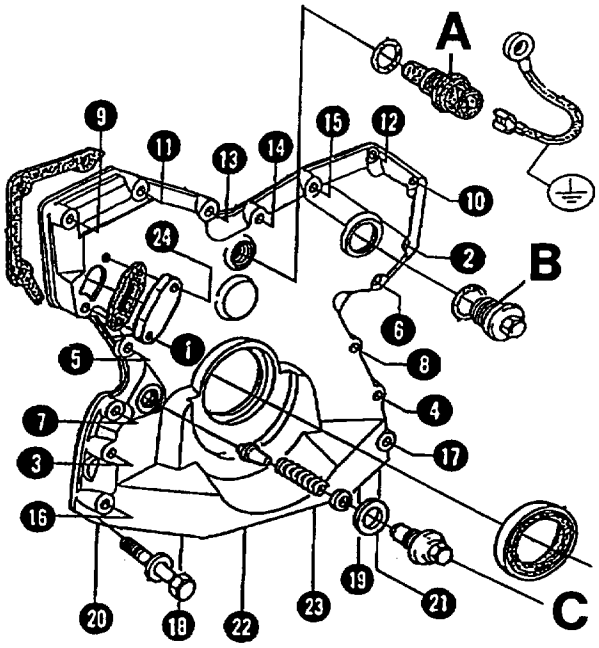
CD,3274,G20,35 -19-04JAN99

INSTALL ALUMINUM TIMING GEAR COVER

1. Install new gasket on front plate.

2. Install cover on engine and apply the following torques in sequence:

Cover cap screws (1—17)	50 N·m (35 lb-ft)
Oil pan cap screws (18—23)	50 N·m (35 lb-ft)
Magnetic pick-up (A)	15 N·m (11 lb-ft)
Inj. pump gear plug (B)	30 N·m (22 lb-ft)
Oil pressure valve plug (C)	95 N·m (70 lb-ft)



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CD,3274,G20,50 -19-04JAN99

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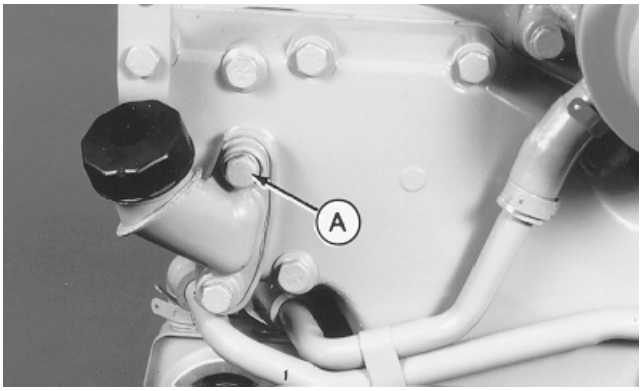
3. Install oil filler neck or obturation plate then tighten cap screws (A) to:

Aluminum neck	50 N·m (35 lb-ft)
Composite neck	30 N·m (22 lb-ft)
Obturation plate	50 N·m (35 lb-ft)

4. Cut off protruding edge of gasket.



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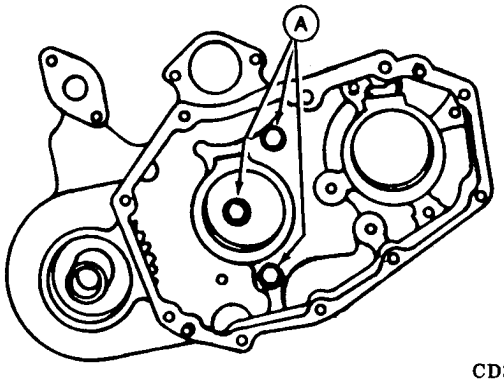
INSTALLATION OF TIMING GEAR COVER FOR 37 KW AUXILIARY DRIVE

1. Position new gasket on front plate. Make sure gasket surfaces on cover and front plate are clean.

2. Install cover with new built-in crankshaft front oil seal onto engine.

3. Install the timing gear cover cap screws, nuts and washers and tighten to 50 N·m (35 lb-ft).
Be sure to install the three cap screws and washers (A) located behind the auxiliary idler and securing the cover to the front plate and engine block.



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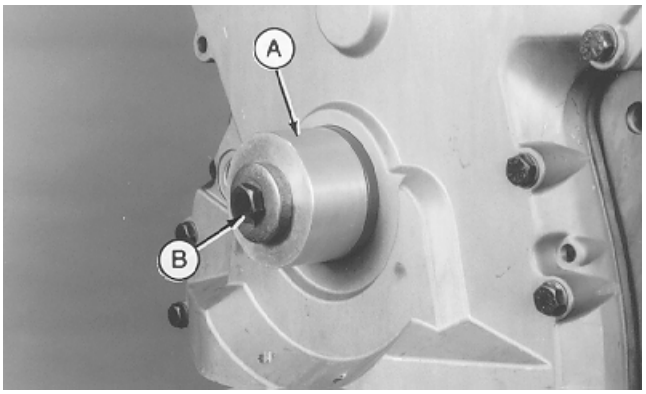
INSTALL CRANKSHAFT FRONT OIL SEAL



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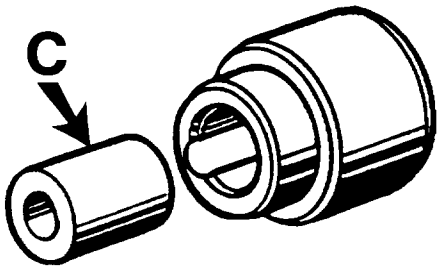

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CD30698

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.

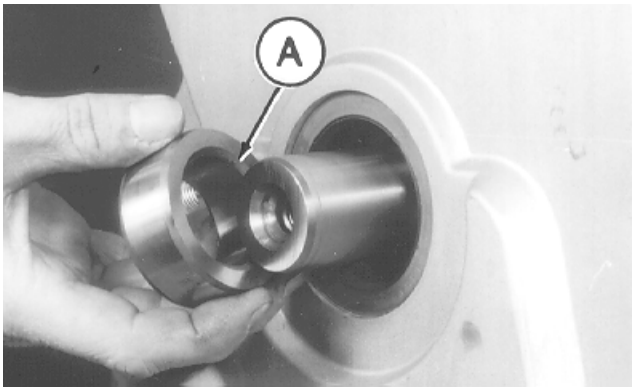
NOTE: KJD10164 tool set contains also a spacer (C) to be used only on old applications with short nose crankshaft (35 mm length).

CD,CTM125,129 -19-01DEC97

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.



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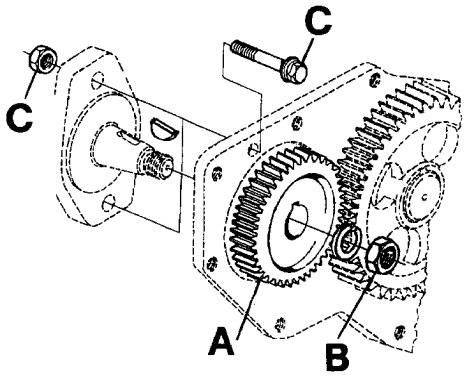
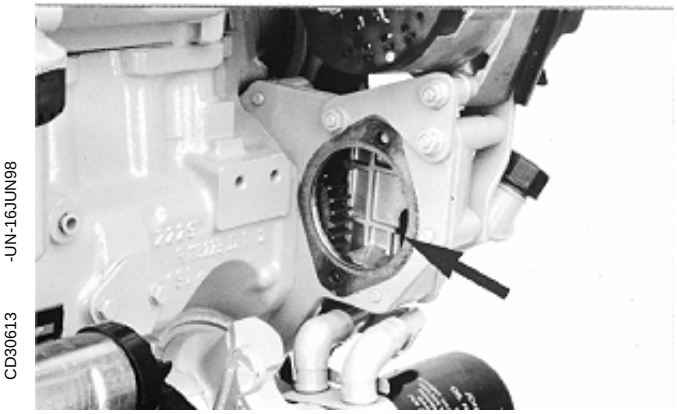
INSTALL AUXILIARY EQUIPMENT DRIVEN BY CAMSHAFT GEAR (19 KW AUX. DRIVE)





1. Install shaft key and gear (A) onto accessory shaft. Tighten nut (B) to 55 N·m (41 lb-ft) then, if equipped, bend tabs of washer up against nut.

2. Install accessory with gasket on engine (arrow).

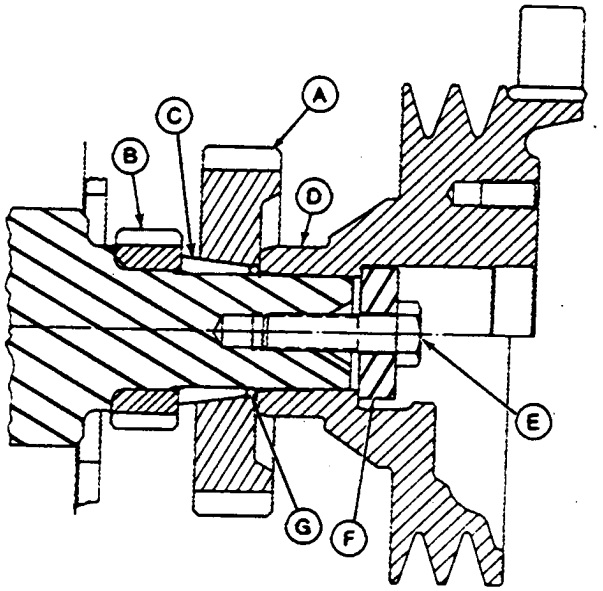
3. Tighten the two fastening cap screws or nuts (C) to 50 N·m (35 lb-ft).

CD,3274,G20,44 -19-04JAN99

CRANKSHAFT-GEAR-DRIVEN AUXILIARY DRIVE (37 KW)

NOTE: O-ring (G), installed against the collet (C), is not necessary when the washer (F) is machined to receive an O-ring (see AUXILIARY DRIVE GEAR INSTALLATION earlier in this group). Refer to Group 15 for pulley installation.

A—Auxiliary drive gear
B—Crankshaft gear
C—Tapered collet
D—Pulley
E—Cap screw
F—Washer
G—O-ring



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RG5175

CD,3274,G20,51 -19-04JAN99

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AUXILIARY DRIVE GEAR REMOVAL (37 KW)

1. Remove crankshaft pulley or damper pulley.

2. Remove auxiliary cover (A) with bearings.

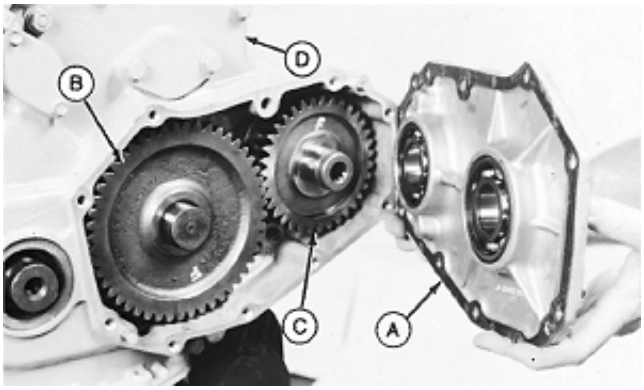
3. Remove auxiliary idler (B) and output drive (C) gears.

4. Remove timing gear cover (D) and auxiliary drive gear (E) with collet.

5. Replace any bearings which are unserviceable.

6. Clean all covers and inspect for cracks or damage. Make sure that the bearing seal bores are clean and not nicked.

A—Auxiliary cover
B—Auxiliary idler
C—Output drive
D—Timing gear cover
E—Auxiliary drive gear



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RG6315

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RG6316

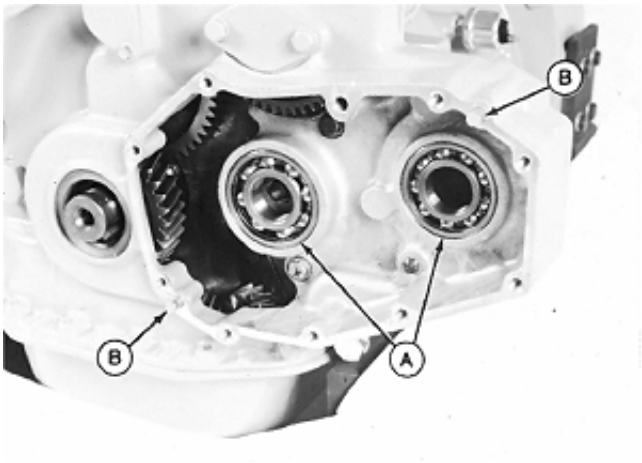
CD,3274,G20,37 -19-01FEB94

BALL BEARING AND DOWEL INSTALLATION

1. Apply a light coating of engine oil to outer circumference of the ball bearings (A).

2. Press bearings into timing gear cover and accessory gear (front) cover. Press only on outer bearing race; stop pressing when the bearing bottoms on shoulder of bearing bore.

3. If dowel pins (B) were removed from the timing gear cover, press in replacement pins so that tops of dowels are 11—12 mm (0.43—0.47 in.) above surface of cover.



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CD,3274,G20,38 -19-01FEB94

AUXILIARY GEAR AND SHAFT INSTALLATION (37 KW)

1. Lubricate gear shafts with engine oil.

2. Place idler gear (B) in timing gear cover (D) so that shaft enters bore of bearing and gear meshes with auxiliary drive gear (E).

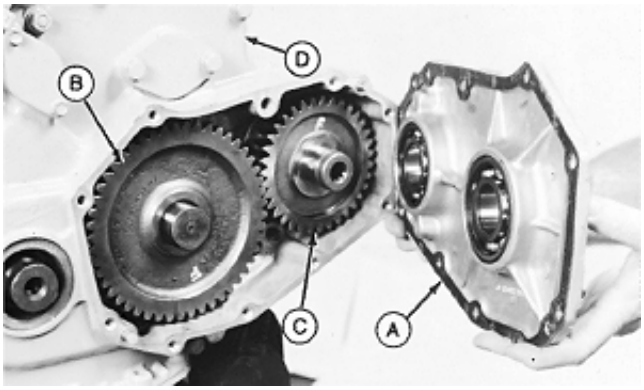
3. Install ouput gear (C) so 9-tooth spline faces front of engine and 13 or 15-tooth spline faces rear of engine. Apply high-temperature grease to internal splines.

NOTE: Depending on option, the output gear can be installed directly on accessory shaft. In this case, the output ball bearings are not required.

4. Place a new gasket over dowels on timing gear cover. Install auxiliary gear cover (A) on timing gear cover. When both shafts have entered their respective bearings, align cover with dowel pins and push into place against timing gear cover.

5. Tighten cap screws to 50 N·m (35 lb-ft).

RG6316 -UN-03AUG92



RG6315 -UN-03AUG92

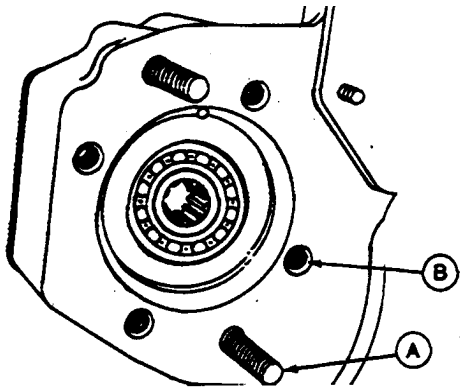
CD,3274,G20,41 -19-01FEB94

OUTPUT SHAFT COVER INSTALLATION

1. If studs (A) are used, apply sealant to threads of stud (timing gear cover end) and install in cover.

2. If the four threaded holes (B) are not used, apply a thread sealant to the set screws then install them up to a recess of 0—1.0 mm (0—0.04 in.) from flange surface.

3. If front and/or rear cover plates for output shaft are used, install using new gaskets.



RG5182 -UN-06DEC88

CD,3274,G20,42 -19-01FEB94

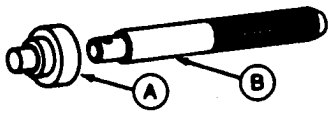
SPECIAL OR ESSENTIAL TOOLS

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

DX,TOOLS -19-20JUL95

RG5183 -UN-13SEP89

Bushing Driver (A) JD-248A
Handle (B) . . . . . JDG536(OTC813)



Install oil pressure regulating valve bushing.

CD,JD248A -19-04AUG92

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1

SPECIFICATIONS

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Oil pump (standard):		
• Bore of drive shaft in pump housing	16.05—16.08 mm (0.632—0.633 in.)	0.08 mm (0.003 in.)
• Diameter of idler shaft	12.32—12.34 mm (0.485—0.486 in.)	0.013 mm (0.0005 in.)
• Diameter of drive shaft journal	16.02—16.03 mm (0.630—0.631 in.)	0.025 mm (0.001 in.)
• Radial clearance between gear and pump housing	0.10—0.16 mm (0.004—0.006 in.)	0.20 mm (0.008 in.)
• Thickness of gears	41.15—41.20 mm (1.620—1.622 in.)	0.05 mm (0.002 in.)
• Axial clearance between gears and pump cover	0.05—0.17 mm (0.002—0.007 in.)	0.22 mm (0.0085 in.)
Oil pump with high flow capacity:		
• Bore of drive shaft in pump cover	16.06—16.08 mm (0.632—0.633 in.)	0.08 mm (0.003 in.)
• Bore of drive shaft in pump housing	12.28—12.31 mm (0.4835—0.4845 in.)	0.013 mm (0.0005 in.)
• Diameter of drive shaft journal	16.02—16.03 mm (0.630—0.631 in.)	0.025 mm (0.001 in.)
• Thickness of gears	50.97—51.02 mm (2.007—2.009 in.)	0.05 mm (0.002 in.)
• Radial clearance between gear and pump housing	0.08—0.18 mm (0.003—0.007 in.)	0.23 mm (0.009 in.)
• Axial clearance between gears and pump cover	0.04—0.17 mm (0.0015—0.006 in.)	0.22 mm (0.0085 in.)

(Continued on next page)

CD,3274,G25,1 -19-10MAR92

SPECIFICATIONS - CONTINUED

	DIMENSIONS OF NEW PARTS	WEAR TOLERANCE
Spring of oil pressure regulating valve:		
• Free length of spring (approx.)	120 mm (4.7 in.)	
• Spring calibration at a length of 42.5 mm (1.68 in.)	60—75 N (13.5—16.5 lb)	
Minimum oil pressure at 800 rpm (slow idle) and engine oil temperature 90˚C (194˚F)	100 kPa (1 bar; 14 psi)	
Spring of by-pass valve:		
• Free length (approx.)		
— Long spring	59 mm (2.32 in.)	
— Short spring	51 mm (2.00 in.)	
• Spring calibration		
— Long spring at a length of 34 mm (1.34 in.)	92—112 N (21—25 lb)	
— Short spring at a length of 29 mm (1.14 in.)	79—96.5 N (18—22 lb)	

CD,3274,G25,2 -19-04JAN99

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3

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment:

Machine Model No.	Engine Model	Dipstick guide height
• 4000-Series Telescopic Handlers:		
4400	CD4039TF005	198mm (7.79 in.)
4500	CD4039TF005	198mm (7.79 in.)
• 5000-Series Tractors: (Agritalia-built)		
5300/5300N	CD3029DAT01	136 mm (5.35 in.)
5400/5400N	CD3029TAT02	156 mm (6.14 in.)
5500/5500N	CD4039TAT01	160 mm (6.30 in.)
• 5000-Series Tractors: (Augusta-built)		
5400N	CD3029TLV01	156 mm (6.14 in.)
5500N	CD4039TLV01	160 mm (6.30 in.)
• 5000-Series Tractors: (For India)		
5300	CD3029DPY01	156 mm (6.14 in.)
• 6000-Series Tractors:		
6100	CD4045DL001	198 mm (7.79 in.)
	CD4045DL002	198 mm (7.79 in.)
6200	CD4039TL001	198 mm (7.79 in.)
	CD4039TL004	198 mm (7.79 in.)
6300	CD4039TL003	198 mm (7.79 in.)
	CD4039TL006	198 mm (7.79 in.)
6400	CD4045TL001	198 mm (7.79 in.)
	CD4045TL003	198 mm (7.79 in.)
6506	CD6068DL001	196 mm (7.72 in.)
6600	CD6059TL001	196 mm (7.72 in.)
6800	CD6068TL001	196 mm (7.72 in.)
6900	CD6068TL002	196 mm (7.72 in.)
• 7000-Series Tractors:		
7600	T06068TRW01	194 mm (7.64 in.)
• 2000-Series Combines:		
2054	CD6068HZ001	416 mm (16.4 in.)
2254	CD6068HZ001	416 mm (16.4 in.)

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CD,3274,G25,43 -19-04JAN99

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment (cont'd):

Engine Model	Dipstick guide height
• Engines for Chinese Combines:	
CD6059TYC01	402 mm (15.83 in.)
CD6059TYC02	402 mm (15.83 in.)
• Engines for GOLDONI Tractors:	
CD3029DFG21	187 mm (7.36 in.)
CD3029DFG22	187 mm (7.36 in.)
CD3029TFG21	187 mm (7.36 in.)

SARAN OEM ENGINES	Option code	Dipstick guide height
• CD3029DF	4001,4002	189 mm (7.44 in.)
	4003	387 mm (15.24 in.)
	4022	176 mm (6.93 in.)
• CD3029DF001	4001,4002	189 mm (7.44 in.)
	4003	387 mm (15.24 in.)
• CD3029DF005	4001	189 mm (7.44 in.)
• CD3029DF031	4001,4002	189 mm (7.44 in.)
	4003	387 mm (15.24 in.)
	4022	141 mm (5.55 in.)
• CD3029DF032	4022	141 mm (5.55 in.)
• CD3029DF033	4002	189 mm (7.44 in.)
• CD3029DF034	4022	141 mm (5.55 in.)

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CD,3274,G25,44 -19-04JAN99

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment (cont'd):

SARAN OEM ENGINES	Option code	Dipstick guide height
• CD3029DF120	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	4004	187 mm (7.36 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.)
	4024	136 mm (5.35 in.)
	4033	155 mm (6.10 in.)
• CD3029DF161	4024	136mm (5.35 in.)
• CD3029DF162	4006	205 mm (8.07 in.)
• CD3029DF163	4024	136mm (5.35 in.)
• CD3029DF164	4033	155 mm (5.35 in.)
• CD3029DF165	4024	136mm (5.35 in.)

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CD,3274,G25,45 -19-04JAN99

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment (cont'd):

SARAN OEM ENGINES	Option code	Dipstick guide height
• CD3029TF	4001	208 mm (8.19 in.)
	4002	189 mm (7.44 in.)
	4003	219 mm (8.62 in.)
	4009	223 mm (8.78 in.)
• CD3029TF001	4001	208 mm (8.19 in.)
	4002	189 mm (7.44 in.)
	4003	219 mm (8.62 in.)
	4023	403 mm (15.87 in.)
• CD3029TF002	4020	507 mm (19.96 in.)
	4023	403 mm (15.87 in.)
• CD3029TF031	4001	208 mm (8.19 in.)
	4002	189 mm (7.44 in.)
	4003	219 mm (8.62 in.)
	4009	223 mm (8.78 in.)
	4021	156 mm (6.14 in.)
• CD3029TF032	4002	189 mm (7.44 in.)
	4021	156 mm (6.14 in.)
• CD3029TF033	4001	208 mm (8.19 in.)

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CD,3274,G25,52 -19-04JAN99

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment (cont'd):

SARAN OEM ENGINES	Option code	Dipstick guide height
• CD3029TF120	4001	208 mm (8.19 in.)
	4006	205 mm (8.07 in.)
	4023	212 mm (8.35 in.)
	4024	136 mm (5.35 in.)
	4025	408 mm (16.06 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.)
	4021	156 mm (6.14 in.)
	4024	136 mm (5.35 in.)
	4026	156 mm (6.14 in.)
	4033	155 mm (6.10 in.)
• CD3029TF161	4021	156 mm (6.14 in.)
	4022	141 mm (5.55 in.)
	4024	136 mm (5.35 in.)
	4026	141 mm (5.55 in.)
• CD3029TF162	4001	208 mm (8.19 in.)
	4006	205 mm (8.07 in.)
• CD3029TF163	4001	208 mm (8.19 in.)
	4006	205 mm (8.07 in.)
	4024	136 mm (5.35 in.)

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CD,3274,G25,53 -19-04JAN99

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment (cont'd):

SARAN OEM ENGINES	Option code	Dipstick guide height
• CD4039DF	4001	157 mm (6.18 in.)
	4002,4019	200 mm (7.87 in.)
	4005	160 mm (6.30 in.)
	4006	155 mm (6.10 in.)
	4010	418 mm (16.45 in.)
• CD4039DF001	4001	157 mm (6.18 in.)
	4002,4019	200 mm (7.87 in.)
	4003	198 mm (7.79 in.)
	4004	274 mm (10.79 in.)
	4005	160 mm (6.30 in.)
	4006	155 mm (6.10 in.)
	4010	418 mm (16.45 in.)
	4011	405 mm (15.94 in.)
	4012	146 mm (5.75 in.)
	4031	148 mm (5.83 in.)
• CD4039DF002	4003	198 mm (7.79 in.)
	4005	160 mm (6.30 in.)
• CD4039DF004	4005	160 mm (6.30 in.)
	4015	173 mm (6.81 in.)
• CD4039DF005	4003	198 mm (7.79 in.)
• CD4039DF006	4003	198 mm (7.79 in.)
• CD4039DF007	4003	198 mm (7.79 in.)
• CD4039DF008	4003	198 mm (7.79 in.)
• CD4039DF031	4001	157 mm (6.18 in.)
	4002,4019	200 mm (7.87 in.)
	4004	154 mm (6.06 in.)
	4005	160 mm (6.30 in.)
	4010	418 mm (16.45 in.)
	4031	148 mm (5.83 in.)
• CD4039DF032	4001	157 mm (6.18 in.)
	4031	148 mm (5.83 in.)

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CD,3274,G25,46 -19-04JAN99

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment (cont'd):

SARAN OEM ENGINES	Option code	Dipstick guide height
• CD4039TF	4002	280 mm (11.02 in.)
	4005	408 mm (16.06 in.)
	4006	197 mm (7.76 in.)
	4008	211 mm (8.31 in.)
	4009	214 mm (8.42 in.)
	4020	198 mm (7.79 in.)
• CD4039TF001	4002	280 mm (11.02 in.)
	4003,4020	198 mm (7.79 in.)
	4004	274 mm (10.79 in.)
	4005	408 mm (16.06 in.)
	4006	197 mm (7.76 in.)
	4008,4012	211 mm (8.31 in.)
	4013	217 mm (8.54 in.)
	4031	148 mm (5.83 in.)
• CD4039TF002	4003,4020	198 mm (7.79 in.)
• CD4039TF003	4003	198 mm (7.79 in.)
• CD4039TF004	4003	198 mm (7.79 in.)
	4006	197 mm (7.76 in.)
	4032	203 mm (7.99 in.)
• CD4039TF005	4003	198 mm (7.79 in.)
• CD4039TF006	4003	198 mm (7.79 in.)
• CD4039TF007	4003	198 mm (7.79 in.)
• CD4039TF008	4003	198 mm (7.79 in.)
• CD4039TF031	4002	280 mm (11.02 in.)
	4004	274 mm (10.79 in.)
	4005	408 mm (16.06 in.)
	4006	197 mm (7.76 in.)
	4007	123 mm (4.84 in.)
	4008	211 mm (8.31 in.)
	4013	217 mm (8.54 in.)
	4020	198 mm (7.79 in.)
	4031	148 mm (5.83 in.)
• CD4039TF032	4012	211 mm (8.31 in.)

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CD,3274,G25,47 -19-04JAN99

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment (cont'd):

SARAN OEM ENGINES	Option code	Dipstick guide height
• CD6059DF	4001	194 mm (7.64 in.)
	4004	398 mm (15.67 in.)
	4005	68 mm (2.68 in.)
	4007	210 mm (8.27 in.)
	4010	192 mm (7.56 in.)
	4011	200 mm (7.87 in.)
	4012	406 mm (15.98 in.)
	4015	412 mm (16.22 in.)
• CD6059DF001	4001	194 mm (7.64 in.)
	4004	398 mm (15.67 in.)
	4005	68 mm (2.68 in.)
	4006,4008	185 mm (7.28 in.)
	4007	210 mm (8.27 in.)
	4010	192 mm (7.56 in.)
	4011	200 mm (7.87 in.)
	4012	406 mm (15.98 in.)
	4015	412 mm (16.22 in.)
• CD6059DF002	4010	192 mm (7.56 in.)
• CD6059DF003	4010	192 mm (7.56 in.)

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CD,3274,G25,48 -19-04JAN99

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment (cont'd):

SARAN OEM ENGINES	Option code	Dipstick guide height
• CD6059TF	4001	194 mm (7.64 in.)
	4004	398 mm (15.67 in.)
	4007	210 mm (8.27 in.)
	4009	68 mm (2.68 in.)
	4010	192 mm (7.56 in.)
	4011	200 mm (7.87 in.)
	4012	406 mm (15.98 in.)
	4015	412 mm (16.22 in.)
• CD6059TF001	4001	194 mm (7.64 in.)
	4004	398 mm (15.67 in.)
	4006,4008	185 mm (7.28 in.)
	4007	210 mm (8.27 in.)
	4009	68 mm (2.68 in.)
	4010	192 mm (7.56 in.)
	4011	200 mm (7.87 in.)
	4012	406 mm (15.98 in.)
	4015	412 mm (16.22 in.)
• CD6059TF002	4011	200 mm (7.87 in.)
	4013	135 mm (5.31 in.)
• CD6059TF003	4011	200 mm (7.87 in.)
	4013	135 mm (5.31 in.)
• CD6059TF004	4010	192 mm (7.56 in.)
• CD6059TF005	4010	192 mm (7.56 in.)
• CD6059TF006	4010	192 mm (7.56 in.)
• CD6059TF007	4010	192 mm (7.56 in.)
• CD6059TF008	4010	192 mm (7.56 in.)

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CD,3274,G25,49 -19-04JAN99

SPECIFICATIONS - CONTINUED

Dipstick guide height adjustment (cont'd):

SARAN OEM ENGINES	Option code	Dipstick guide height
• CD4045DF001	4003,4020	198 mm (7.79 in.)
• CD4045DF031	4004	154 mm (6.06 in.)
• CD4045TF001	4002	280 mm (11.02 in.)
	4003,4020	198 mm (7.79 in.)
	4005	408 mm (16.06 in.)
	4006	197 mm (7.76 in.)
	4008	211 mm (8.31 in.)
• CD4045TF002	4003	198 mm (7.79 in.)
• CD4045TF003	4003	198 mm (7.79 in.)
• CD4045TF008	4003	198 mm (7.79 in.)
• CD4045TF031	4007	123 mm (4.84 in.)
• 6068DF001	4010	192 mm (7.56 in.)
• 6068TF001	4010	192 mm (7.56 in.)
• 6068TF002	4010	192 mm (7.56 in.)
• 6068TF003	4010	192 mm (7.56 in.)
• 6068TF004	4010	192 mm (7.56 in.)
• 6068TF008	4010	192 mm (7.56 in.)
• 6068TF009	4010	192 mm (7.56 in.)

CD,3274,G25,50 -19-04JAN99

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TORQUES FOR HARDWARE

Oil pump assembly to cylinder block front plate, cap screws	50 N·m (35 lb-ft)
Drive gear on oil pump shaft, hex. nut (staked)	75 N·m (55 lb-ft)
Oil pan to cylinder block and flyweel housing:	
• Sheet metal pan	50 N·m (35 lb-ft)
• Aluminium pan	50 N·m (35 lb-ft)
• Cast iron pan:	
SAE 5 screws (3 dashes)	50 N·m (35 lb-ft)
SAE 8 screws (6 dashes)	70 N·m (50 lb-ft)
Oil pan to timing gear cover:	
• Aluminium	50 N·m (35 lb-ft)
• Composite material	30 N·m (22 lb-ft)
Plug of oil pressure regulating valve	
• on aluminium timing gear cover	95 N·m (70 lb-ft)
• on composite material timing gear cover	30 N·m (22 lb-ft)
Oil cooler adapter in cylinder block	35 N·m (25 lb-ft)
Oil cooler lines, banjo bolts	100 N·m (74 lb-ft)
Oil filler neck, cap screws:	
• Aluminium neck	50 N·m (35 lb-ft)
• Composite material neck	30 N·m (22 lb-ft)
Oil drain plug:	
• Cylindrical	70 N·m (50 lb-ft)
• Conical	55 N·m (40 lb-ft)

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CD,3274,G25,4 -19-01FEB94

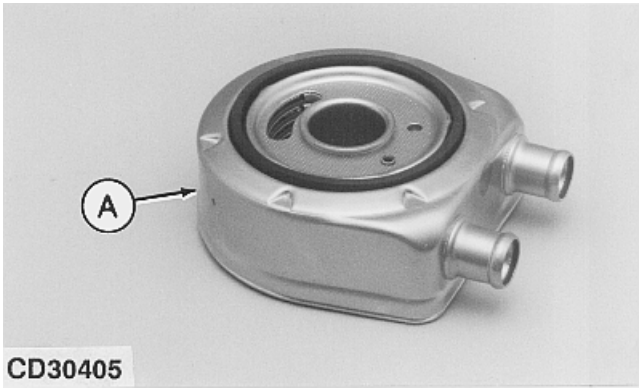
OIL COOLER IDENTIFICATION

Two types of oil cooler are installed on engines:

Type 1 (A) is a standard oil cooler which is clamped between oil filter and cylinder block or adapter housing.

Type 2 (B) is a high-flow oil cooler which is attached to the cylinder head or block.

A—Standard oil cooler with 6, 8 or 10 plates
B—High-flow oil cooler with 7 plates



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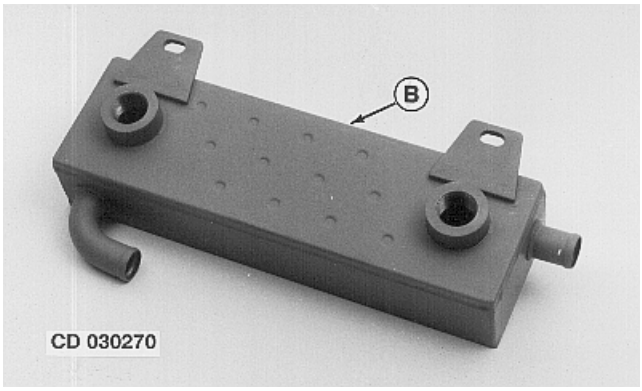
CD30405



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CD,3274,G25,5 -19-01FEB94

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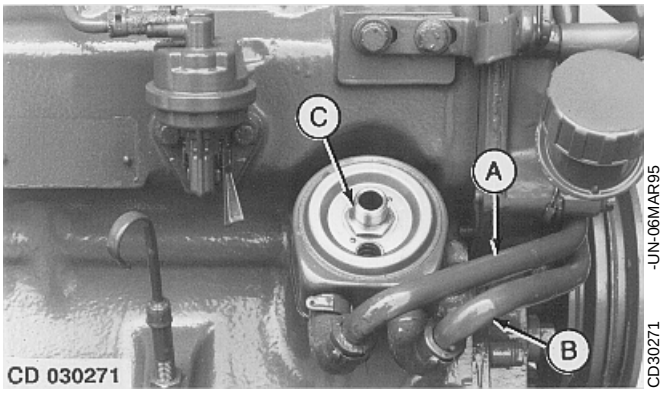
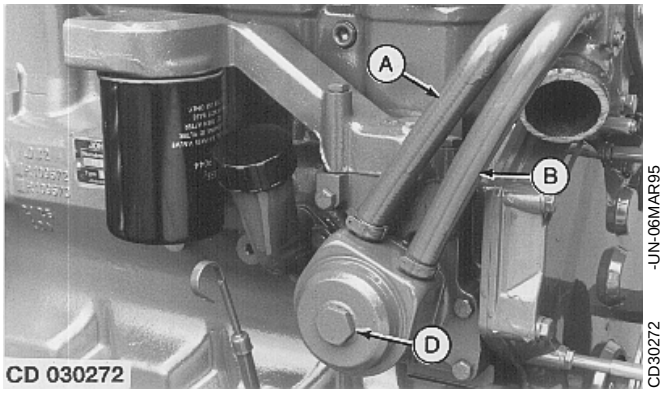
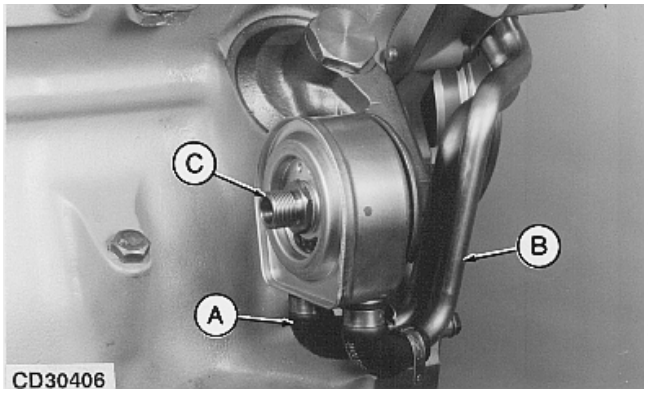
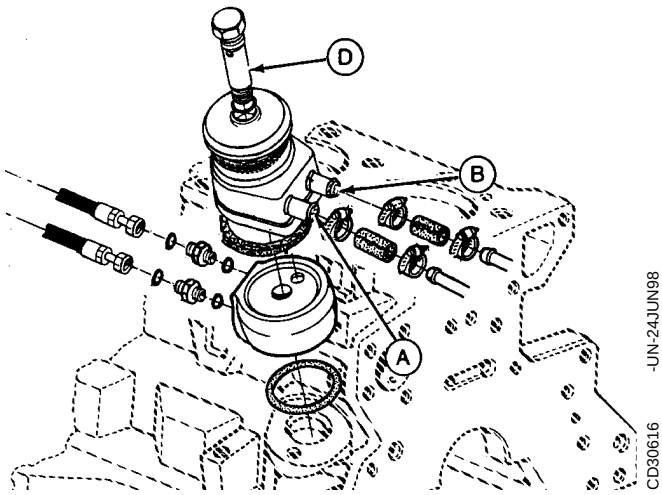
15

STANDARD OIL COOLER REMOVAL









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16

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

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.

CD,3274,G25,6 -19-04JAN99

STANDARD OIL COOLER ADAPTER REPLACEMENT

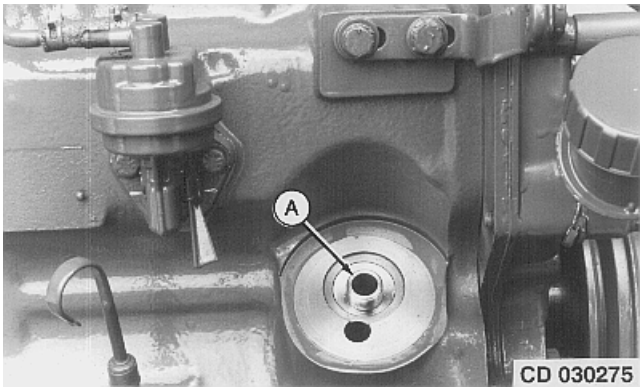
1. Remove oil cooler adapter (A).

2. Press in new adapter so that threaded end faces outward (farthest point from cylinder block).

3. Install new packing between oil cooler and cylinder block.

4. Attach oil cooler with nipple (B). Tighten to 35 N·m (25 lb-ft).

5. Connect coolant lines to oil cooler.



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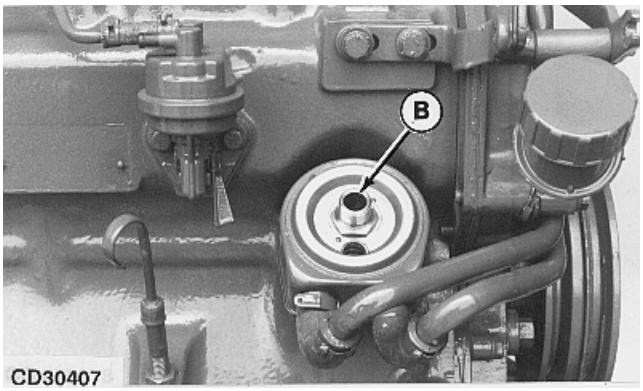

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CD,3274,G25,8 -19-01FEB94

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17

STANDARD OIL COOLER/OIL FILTER BRACKETS REPLACEMENT

A. Engine without camshaft-gear-driven auxiliary drive and bracket installed on sloped base of cylinder block.

1. Remove oil filter bracket (A) and oil cooler bracket (B).

2. Clean and check parts.

3. Install oil cooler bracket (B) with a new O-ring (C). Tighten adapter (D) to 35 N·m (25 lb-ft).

4. Install oil filter bracket (A) with O-rings (G). Tighten cap screws (3 used) to 50 N·m (35 lb-ft).

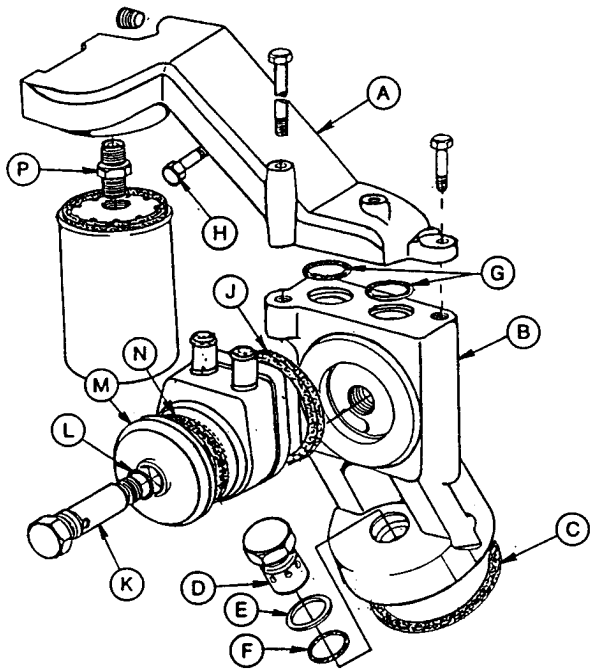
NOTE: Apply sealing compound on thread of cap screw (H).

5. Install new packing (J) between oil cooler and bracket.

6. Attach oil cooler with holding screw (K), cover (M) and O-rings (L) and (N). Tighten to 35 N·m (25 lb-ft).

7. Connect coolant lines to oil cooler.

8. Install oil filter adapter (P). Tighten to 45 N·m (33 lb-ft).



CD30408 -UN-25OCT94

A—Oil filter bracket
B—Oil cooler bracket
C—O-ring
D—Adapter
E—Washer
F—O-ring
G—O-rings
H—Cap screw (to be installed with sealing compound)
J—Packing
K—Holding screw
L—O-ring
M—Cover
N—O-ring
P—Adapter

CD,3274,G25,9 -19-01FEB94

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18

B. Engine without camshaft-gear-driven auxiliary drive and bracket installed on vertical base of cylinder block.

1. Remove oil filter bracket (A) and oil cooler bracket (B).

2. Clean and check parts.

3. Install oil cooler bracket (B) with a new gasket (C). Tighten cap screws to 50 N·m (35 lb-ft).

4. Install oil filter bracket (A) with a new gasket (D). Tighten cap screws (3 used) to 50 N·m (35 lb-ft).

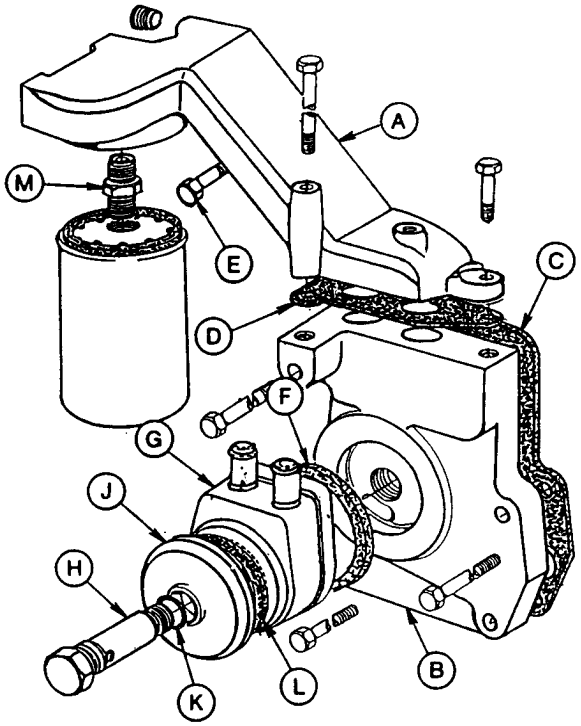
NOTE: Apply sealing compound on thread of cap screw (E).

5. Install new packing (F) between oil cooler (G) and bracket.

6. Attach oil cooler with holding screw (H), cover (J) and O-rings (K and L). Tighten to 35 N·m (25 lb-ft).

7. Connect coolant lines to oil cooler.

8. Install oil filter adapter (M). Tighten to 45 N·m (33 lb-ft).



CD30409 -UN-25OCT94

A—Oil filter bracket
B—Oil cooler bracket
C—Gasket
D—Gasket
E—Cap screw (to be installed with sealing compound)
F—Packing
G—Oil cooler
H—Holding screw
J—Cover
K—O-ring
L—O-ring
M—Adapter

CD,3274,G25,37 -19-01FEB94

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C. Engine with camshaft-gear-driven auxiliary drive.

1. Remove oil cooler/filter bracket (A).

2. Clean and check parts.

3. Install bracket (A) with a new packing (B) or gasket (C). Tighten holding screw (D) to 35 N·m (25 lb-ft) or cap screws (E) to 50 N·m (35 lb-ft).

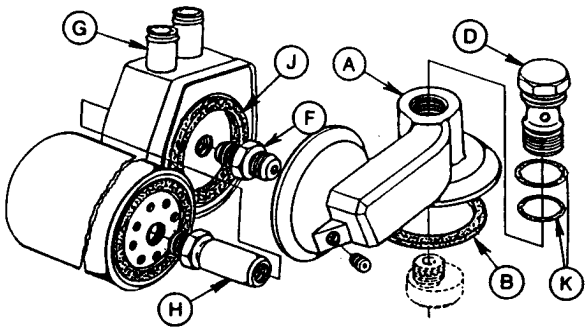
4. Install adapter (F) onto bracket. Tighten to 45 N·m (33 lb-ft).

5. Install a new packing (J) between oil cooler (G) and bracket.

6. Attach oil cooler with nipple (H). Tighten to 35 N·m (25 lb-ft).

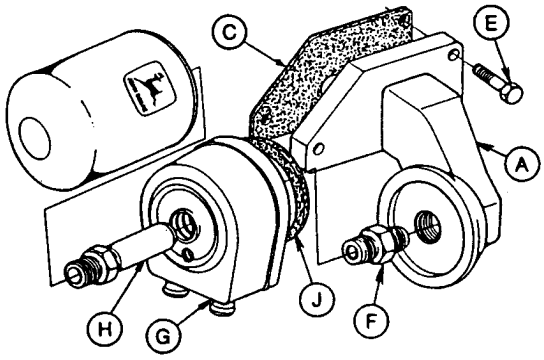
7. Connect coolant lines to oil cooler.

A—Oil cooler/filter bracket
B—Packing
C—Gasket
D—Holding screw
E—Cap screws (3 used)
F—Adapter
G—Oil cooler
H—Nipple
J—Packing
K—O-rings



CD30410 -UN-25OCT94

Short stroke engine

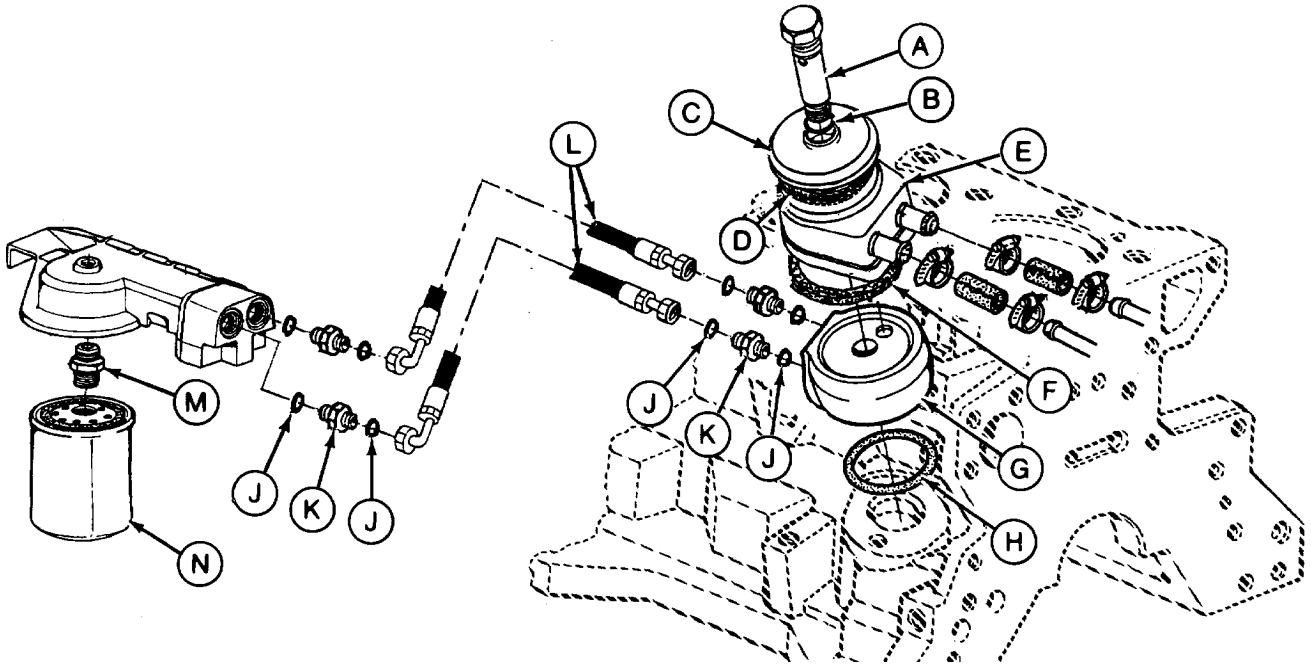


CD30411 -UN-25OCT94

Long stroke engine

CD,3274,G25,10 -19-01FEB94

REPLACE OIL FILTER ADAPTER ON ENGINE WITH REMOTE OIL FILTER



A—Holding screw
B—O-ring
C—Cover
D—O-ring
E—Oil cooler
F—Packing
G—Oil filter adapter
H—O-ring
J—O-ring
K—Fitting
L—oil hose
M—Fitting
N—Oil filter

1. Remove special screw (A) holding both the oil cooler (E) and the oil filter adapter (G).

2. Disconnect oil hoses (L) from adapter.

3. Clean and check parts.

4. Install adapter with a new O-ring (H), then attach oil cooler with packing (F), cover (C) and O-rings (D) and (B). Tighten holding screw (A) to 35 N·m (25 lb-ft).

5. Reconnect oil hoses to adapter and coolant lines to oil cooler.

CD,CTM125,141 -19-01DEC97

HIGH-FLOW OIL COOLER REMOVAL

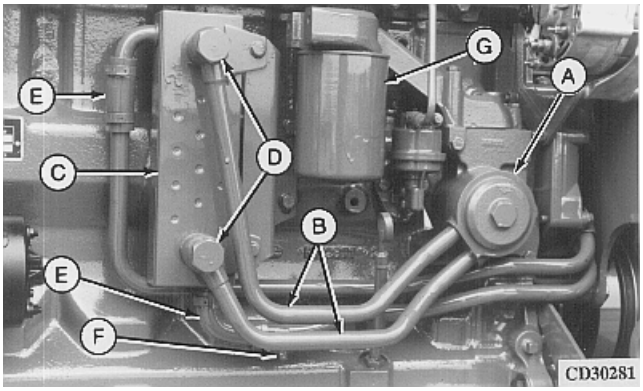
1. Drain oil cooler at coolant drain plug (F).

2. Disconnect coolant lines and remove the two banjo bolts.

3. Remove oil cooler from its support.

4. Check that water passage through cooler is not restricted by scale or dirt.

A—Distributor base
B—Oil lines
C—Oil cooler
D—Banjo bolts
E—Coolant connections
F—Coolant drain plug
G—Oil filter



-UN-06MAR95
CD30281

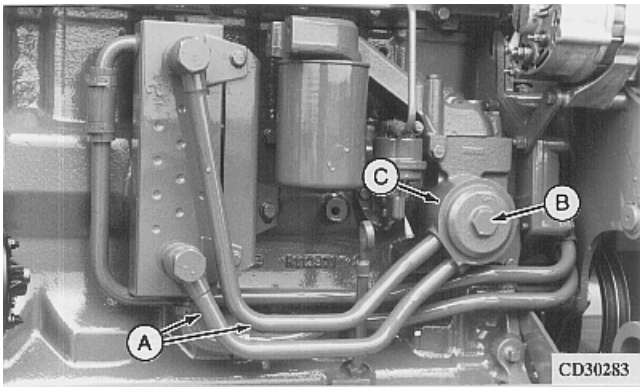
CD,3274,G25,12 -19-01FEB94

OIL COOLER DISTRIBUTOR BASE REMOVAL

1. Disconnect oil lines (A).

2. Remove holding screw (B) and lift out distributor base (C).

3. Discard packing.



-UN-06MAR95
CD30283

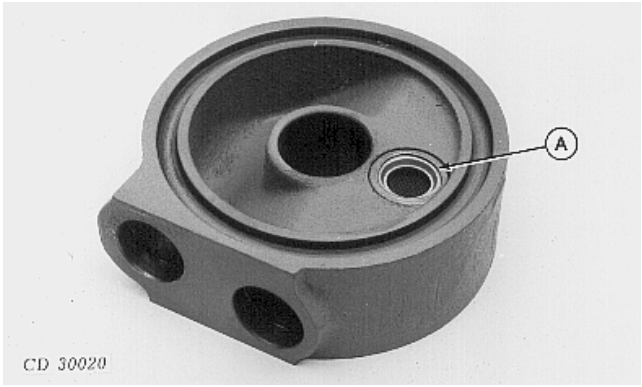
CD,3274,G25,14 -19-04AUG92

OIL COOLER DISTRIBUTOR BASE REPAIR

1. Remove oil cooler relief valve (A) and inspect for damage.

2. Replace valve if necessary.

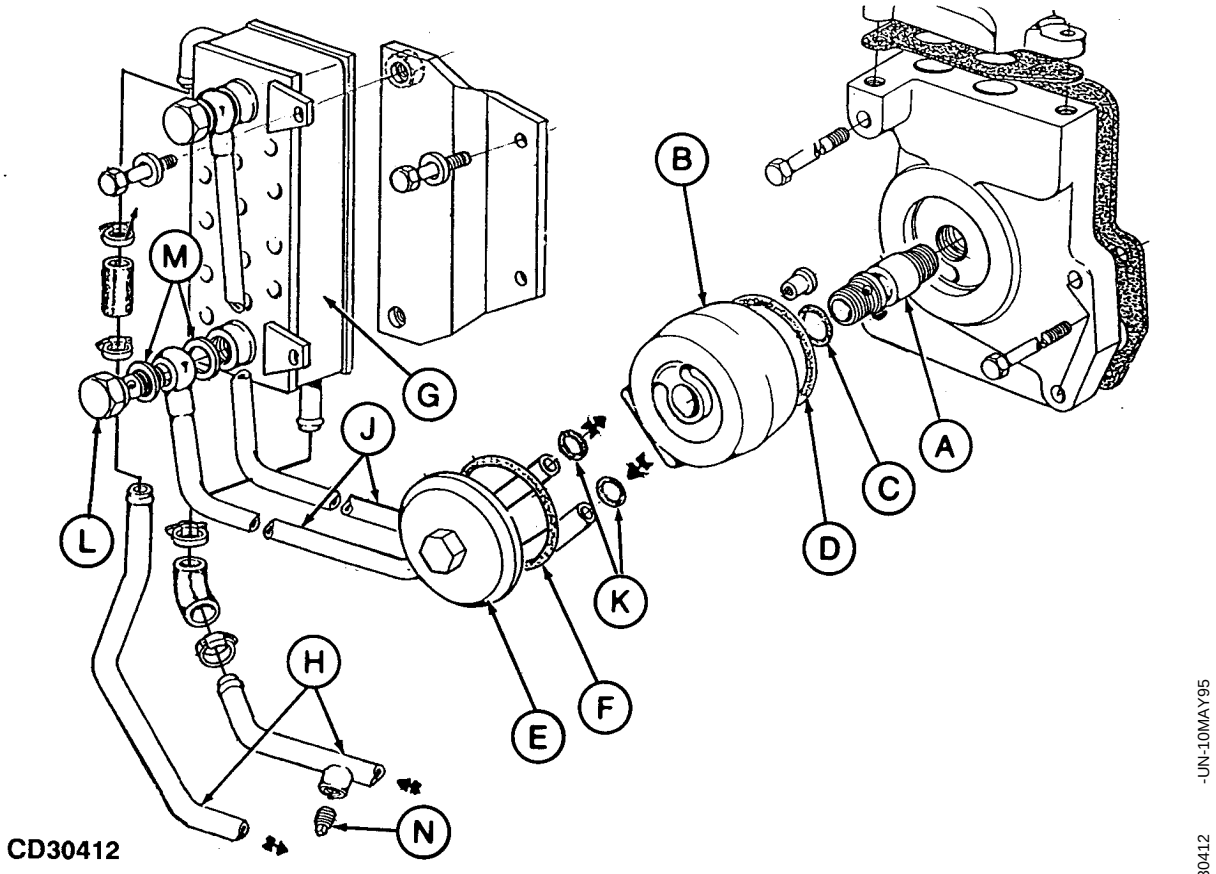
3. Install relief valve.



-UN-07MAR95
CD30020

CD,3274,G25,15 -19-30MAR92

HIGH-FLOW OIL COOLER/DISTRIBUTOR BASE INSTALLATION



A—Adapter
B—Distributor base
C—O-ring
D—O-ring
E—Cover
F—O-ring
G—Oil cooler
H—Coolant lines
J—Oil lines
K—O-rings
L—Banjo bolt
M—Copper washers
N—Coolant drain plug

1. Hand-tighten adapter (A).

2. Install distributor base (B) with O-rings (C and D).

3. Install cover (E) with O-ring (F). Tighten to 35 N·m (25 lb-ft).

4. Attach oil cooler (G) to support and connect coolant lines (H).

5. Press oil lines (J) into distributor base using new O-rings (K).

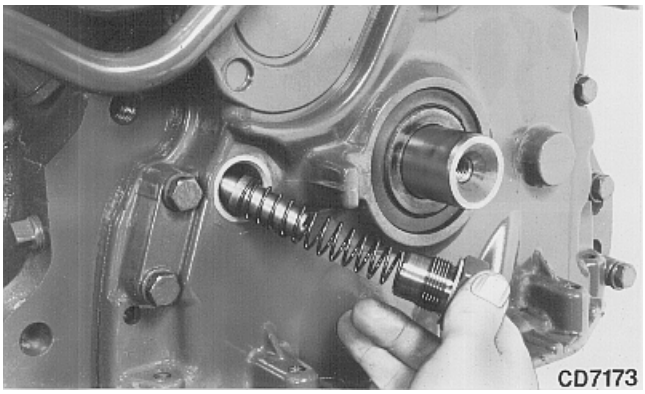
6. Connect oil lines to oil cooler using banjo bolts (L) with new copper washers (M). Tighten to 100 N·m (74 lb-ft).

CD,3274,G25,16 -19-01FEB94

OIL PRESSURE REGULATING VALVE REMOVAL

Remove oil pressure regulating valve plug. Check valve cone for excessive wear and damaged sealing face.

Spring tension at a length of 42.5 mm (1.68 in.): 60 to 75 N (13.5 to 16.5 lb).



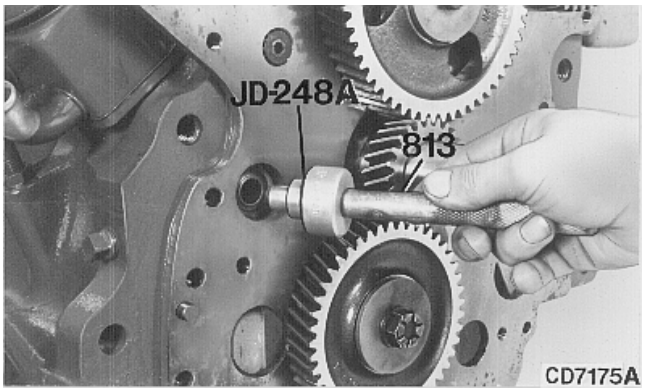
CD,3274,G25,17 -19-30MAR92

OIL PRESSURE REGULATING VALVE SEAT REPLACEMENT

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.



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CD,3274,G25,18 -19-30MAR92

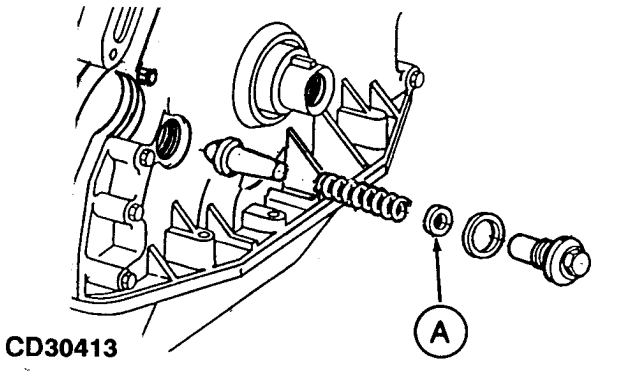
OIL PRESSURE REGULATING VALVE INSTALLATION

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 to following torque:

—Aluminium timing gear cover: 95 N·m (70 lb-ft)
—Composite material timing gear cover: 30 N·m (22 lb-ft)



CD,3274,G25,19 -19-01FEB94

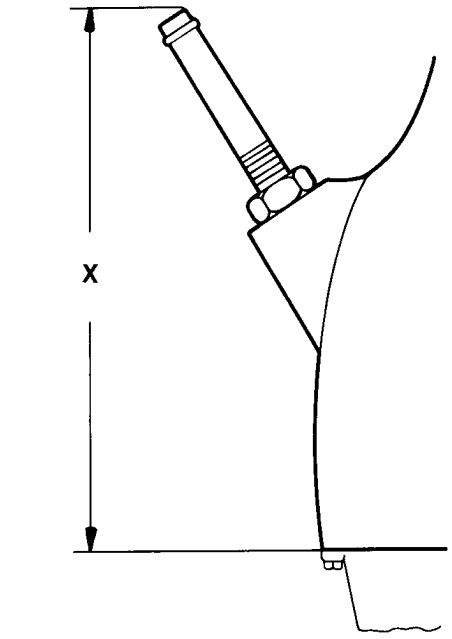
DIPSTICK GUIDE REPLACEMENT

A. Dipstick guide fastened onto cylinder block

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.



Z 20 746

Z20746 -UN-08MAR95

CD,3274,G25,20 -19-01FEB94

B. Dipstick guide fastened onto oil pan

NOTE: This type of dipstick guide acts also as oil filler neck.

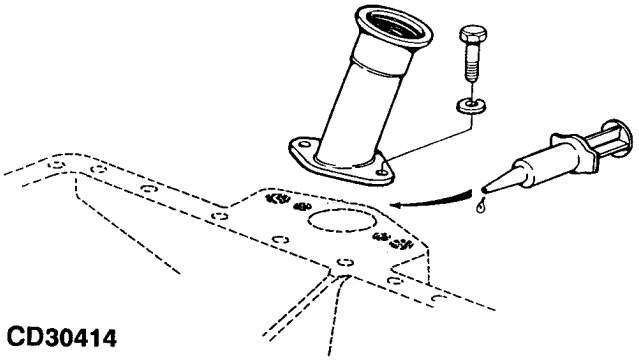
1. Remove dipstick guide.

2. Clean oil pan sealing surface.

3. Apply a bead of LOCTITE® 515 Sealant, then install a new dipstick guide.

NOTE: A tube of LOCTITE® 515 Sealant is provided with overhaul gasket set. This tube is also available under part number DD15664.

4. Tighten cap screws to 50 N·m (35 lb-ft).



CD30414

CD30414 -UN-10MAY95

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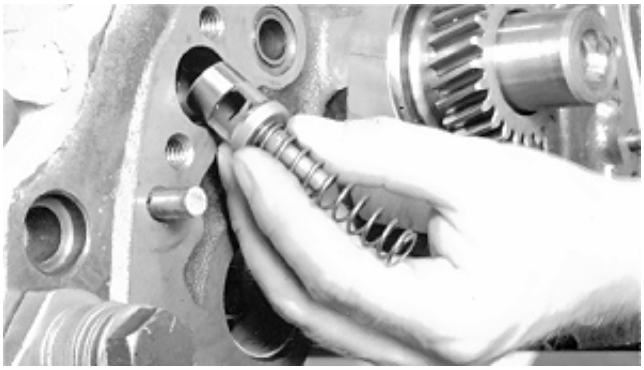
CD,3274,G25,38 -19-04JAN99

OIL BY-PASS VALVE REPLACEMENT


T87436 -UN-09NOV88

1. Remove timing gear cover and front plate.

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

IMPORTANT: By-pass valves and springs of two lengths may be installed on engine. Check the relationship between cylinder block bore depth (C), valve length (B) and free length of spring (A) as indicated in the chart.

3. Check spring calibration:

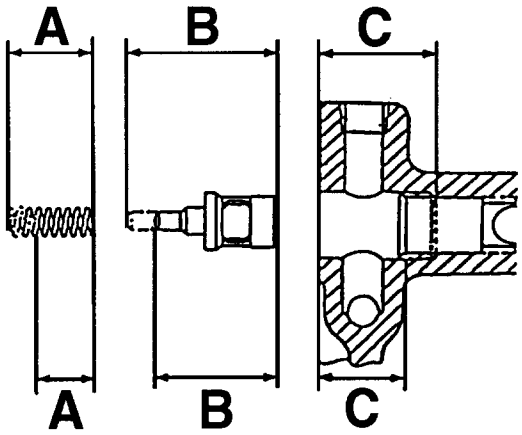
- 92 to 112 N (21 to 25 lb) for the longer spring when compressed at 34 mm (1.34 in.) length.

- 79 to 96.5 N (18 to 22 lb) for the shorter spring when compressed at 29 mm (1.14 in.) length.

4. Install oil by-pass valve and spring.

5. Install front plate and timing gear cover.

A—Spring length
B—Valve length
C—Cylinder block bore depth
Y—Longer configuration (earlier engines)
Z—Shorter configuration (later engines)



	A	B	C
Y	59.0 mm (2.32 in.)	49.5 mm (1.95 in.)	41.5 mm (1.63 in.)
Z	51.0 mm (2.00 in.)	41.0 mm (1.61 in.)	33.0 mm (1.30 in.)

CD574P1 -UN-23JUL96
CD574P1

CD,3274,G25,21 -19-04JAN99

OIL SUCTION SCREEN REPLACEMENT (ON STANDARD OIL PUMP)

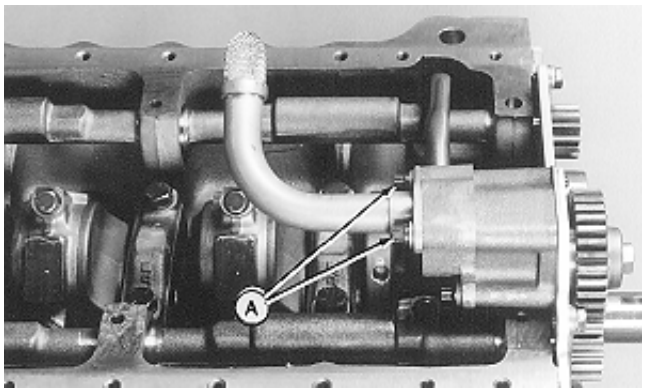
NOTE: Oil suction screen may have a paint mark (B) as shown. Install this part on the following engines only:
CD3029DRT65, CD4039DRT35, CD4039TRT35, CD4045DRT35, CD6059TF002 and CD6059TF003.

1. Remove oil pan.

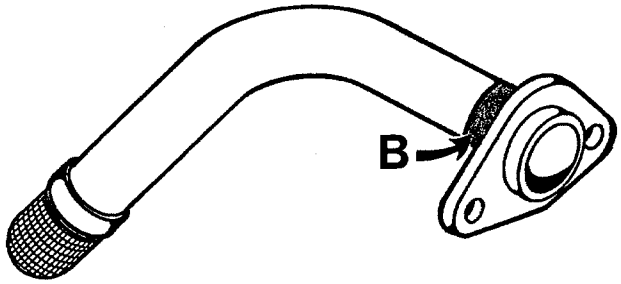
2. Loosen the two lower cap screws (A) and remove oil suction screen.

3. Install new suction screen with new O-ring and tighten cap screws to 50 N·m (35 lb-ft).

4. Reinstall oil pan.



RG7299 -UN-17FEB95



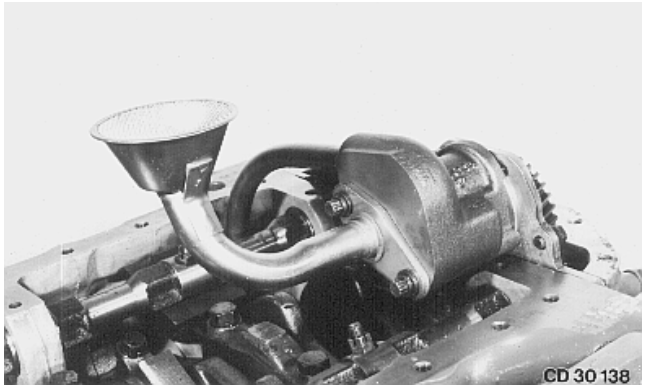
CD30716 -UN-22FEB99

CD,3274,G25,22 -19-04JAN99

OIL SUCTION SCREEN REPLACEMENT (ON HIGH-FLOW OIL PUMP)

The replacement of the oil suction screen requires the complete removal and reinstallation of the oil pump.

Refer to instructions under “HIGH-FLOW OIL PUMP” in this Group.



CD30138 -UN-07MAR95

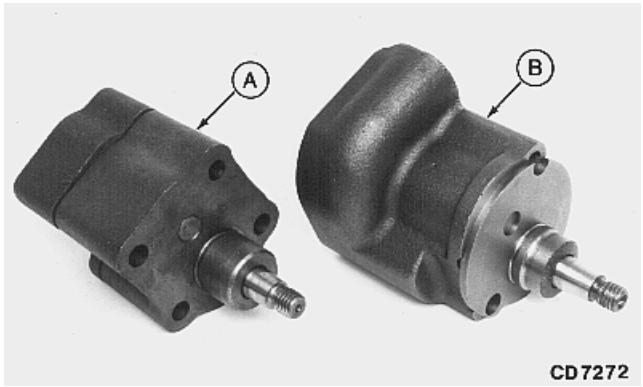
CD,3274,G25,23 -19-30MAR92

OIL PUMP IDENTIFICATION

Two types of oil pump are installed on Saran engines. One type has a higher oil flow capacity than the other.

NOTE: The standard oil pump can be assembled with 3 or 4 cap screws.

A—Standard oil pump
B—High-flow oil pump



CD7272 -UN-23MAY95

CD,3274,G25,24 -19-31MAR92

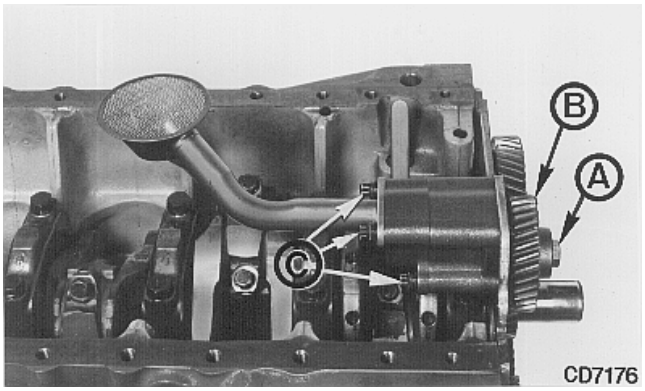
STANDARD OIL PUMP REMOVAL

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 or 4 cap screws (C) attaching pump housing to front plate.

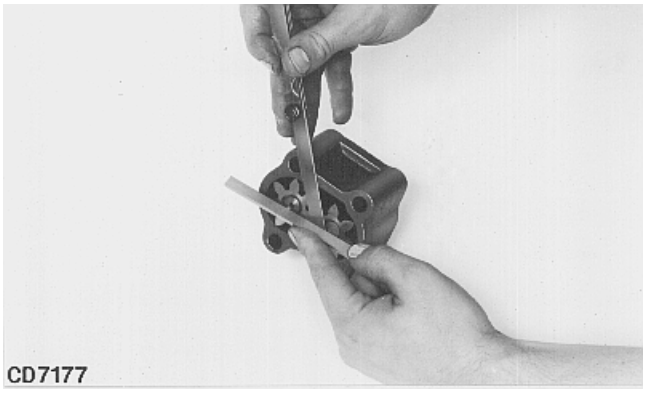


-UN-07MAR95 CD7176

CD,3274,G25,25 -19-30MAR92

GEAR AXIAL CLEARANCE (STANDARD OIL PUMP)

Thickness of gears:
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.)
Max. permissible axial clearance :
0.22 mm (0.0085 in.)

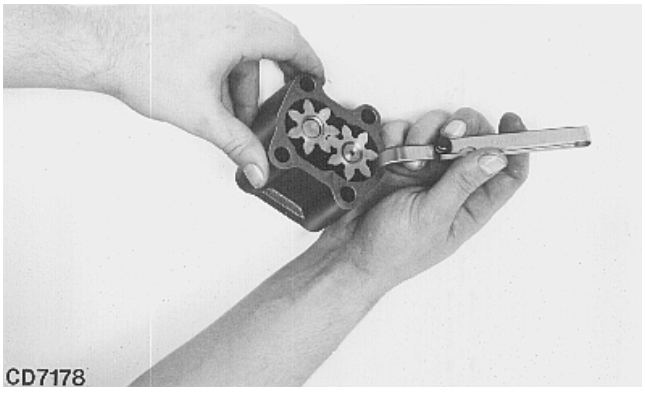


-UN-07MAR95 CD7177

CD,3274,G25,26 -19-30MAR92

GEAR RADIAL CLEARANCE (STANDARD OIL PUMP)

Radial clearance between gear and pump housing :
0.10 to 0.16 mm (0.004 to 0.006 in.)
Max. permissible radial clearance :
0.20 mm (0.008 in.)



-UN-07MAR95 CD7178

CD,3274,G25,27 -19-30MAR92

STANDARD OIL PUMP SPECIFICATIONS

Bore of drive shaft in pump housing:
16.05 to 16.08 mm (0.632 to 0.633 in.)

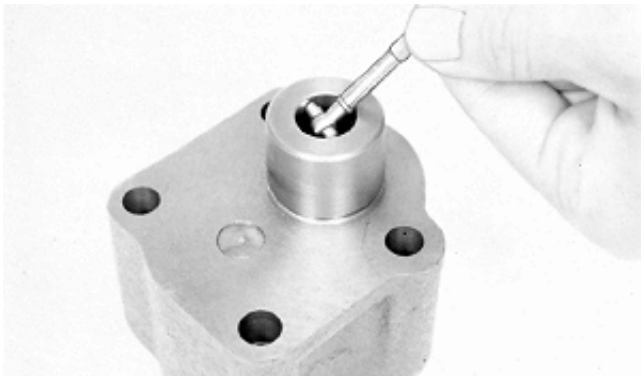
Max. permissible wear: 0.08 mm (0.003 in.)

Drive shaft O.D.:
16.02 to 16.03 mm (0.630 to 0.631 in.)

Max. permissible wear: 0.025 mm (0.001 in.)

Idler shaft O.D.: 12.32 to 12.34 mm (0.485 to 0.486 in.)

Max. permissible wear: 0.013 mm (0.0005 in.)

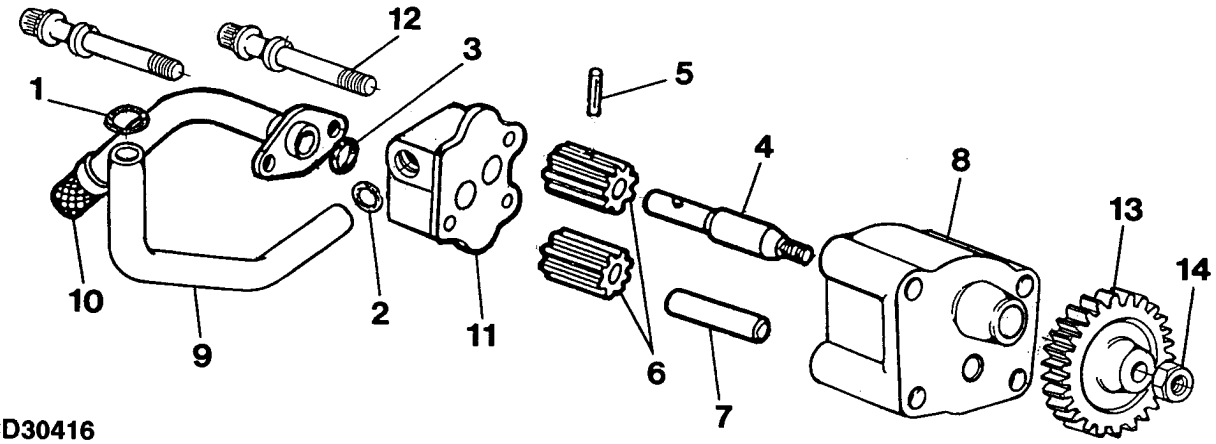


T81953 -UN-09NOV88

T81781 -UN-09NOV88

CD,3274,G25,28 -19-30MAR92

STANDARD OIL PUMP INSTALLATION



CD30416 -UN-10MAY95

1—Cylinder block seal
2—O-ring (outlet tube)
3—O-ring (oil strainer tube)
4—Drive shaft
5—Spring pin
6—Gears
7—Shaft
8—Housing
9—Outlet tube
10—Strainer
11—Cover
12—Cap screws (3 or 4 used)
13—Drive gear
14—Nut

CD,3274,G25,29 -19-01FEB94

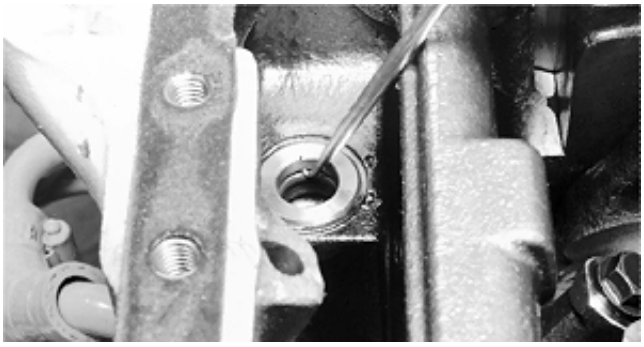
1. Install new seal in cylinder block.

NOTE: Depending on the machining of the cylinder block, two types of seals can be used:

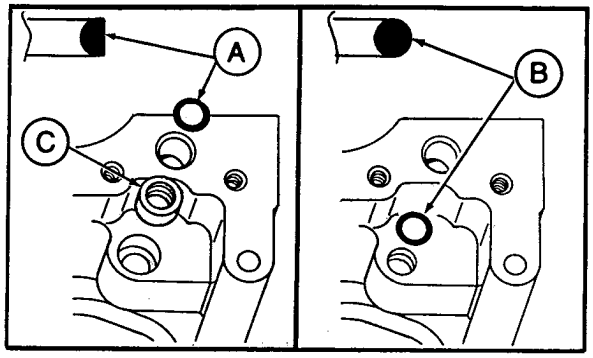
- Type (A) for cylinder block with bushing (C).
- Type (B) for cylinder block without bushing.

2. 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.



T88931 -UN-09NOV88



CD30417

CD30417 -UN-10MAY95

CD,3274,G25,39 -19-04JAN99

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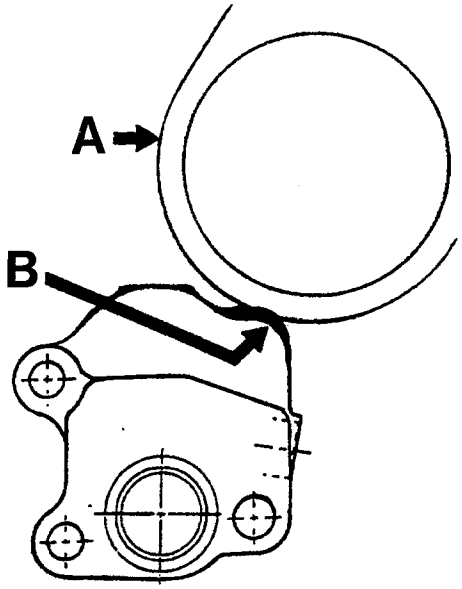
4. Install outlet tube, strainer and pump cover as follows:

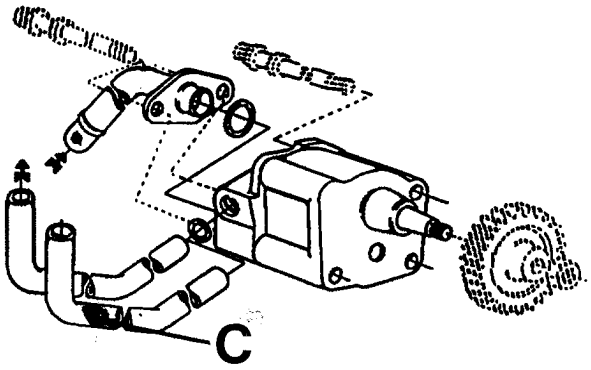
• On engines up to 248035CD, it may be necessary to grind the oil pump cover as shown, to prevent contact with crankshaft.

• Use outlet tube with paint mark (C) on 6200 and 6300 tractors with engines up to 221092CD as well as on all long stroke engines (4045 and 6068).

A—Crankshaft
B—Oil pump cover area to be ground
C—Paint mark



CD30717 -UN-22FEB99



CD30718 -UN-22FEB99

CD,3274,G25,51 -19-04JAN99

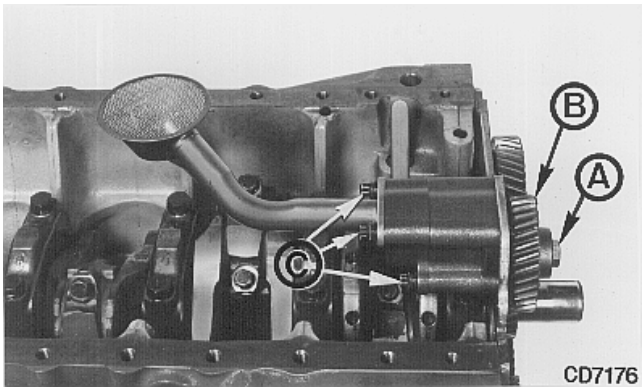
5. Attach oil pump assembly to front plate, tightening cap screws (C) to 50 N·m (35 lb-ft).

6. Rotate pump shaft, again making sure that pump gears turn freely.

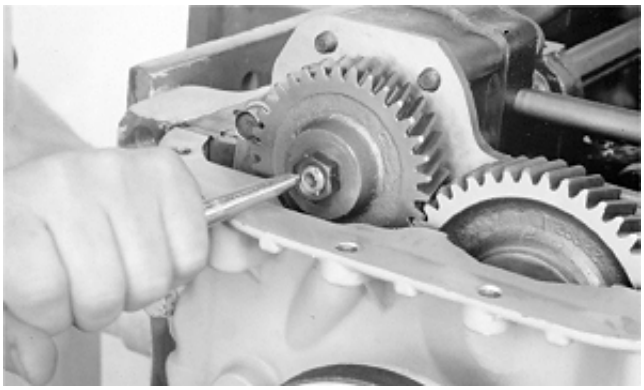
7. Install pump drive gear (B) and tighten hex. nut (A) to 75 N·m (55 lb-ft).

8. Secure the nut by applying three center punch marks.

NOTE: When installing the oil pump, make sure that crankshaft gear and gear of left-hand balancer shaft are not turned (4-cyl. engines only).



-UN-07MAR95
CD7176



-UN-09NOV88
T81782

CD,3274,G25,40 -19-01FEB94

HIGH-FLOW OIL PUMP REMOVAL

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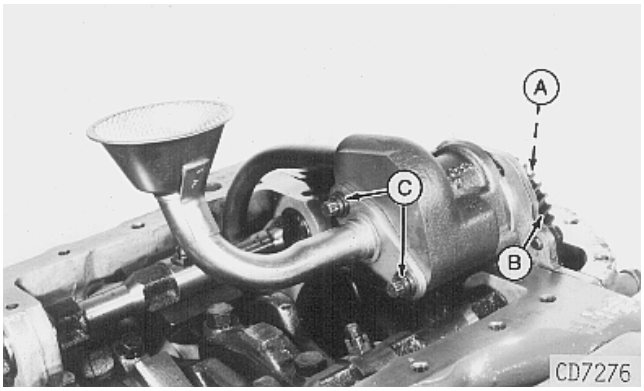
32

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 two cap screws (C) attaching pump housing to front plate.

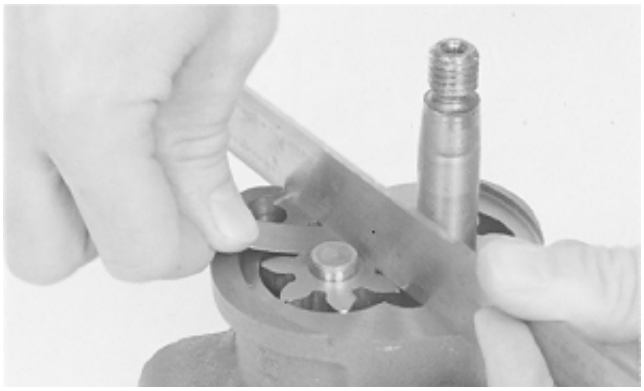


-UN-07MAR95
CD7276

CD,3274,G25,30 -19-30MAR92

GEAR AXIAL CLEARANCE (HIGH-FLOW OIL PUMP)

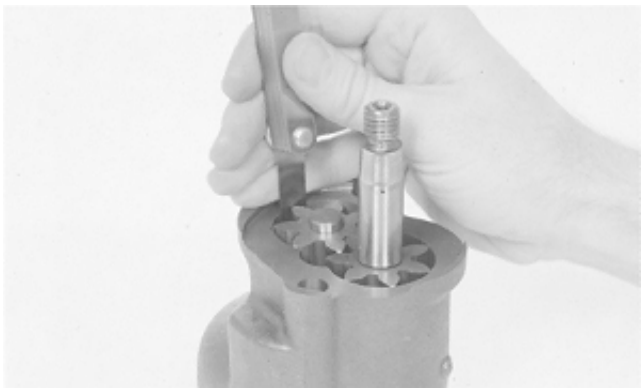
Thickness of gears:
50.97 to 51.02 mm (2.007 to 2.009 in.)
Axial clearance:
0.04 to 0.17 mm (0.0015 to 0.006 in.)
Max. permissible axial clearance:
0.22 mm (0.0085 in.)



CD,3274,G25,31 -19-30MAR92

GEAR RADIAL CLEARANCE (HIGH-FLOW OIL PUMP)

Radial clearance between gear and pump housing:
0.08 to 0.18 mm (0.003 to 0.007 in.)
Max. permissible radial clearance:
0.23 mm (0.009 in.)



CD,3274,G25,32 -19-30MAR92

HIGH-FLOW OIL PUMP SPECIFICATIONS

Bore of drive shaft in pump cover (A) :
16.06 to 16.08 mm (0.632 to 0.633 in.)

Max. permissible wear: 0.08 mm (0.003 in.)

Drive shaft O.D. (B):
16.02 to 16.03 mm (0.630 to 0.631 in.)

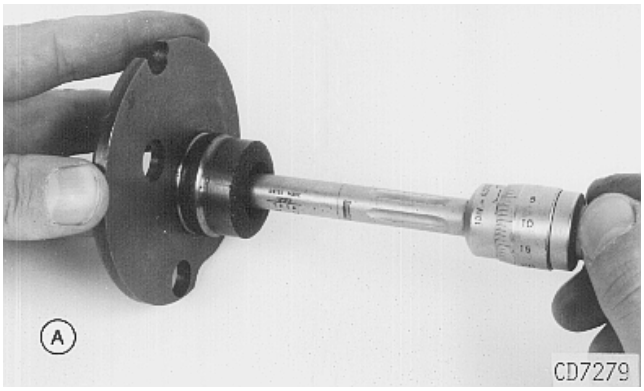
Max. permissible wear: 0.025 mm (0.001 in.)

Drive shaft O.D. (C):
12.256 to 12.266 mm (0.4825 to 0.4829 in.)

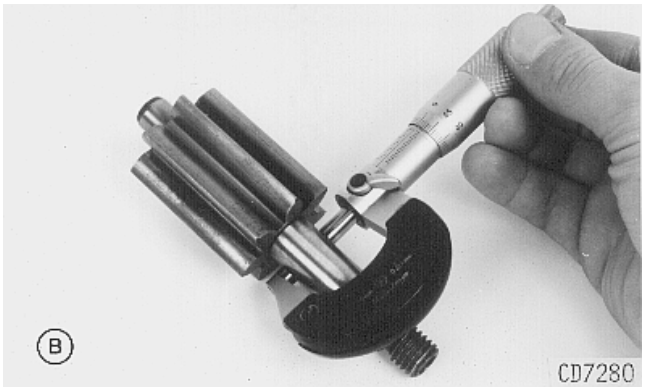
Max. permissible wear: 0.025 mm (0.001 in.)

Bore of drive shaft in pump housing (D) :
12.28 to 12.31 mm (0.4835 to 0.4845 in.)

Maximum permissible wear: 0.013 mm (0.0005 in.)

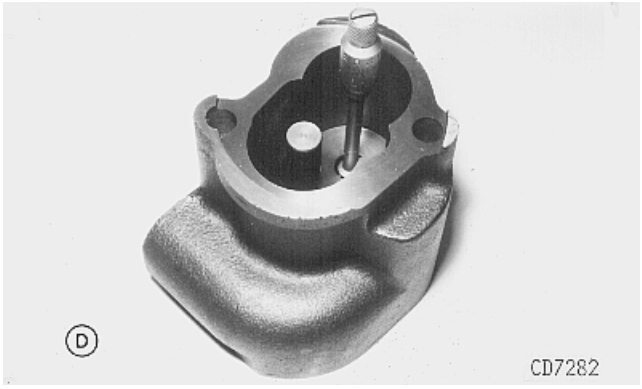


-UN-07MAR95 CD7279



-UN-07MAR95 CD7280

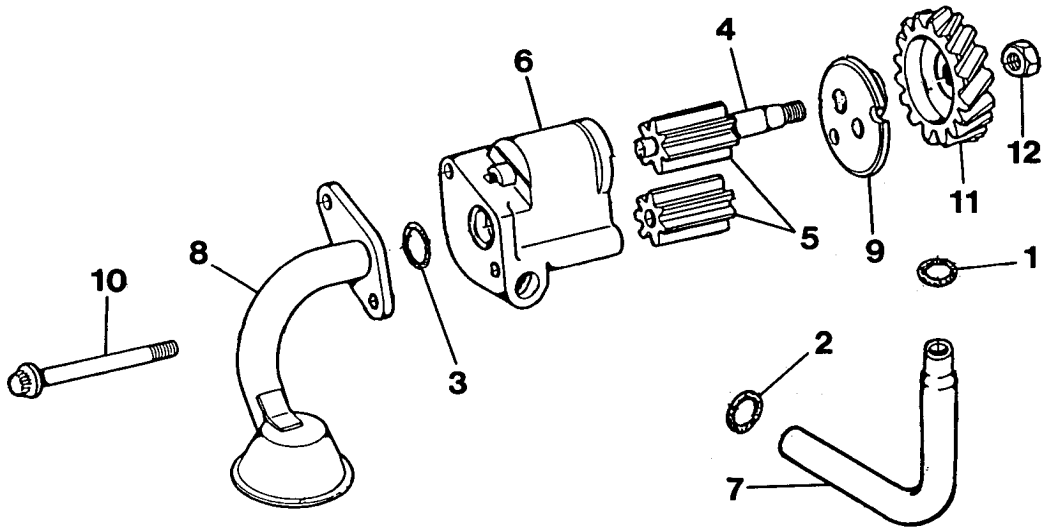
-UN-07MAR95 CD7281



-UN-07MAR95 CD7282

CD,3274,G25,33 -19-30MAR92

HIGH-FLOW OIL PUMP INSTALLATION



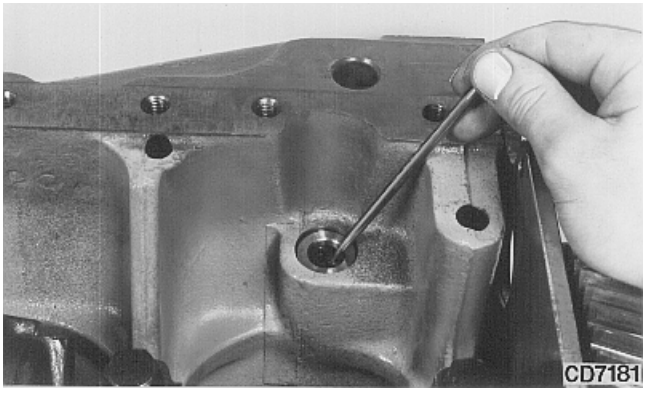
1—Cylinder block O-ring
2—O-ring (outlet tube)
3—O-ring (strainer tube)
4—Drive shaft
5—Gears
6—Housing
7—Outlet tube
8—Strainer
9—Pump cover
10—Cap screws (2 used)
11—Drive gear
12—Nut

CD,3274,G25,34 -19-01FEB94

1. Install new O-rings in cylinder block, pump housing (for outlet tube) and on oil strainer tube.

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

3. Install outlet tube, strainer and pump cover.



CD,3274,G25,41 -19-01FEB94

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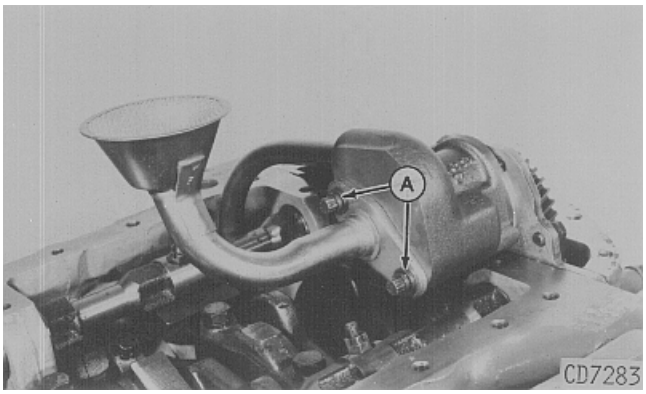
4. Attach oil pump assembly to front plate, tightening cap screws (A) to 50 N·m (35 lb-ft).

5. Rotate pump shaft, again making sure that pump gears turn freely.

6. Install pump drive gear (B) and tighten hex. nut (C) to 75 N·m (55 lb-ft).

7. Secure the nut by applying three center punch marks.

NOTE: When installing the oil pump, make sure that crankshaft gear and gear of left-hand balancer shaft are not turned (4-cyl. engines only).



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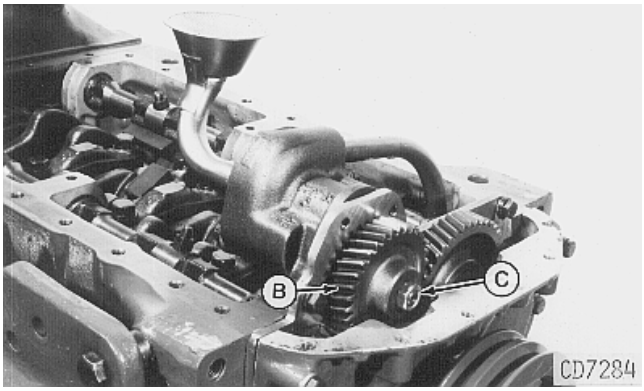
CD7283



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CD7284

CD,3274,G25,42 -19-01FEB94

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OIL PAN INSTALLATION

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.

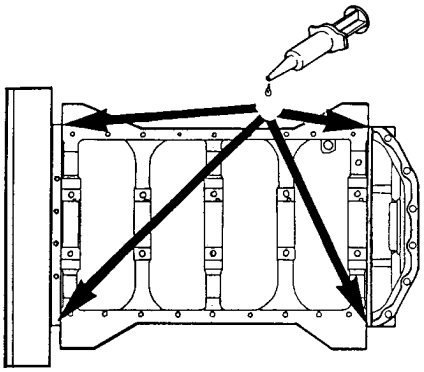
3. Install oil pan and tighten cap screws as follows:

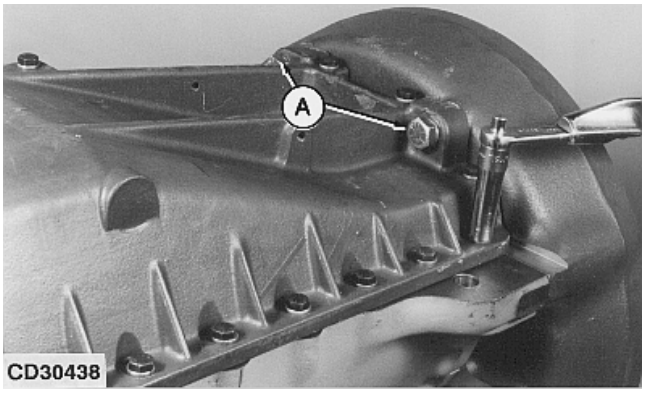
Oil pan (all types) to aluminium timing gear cover	50 N·m (35 lb-ft)
Oil pan (all types) to composite material timing gear cover	30 N·m (22 lb-ft)
Sheet metal oil pan to block and flywheel housing	50 N·m (35 lb-ft)
Aluminium oil pan to block and flywheel housing	50 N·m (35 lb-ft)
Cast iron pan to block and flywheel housing:	
SAE 5 screws (3 dashes)	50 N·m (35 lb-ft)
SAE 8 screws (6 dashes)	70 N·m (50 lb-ft)

4. On 3000/3010 Series tractors, tighten the two cap screws (A) to 320 N·m (235 lb-ft).

5. Install a new seal onto cylindrical drain plug. Tighten as follows:

Cylindrical plug	70 N·m (50 lb-ft)
Conical plug	55 N·m (40 lb-ft)





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CD,3274,G25,35 -19-04JAN99

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SPECIAL OR ESSENTIAL TOOLS

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

DX,TOOLS -19-20JUL95

CD30285 -UN-08MAR95

Bearing driver JD-262A

To install water pump bearing (small bearing).

CD 030285

CD,JD262A -19-04AUG92

CD30286 -UN-08MAR95

Bearing driver JDE74

To install water pump bearing (large bearing).

CD 030286

CD,JDE74 -19-07APR92

RG5109 -UN-23AUG88

Seal Remover JDG22

Remove oil seals.

S53,JDG22 -19-05APR90

RG5133 -UN-23AUG88

O-Ring Seal Tool Set JDG127

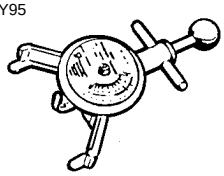
Remove O-rings.

S53,JDG127,B -19-05APR90

JDG529 -UN-10MAY95

Tension gauge JDG529

Measure V-Belt tension.



CD,JDG529 -19-01FEB94

SPECIFICATIONS

	DIMENSIONS OF NEW PARTS	WEAR LIMIT
Clearance between pump housing and impeller		
• Engine without rotating assembly	0—0.25 mm (0—0.01 in.)	
• Engine with rotating assembly	1—1.3 mm (0.04—0.05 in.)	
Thermostat opening	82˚C (180˚F)	
Fan belt tension (standard V-belts)	19 mm (0.75 in.) deflection with a 90 N (20 lb) force applied halfway between the two pulleys.	

CD,3274,G30,1 -19-04JAN99

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SPECIFICATIONS - CONTINUED

Distance from pulley or hub to pump housing sealing surface:

Machine Model No.	Distance
• Mannheim Tractors:	
3100 to 3400/3400 X	155 mm (6.10 in.)
3110 to 3410/3410 X	155 mm (6.10 in.)
6100 to 6400 with cast iron pulley	94 mm (3.70 in.)
6100 to 6400 with sheet metal pulley	97.5 mm (3.84 in.)
6506 to 6900	95.5 mm (3.84 in.)
• 5000-Series Tractors: (Agritalia-built)	
5300/5300N	136 mm (5.35 in.)
5400/5400N	136 mm (5.35 in.)
5500/5500N	137 mm (5.39 in.)
• 5000-Series Tractors: (Augusta-built)	
5400N	136 mm (5.35 in.)
5500N	137 mm (5.39 in.)
• 5000-Series Tractors: (For India)	
5300	136 mm (5.35 in.)
• 7000-Series Tractors:	
7600	94 mm (3.70 in.)
• 4000-Series Telescopic Handlers:	
4400 and 4500	140 mm (5.51 in.)
• 2000-Series Combines:	
2054 and 2254 (Water pump pulley)	158.5 mm (6.24 in.)
2054 and 2254 (Fan pulley)	174.5 mm (6.87 in.)
• Engines for Chinese Combines:	
CD6059TYC01 and CD6059TYC02	181.5 mm (7.14 in.)
• Engines for GOLDONI Tractors:	
CD3029DFG21	137 mm (5.39 in.)
CD3029DFG22	137 mm (5.39 in.)
CD3029TFG21	137 mm (5.39 in.)

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CD,3274,G30,39 -19-04JAN99

SPECIFICATIONS - CONTINUED

Distance from pulley or hub to pump housing sealing surface:

SARAN OEM ENGINES	Option code	Distance
• CD3029DF, CD3029DF001	2004, 2005, 2007	140 mm (5.51 in.)
	2014	137 mm (5.39 in.)
	2033	165 mm (6.50 in.)
• CD3029DF005	2007	140 mm (5.51 in.)
• CD3029DF031	2004, 2005	140 mm (5.51 in.)
	2007, 2014	137 mm (5.39 in.)
• CD3029DF032	2004	140 mm (5.51 in.)
• CD3029DF033	2014	137 mm (5.39 in.)
• CD3029DF034	2004	140 mm (5.51 in.)
• CD3029DF120	2010, 2022, 2024	137 mm (5.39 in.)
	2020, 2021, 2034	140 mm (5.51 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	140 mm (5.51 in.)
• CD3029DF160	2022	137 mm (5.39 in.)
	2020, 2021	140 mm (5.51 in.)
	2023	165 mm (6.50 in.)
• CD3029DF161	2020	140 mm (5.51 in.)
• CD3029DF162	2024	137 mm (5.39 in.)
• CD3029DF163	2020	140 mm (5.51 in.)
• CD3029DF164	2020	140 mm (5.51 in.)
• CD3029DF165	2024	137 mm (5.39 in.)

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CD,3274,G30,40 -19-04JAN99

SPECIFICATIONS - CONTINUED

Distance from pulley or hub to pump housing sealing surface:

SARAN OEM ENGINES	Option code	Distance
• CD3029TF	2007, 2014	137 mm (5.39 in.)
• CD3029TF001	2004, 2005, 2011	140 mm (5.51 in.)
	2007, 2014	137 mm (5.39 in.)
	2033	165 mm (6.50 in.)
• CD3029TF002	2014	137 mm (5.39 in.)
• CD3029TF031	2004, 2005, 2011	140 mm (5.51 in.)
	2007, 2014	137 mm (5.39 in.)
• CD3029TF032	2004	140 mm (5.51 in.)
• CD3029TF033	2014	137 mm (5.39 in.)
• CD3029TF120	2020, 2021	140 mm (5.51 in.)
	2022, 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.)

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CD,3274,G30,41 -19-04JAN99

SPECIFICATIONS - CONTINUED

Distance from pulley or hub to pump housing sealing surface:

SARAN OEM ENGINES	Option code	Distance
• CD4039DF	2004, 2005, 2007, 2013	140 mm (5.51 in.)
	2014	137 mm (5.39 in.)
	2021, 2022	163.5 mm (6.44 in.)
	2033	165 mm (6.50 in.)
• CD4039DF001	2004, 2005, 2013	140 mm (5.51 in.)
	2007, 2014	137 mm (5.39 in.)
	2021, 2022	163.5 mm (6.44 in.)
	2033	165 mm (6.50 in.)
• CD4039DF002	2013, 2026	140 mm (5.51 in.)
• CD4039DF004	2004	140 mm (5.51 in.)
• CD4039DF005	2007	140 mm (5.51 in.)
• CD4039DF006	2007	140 mm (5.51 in.)
• CD4039DF007	2026	137 mm (5.39 in.)
• CD4039DF008	2026	137 mm (5.39 in.)
• CD4039DF031	2004, 2005, 2026	140 mm (5.51 in.)
	2007, 2014	137 mm (5.39 in.)
• CD4039DF032	2014	137 mm (5.51 in.)

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CD,3274,G30,42 -19-04JAN99

SPECIFICATIONS - CONTINUED

Distance from pulley or hub to pump housing sealing surface:

SARAN OEM ENGINES	Option code	Distance
• CD4039TF	2004, 2021, 2022	163.5 mm (6.44 in.)
	2005, 2013, 2026	140 mm (5.51 in.)
	2014	137 mm (5.39 in.)
	2023	188.5 mm (7.42 in.)
• CD4039TF001	2004, 2021, 2022	163.5 mm (6.44 in.)
	2005, 2013, 2026	140 mm (5.51 in.)
	2014	137 mm (5.39 in.)
	2023	188.5 mm (7.42 in.)
• CD4039TF002	2013, 2026	140 mm (5.51 in.)
• CD4039TF003	2026	140 mm (5.51 in.)
• CD4039TF004	2026	140 mm (5.51 in.)
• CD4039TF005	2026	140 mm (5.51 in.)
• CD4039TF006	2026	140 mm (5.51 in.)
• CD4039TF007	2027	137 mm (5.39 in.)
• CD4039TF008	2027	137 mm (5.39 in.)
• CD4039TF031	2004	163.5 mm (6.44 in.)
	2005, 2026	140 mm (5.51 in.)
	2014	137 mm (5.39 in.)
• CD4039TF032	2014	137 mm (5.39 in.)

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CD,3274,G30,43 -19-04JAN99

SPECIFICATIONS - CONTINUED

Distance from pulley or hub to pump housing sealing surface:

SARAN OEM ENGINES	Option code	Distance
• CD6059DF	2004, 2008	163.5 mm (6.44 in.)
	2023	188.5 mm (7.42 in.)
	2033	165 mm (6.50 in.)
• CD6059DF001	2004, 2008	163.5 mm (6.44 in.)
	2023	188.5 mm (7.42 in.)
	2033	165 mm (6.50 in.)
• CD6059DF002	2004, 2008	163.5 mm (6.44 in.)
• CD6059DF003	2004	163.5 mm (6.44 in.)
• CD6059TF, CD6059TF001	2004, 2008	163.5 mm (6.44 in.)
	2023	188.5 mm (7.42 in.)
	2033	165 mm (6.50 in.)
• CD6059TF002	2004, 2005	163.5 mm (6.44 in.)
• CD6059TF003	2004, 2005	163.5 mm (6.44 in.)
• CD6059TF004	2004, 2008	163.5 mm (6.44 in.)
• CD6059TF005	2005	162 mm (6.38 in.)
• CD6059TF006	2005	162 mm (6.38 in.)
• CD6059TF007	2004	163.5 mm (6.44 in.)
	2023	188.5 mm (7.42 in.)
• CD6059TF008	2005	162 mm (6.38 in.)

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CD,3274,G30,44 -19-04JAN99

SPECIFICATIONS - CONTINUED

Distance from pulley or hub to pump housing sealing surface:

SARAN OEM ENGINES	Option code	Distance
• CD4045DF001	2004, 2019	163.5 mm (6.44 in.)
	2016, 2017	140 mm (5.51 in.)
	2023	188.5 mm (7.42 in.)
• CD4045DF031	2004	163.5 mm (6.44 in.)
	2016, 2017	140 mm (5.51 in.)
• CD4045TF001	2004, 2019	163.5 mm (6.44 in.)
	2016, 2017	140 mm (5.51 in.)
	2023	188.5 mm (7.42 in.)
• CD4045TF002	2016, 2026	140 mm (5.51 in.)
• CD4045TF003	2016	140 mm (5.51 in.)
• CD4045TF008	2016	140 mm (5.51 in.)
• CD4045TF031	2004	163.5 mm (6.44 in.)
	2016, 2017	140 mm (5.51 in.)
• CD6068DF001	2004, 2008	163.5 mm (6.44 in.)
	2023	188.5 mm (7.42 in.)
• CD6068TF001	2004, 2008	163.5 mm (6.44 in.)
	2023	188.5 mm (7.42 in.)
• CD6068TF002	2004	163.5 mm (6.44 in.)
	2023	188.5 mm (7.42 in.)
• CD6068TF003	2005	162 mm (6.38 in.)
• CD6068TF004	2005	162 mm (6.38 in.)
• CD6068TF008	2005	162 mm (6.38 in.)
• CD6068TF009	2005	162 mm (6.38 in.)

CD,3274,G30,45 -19-04JAN99

TORQUES FOR HARDWARE

Water pump to cylinder block:	
• Cap screws	50 N·m (35 lb-ft)
• Nut	40 N·m (30 lb-ft)
Back plate to water pump housing	45 N·m (33 lb-ft)
Rotating assembly to water pump housing	30 N·m (22 lb-ft)
Sheet metal pulley and fan to pulley hub	50 N·m (35 lb-ft)
Fan to cast iron pulley:	
• 5/16 in. cap screws	30 N·m (22 lb-ft)
• 3/8 in. cap screws	50 N·m (35 lb-ft)
Thermostat cover to thermostat housing	30 N·m (22 lb-ft)
Thermostat or water outlet housing to cylinder head	50 N·m (35 lb-ft)
Fan bracket onto engine (2054/2254 combines)	
• Cap screws	300 N·m (220 lb-ft)
• Nuts	50 N·m (35 lb-ft)

CD,3274,G30,3 -19-04JAN99

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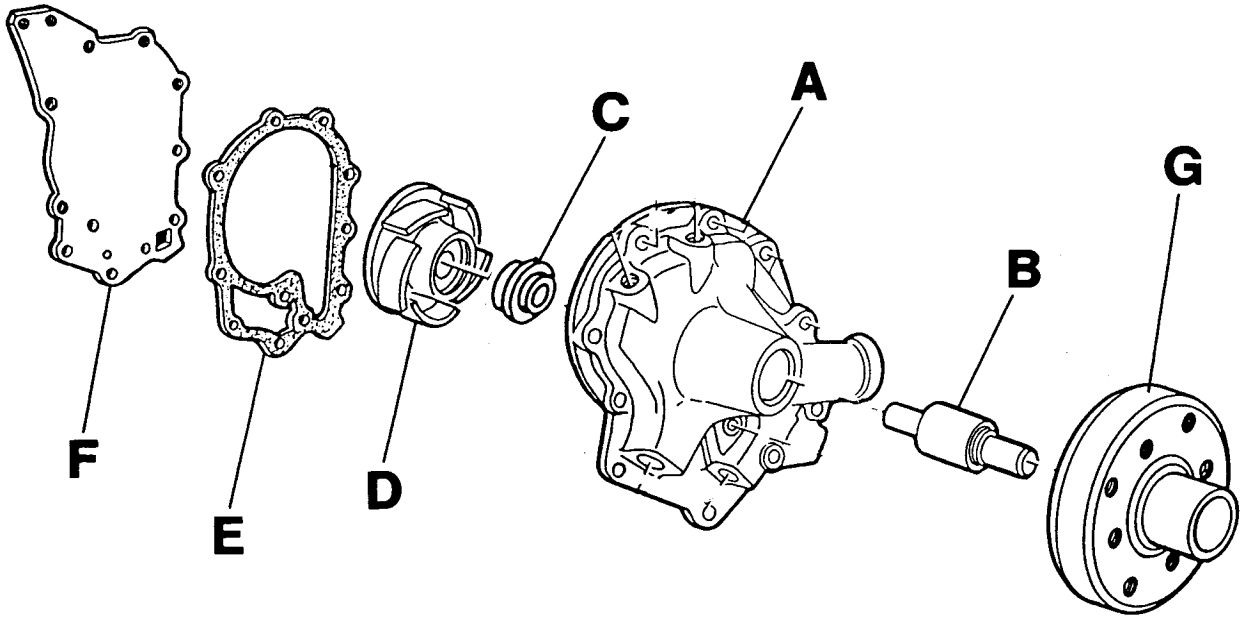
WATER PUMP — EXPLODED VIEW



CD30421 -UN-10MAY95

CD30421

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

CD,3274,G30,22 -19-01FEB94

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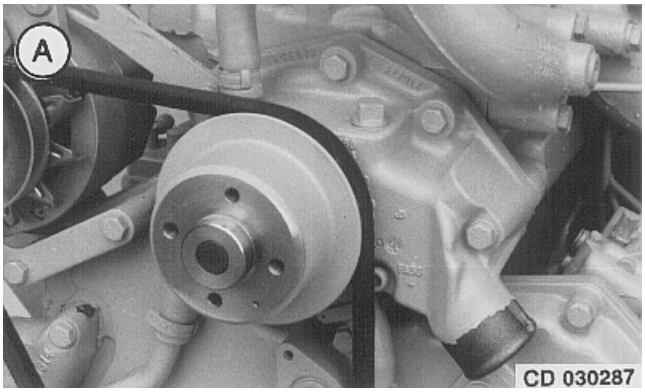
WATER PUMP IDENTIFICATION

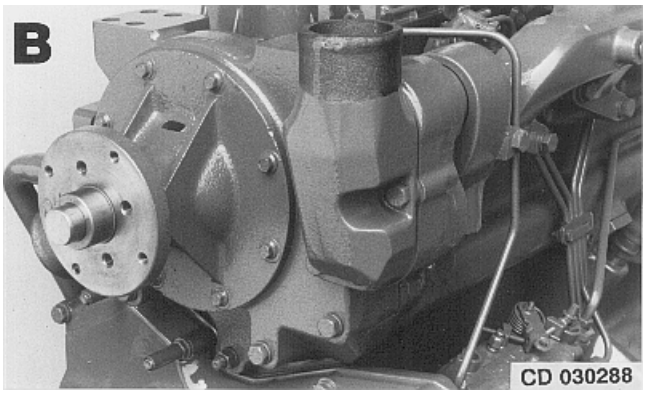
—**A— Standard water pump** with one-piece shaft/ball bearing pressed into housing. Used with separate thermostat housing and rear cover.



CD30287 -UN-06MAR95

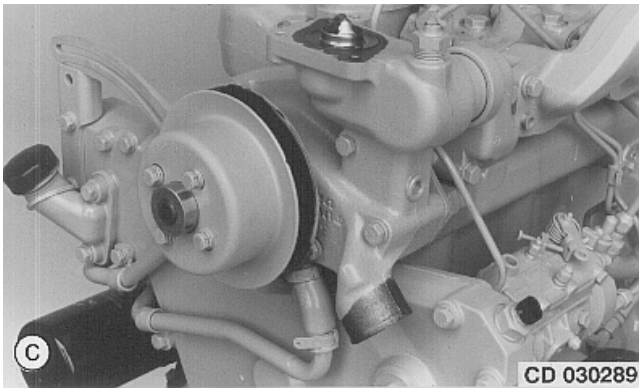
CD,3274,G30,23 -19-01FEB94

—**B— Water pump with removable rotating assembly.** The pump housing incorporates also the dual thermostat housing. A one-piece shaft/ball bearing is pressed into the rotating assembly.



CD,3274,G30,24 -19-01FEB94

—**C— Water pump with built-in single thermostat housing.** A one-piece shaft/ball bearing pressed into the pump housing and a rear cover is used.



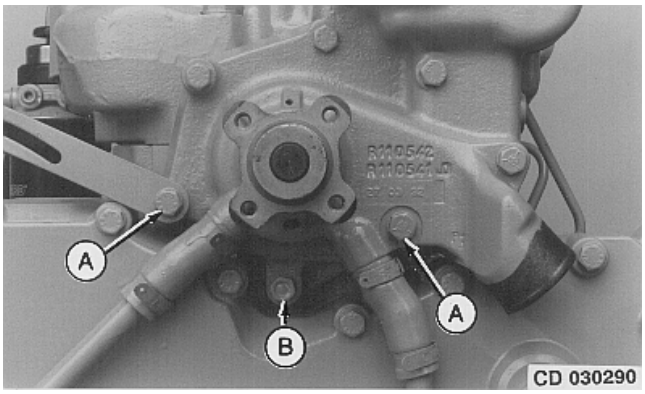
CD,3274,G30,25 -19-01FEB94

WATER PUMP REMOVAL

1. Remove fan.

2. Disconnect water pump hoses.

3. Remove attaching screws (A) and nut (B) then lift out water pump.



CD,3274,G30,5 -19-07APR92

DISASSEMBLE WATER PUMP (STANDARD MODEL)

NOTE: When water pump operation is abnormal or when coolant drains from the weep hole (G), disassemble water pump as follows.

1. Remove rear cover (A) and discard gasket.

2. Using a suitable puller, remove pulley (B) or hub from bearing shaft (C).

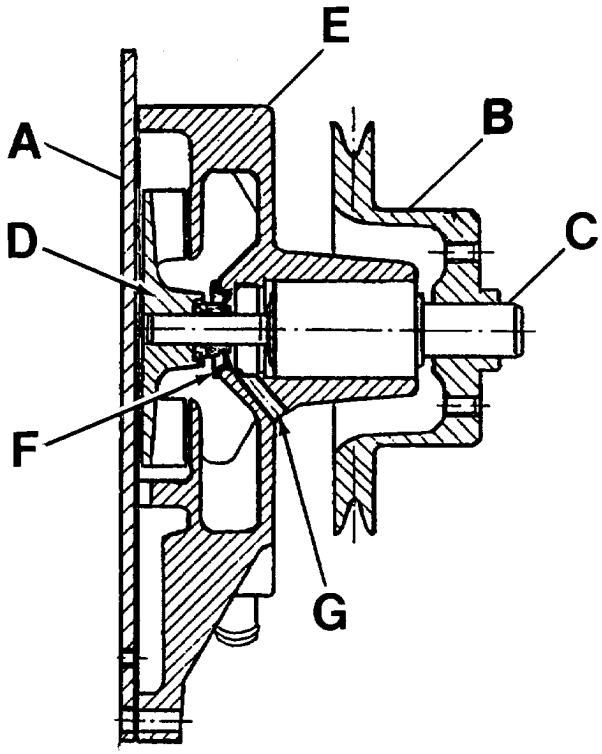
3. Support pulley end of housing, then using a 13 mm (0.5 in.) driver, simultaneously remove impeller (D) from bearing shaft and bearing shaft from pump housing (E). Discard bearing and impeller.

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

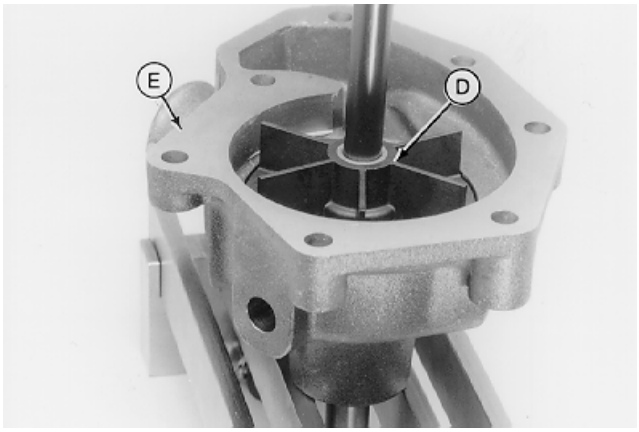
5. Inspect water pump housing, cover and pulley for wear, debris, cracks or other damage. Replace as necessary.

NOTE: Complete or pre-assembled (H) water pumps are available for service as well as a seal kit including bearing shaft (C), impeller (D), seal (F) and gasket set.

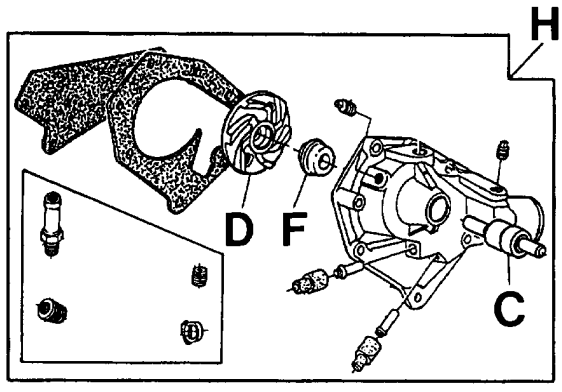
A—Rear cover
B—Pulley
C—Bearing shaft
D—Impeller
E—Housing
F—Seal
G—Weep hole
H—Pre-assembled water pump



CD30630 -UN-16JUN98



CD30631 -UN-04MAY98



CD30632 -UN-16JUN98

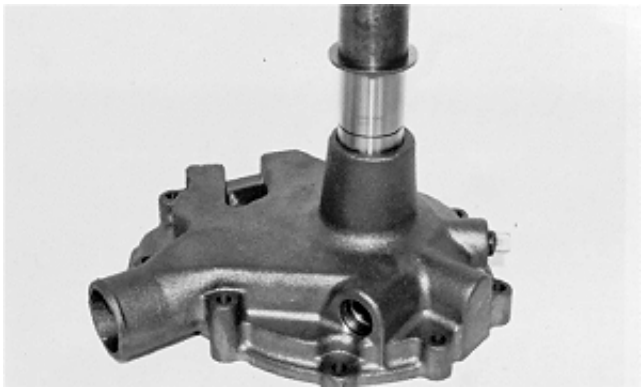
Pre-assembled water pump

CD,3274,G30,46 -19-04JAN99

WATER PUMP BEARING SHAFT INSTALLATION

1. Use JD-262A or JDE74 Bearing Driver to install bearing shaft.

2. Press into housing until bearing face is flush with housing hub face.



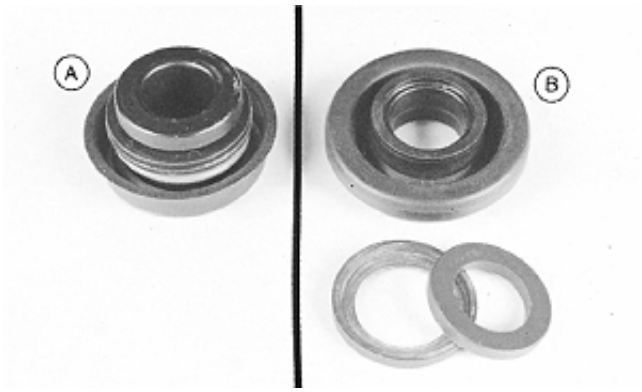
CD7360 -UN-23FEB89

CD,3274,G30,8 -19-07APR92

WATER PUMP SEAL INSTALLATION

NOTE: The unitized (one-piece) water seal (A) has replaced the previous three-piece water seal (B). The unitized seal is to be used even if the three-piece seal is still included in repair kit. In this case, order also AR101549 water pump seal kit.

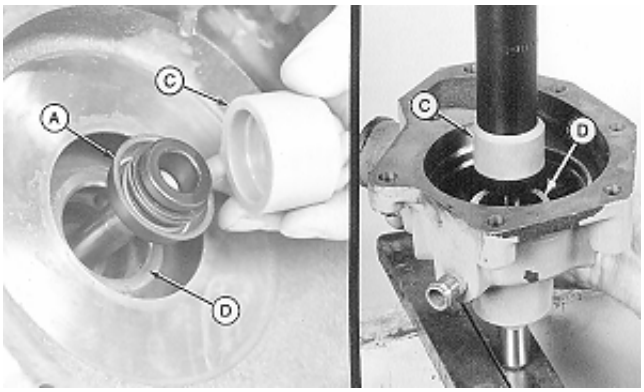
1. Place pump housing under a press so that the thrust when pressing on seal is received only by the pump shaft face.



RG6389 -UN-21AUG92

IMPORTANT: Installation tool (C) MUST be used to drive seal into pump housing. This tool exerts the correct pressure on seal faces. Do not use sealant on any portion of seal.

2. Using special tool (C) included in repair kit, install water pump seal (A) simultaneously over shaft and into housing until seal bottoms on shoulder of housing (D).



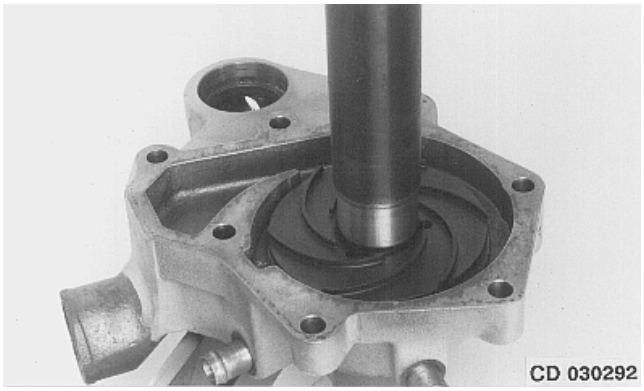
RG6376 -UN-03FEB95

CD,3274,G30,9 -19-01FEB94

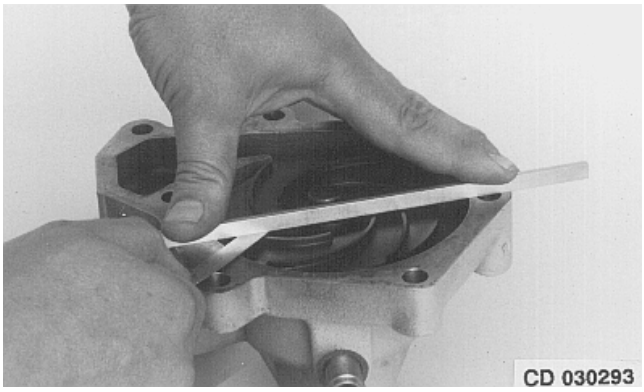
WATER PUMP IMPELLER INSTALLATION

Place water pump under a press so that the thrust when pressing on impeller is received only by the pump shaft face.

Using special tool JD-262A or JDE74, press impeller onto pump shaft until flush with pump housing face within a given tolerance of +0 mm (0 in.) and -0.25 mm (0.01 in.).



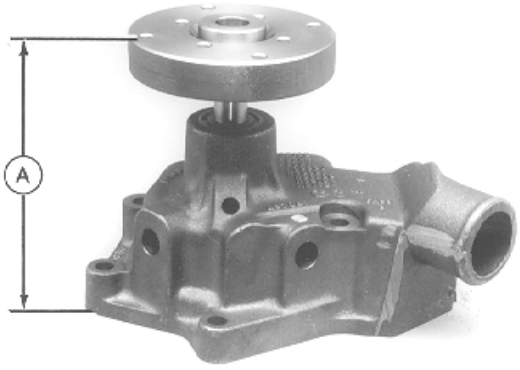
-UN-06MAR95
CD30292



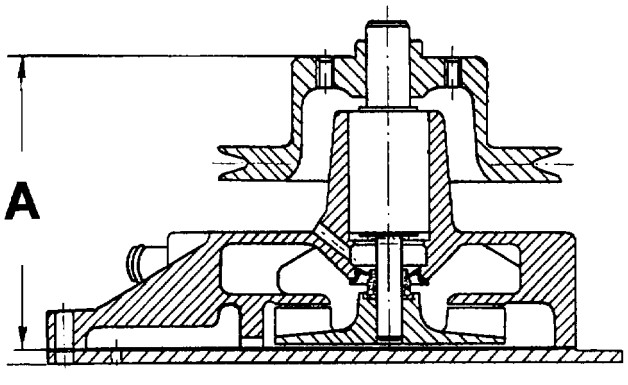
-UN-17FEB95
CD30293

CD,3274,G30,10 -19-07APR92

INSTALL PULLEY OR HUB



-UN-04MAY98
CD30638



-UN-16JUN98
CD30652

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

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

CD,3274,G30,47 -19-04JAN99

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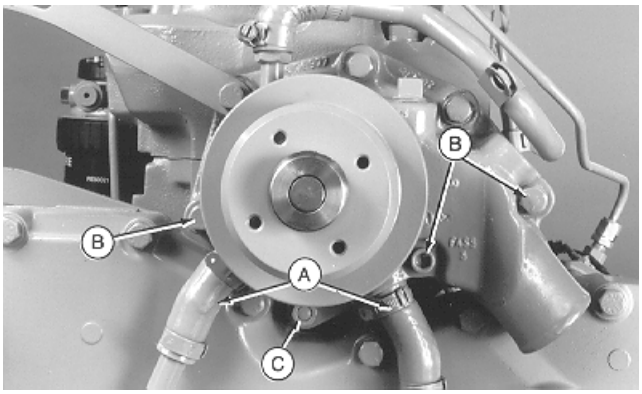
15

INSTALL WATER PUMP

1. Attach pump cover to pump housing using a new gasket and tighten cap screws to 45 N·m (33 lb-ft).

2. Install water pump, placing a new gasket between the pump cover and cylinder block. Tighten cap screws (B) to 50 N·m (35 lb-ft) and nut (C) to 40 N·m (30 lb-ft).

3. Connect coolant hoses (A).

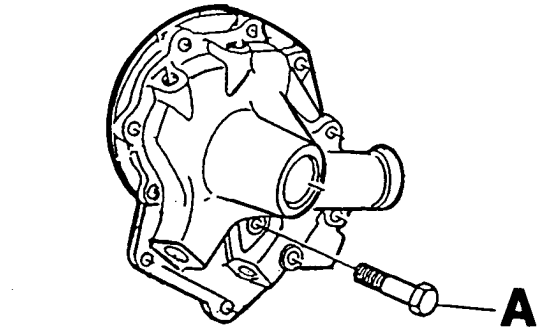


-UN-04MAY98
CD30629

CD,CTM125,163 -19-01DEC97

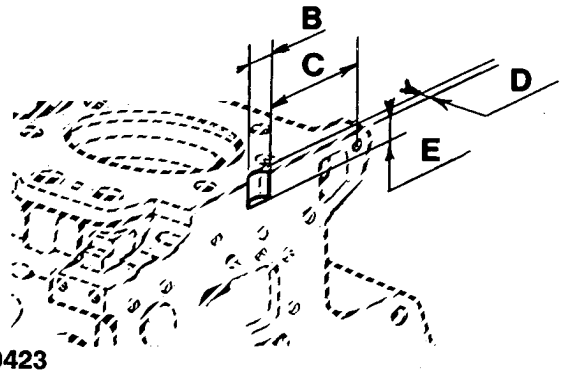
NOTE: Some water pumps may have the cap screw (A) which protrudes from rear cover. Be sure that the cylinder block has the corresponding foundry recess. If necessary, grind the cylinder block as shown.

A—Cap screw
B—14 mm (0.55 in.)
C—90 mm (3.50 in.)
D—4 mm (0.15 in.)
E—25 mm (1 in.)



CD30422

-UN-10MAY95
CD30422

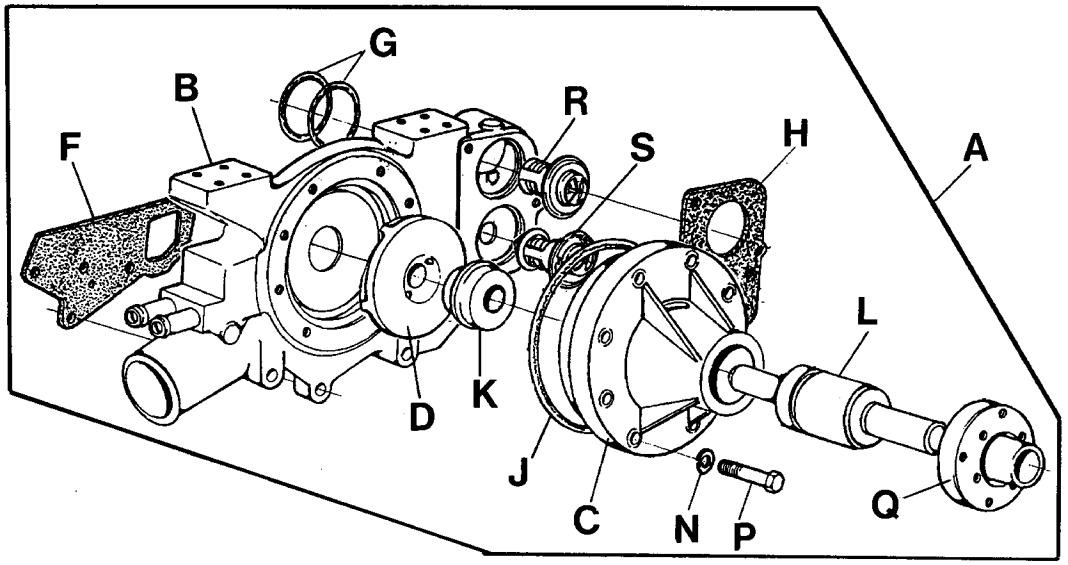


CD30423

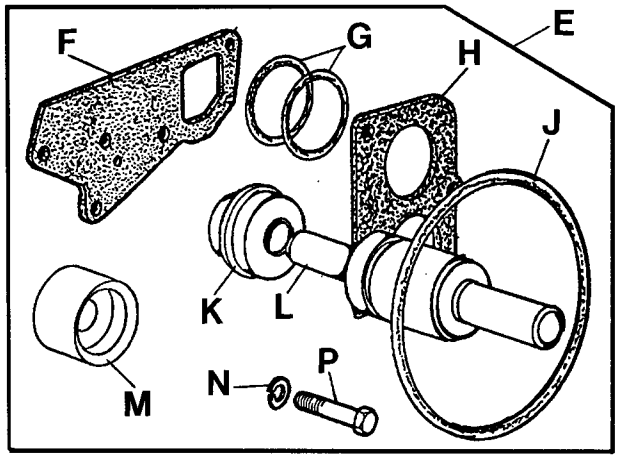
-UN-10MAY95
CD30423

CD,3274,G30,29 -19-01FEB94

WATER PUMP WITH ROTATING ASSEMBLY - EXPLODED VIEW



CD30719 -UN-22FEB99



CD30720 -UN-22FEB99

A—Complete water pump
B—Rear housing*
C—Rotating assembly housing*
D—Impeller*
E—Service seal kit*
F—Gasket*
G—O-ring*
H—Gasket*
J—O-ring*
K—Water pump seal
L—Bearing shaft
M—Seal installation tool
N—Lock washer*
P—Cap screw*
Q—Hub*
R—Thermostat*
S—Thermostat with valve*

** Parts or kit available for service. Refer to appropriate parts catalogs.*

CD,3274,G30,48 -19-04JAN99

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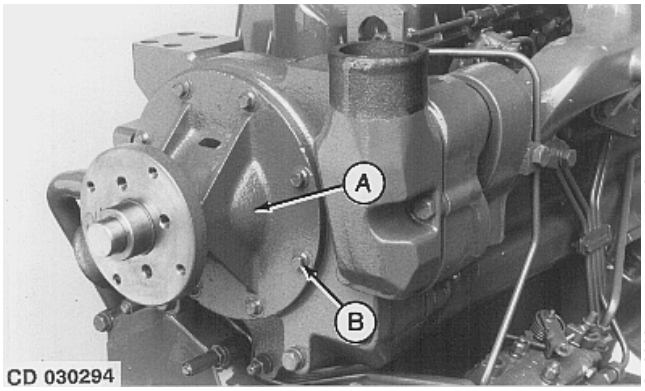
17

ROTATING ASSEMBLY REMOVAL

NOTE: The rotating assembly (A), including front cover, impeller, seal and bearing shaft, can be removed from the pump housing without removing the water pump from engine.

1. Mark rotating assembly and pump housing to facilitate the reinstallation.

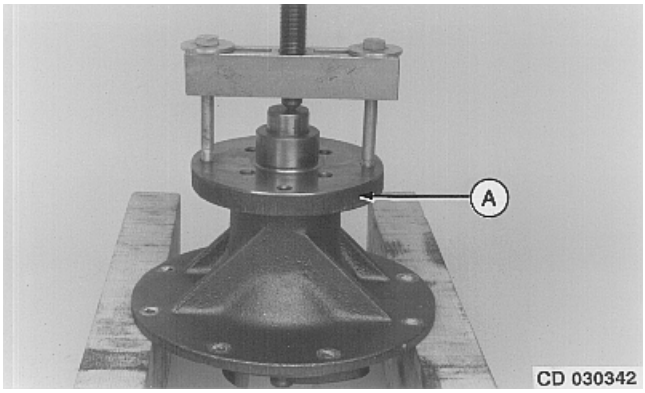
2. Remove the 8 cap screws (B) and lift out rotating assembly.



CD,3274,G30,13 -19-04JAN99

DISASSEMBLING ROTATING ASSEMBLY

1. Using a suitable puller, remove hub (A) from shaft.



CD,3274,G30,20 -19-01FEB94

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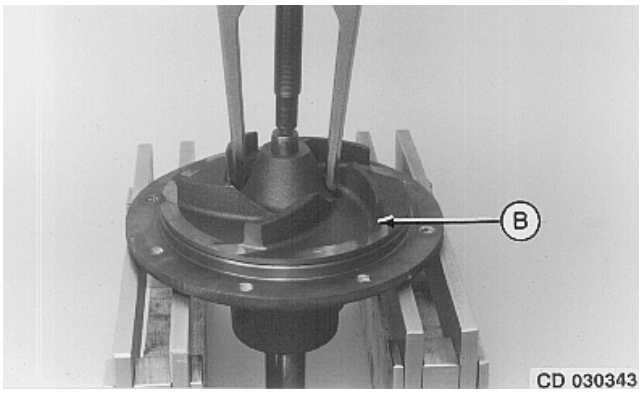
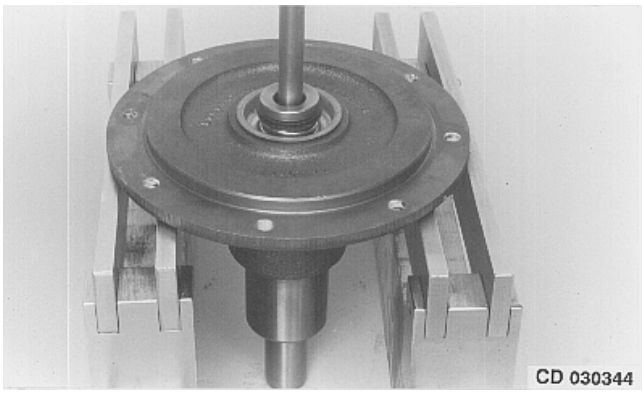
18

2. Using a suitable puller, remove impeller (B) from shaft.



CD,3274,G30,30 -19-01FEB94

3. Support hub end of bearing housing. Push against impeller end of shaft to remove bearing shaft from housing.



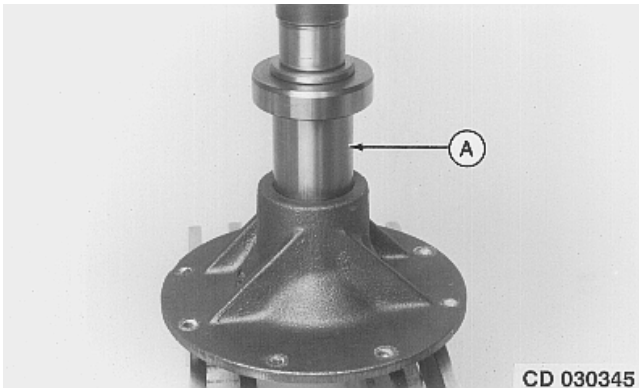
CD,3274,G30,31 -19-01FEB94

REASSEMBLING ROTATING ASSEMBLY

1. Place housing with impeller end side down on a press.

NOTE: Bearing shaft is installed from pulley end of pump housing.

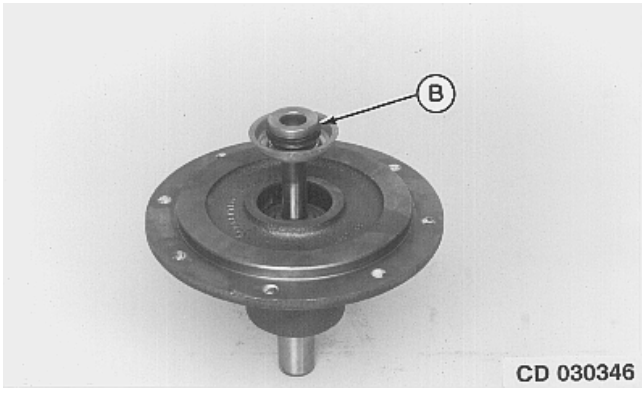
2. Using JD-262A or JDE74 Bearing Driver, press bearing shaft (A) into housing until bearing face is flush with housing end face.



CD,3274,G30,21 -19-01FEB94

3. Install new one-piece water seal (B) using the installation tool provided with the seal.

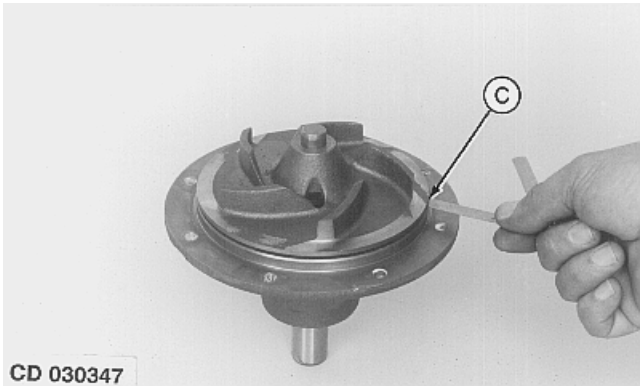
IMPORTANT: The installation tool MUST be used to drive seal into housing. This tool sets the preload on seal faces and protects seal from eventual damage. Do not use sealant on any portion of the seal.



CD,3274,G30,32 -19-04JAN99

NOTE: Place water pump under a press so that the thrust when pressing on impeller is received only by the pump shaft end.

4. Using special tool JD-262A or JDE74, press impeller onto pump shaft until 1 to 1.3 mm (0.04 to 0.05 in.) clearance (C) is obtained.

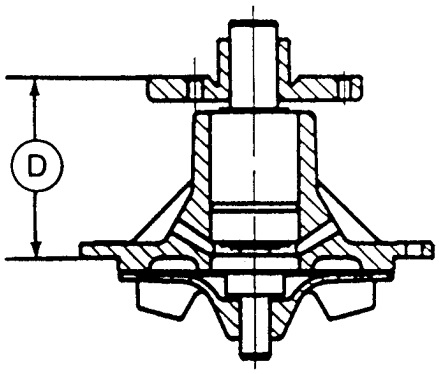


CD,3274,G30,33 -19-01FEB94

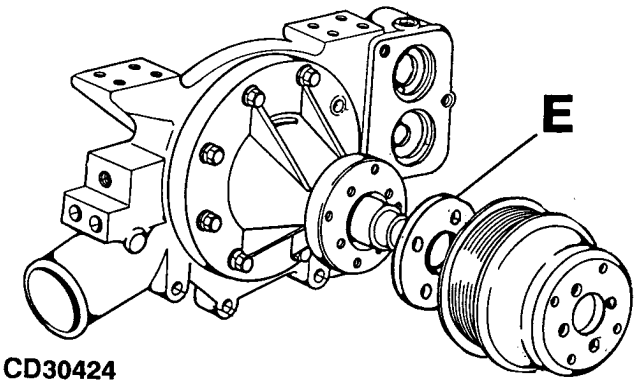
5. Using special tool JD-262A or JDE74, press pulley or hub until specified distance (D) is obtained.

Distance (D) from hub to sealing surface:
- cast iron pulley . . . . . 94 mm (3.70 in.)
- sheet metal pulley . . . . . 97.5 mm (3.84 in.)

NOTE: A L100292 spacer (E) can be used to allow the installation of a sheet metal pulley onto a water pump settled for a cast iron pulley (hub position = 94 mm; 3.7 in.).



CD 030348 -UN-07MAR95 CD30348



CD30424 -UN-10MAY95 CD30424

CD,3274,G30,34 -19-01FEB94

ROTATING ASSEMBLY INSTALLATION

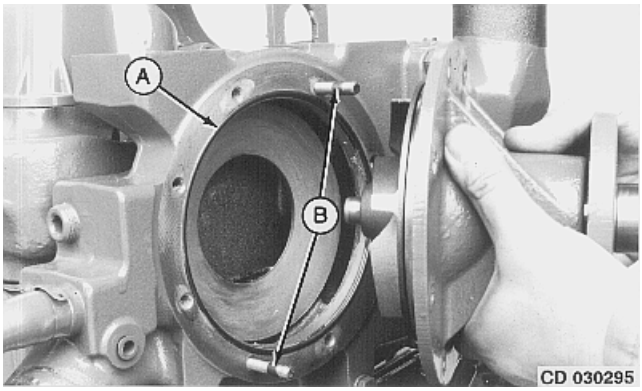
1. Install new O-ring (A) in pump housing.

2. Place 2 guide studs diametrically opposed (B), then slide rotating assembly by aligning marks previously made.

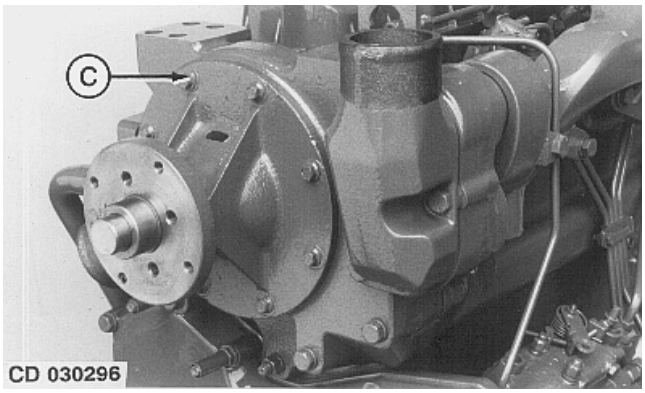
IMPORTANT: Without guide studs, the O-ring could be damaged when repositioning rotating assembly on pump assembly to align cap screw holes.

NOTE: The holes are not equally spaced allowing only one position of the rotating assembly on pump housing.

3. Apply sealing compound on thread of cap screws (C), tighten to 30 N·m (22 lb-ft).



CD 030295 -UN-17FEB95 CD30295



CD 030296 -UN-17FEB95 CD30296

CD,3274,G30,14 -19-07APR92

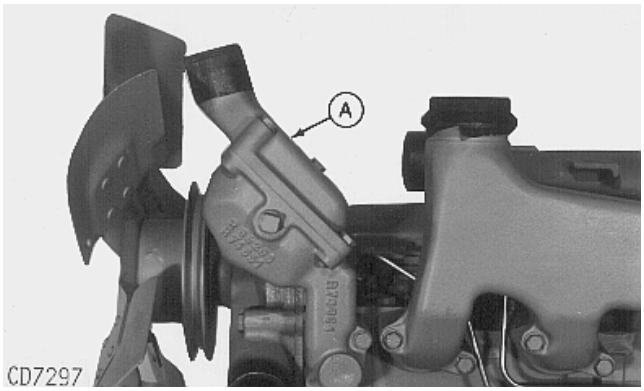
THERMOSTAT TEST AND REPLACEMENT

1. Visually inspect area around thermostat housing for leaks.

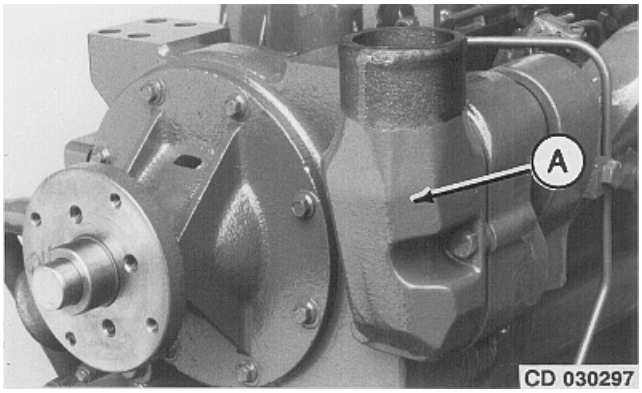
2. Remove thermostat cover (A) and thermostat(s).

NOTE: Engines may be equipped with either one or two thermostats. It is recommended to replace the thermostats after every two years of service.

3. Test in hot water correct opening and closing (see Specifications).



-UN-07MAR95
CD7297



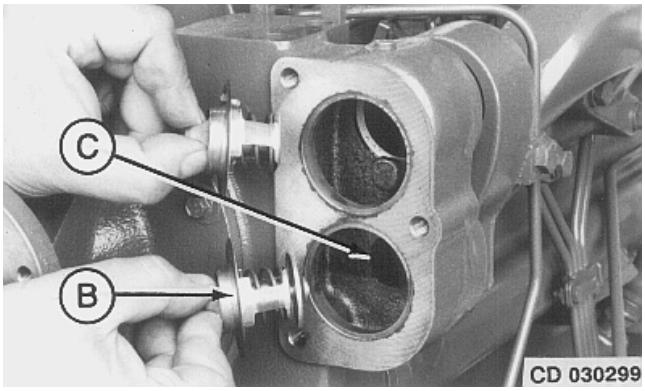
-UN-17FEB95
CD30297

CD,3274,G30,15 -19-01FEB94

4. Install thermostat(s) in proper location.

NOTE: Thermostat(s) with extended end (B) must fit with by-pass hole in housing (C).

5. Install thermostat cover using new gasket, tighten to 30 N·m (22 lb-ft).

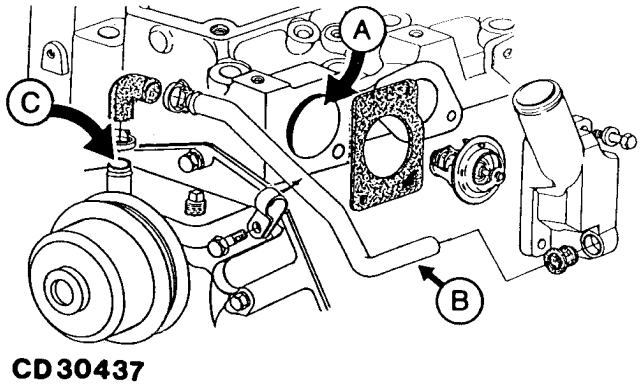


-UN-17FEB95
CD30299

CD,3274,G30,35 -19-04JAN99

NOTE: Some engines may have the thermostat directly installed in cylinder head (A). The by-pass function is performed via the tube (B) connected to water pump (C).

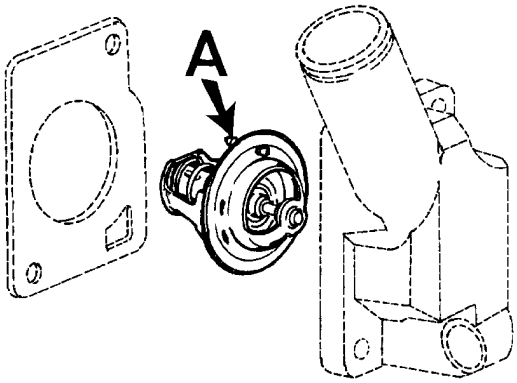
Install thermostat with jiggle pin on top for a proper filling.



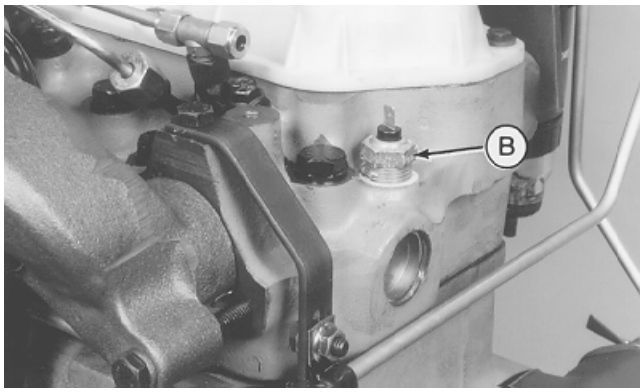
-UN-18MAY95
CD30437

CD,3274,G30,38 -19-01FEB94

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

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)

	Tension New Belt	Tension Used Belt*
Single belt	578—622 N (130—140 lb) force	378—423 N (85—94 lb) force
Dual belts	423—467 N (95—104 lb) force	378—423 N (85—94 lb) force

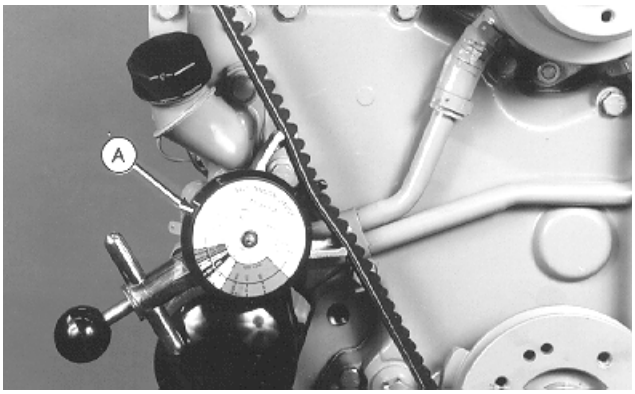
b) Use of tension tester (B) and straightedge (C)
A 89 N (20 lb) force applied halfway between pulleys should deflect belt by 19 mm (0.75 in.).

2. If adjustment is necessary, loosen alternator nuts (D) and (E). Pull alternator frame outward until belt is correctly tensioned.

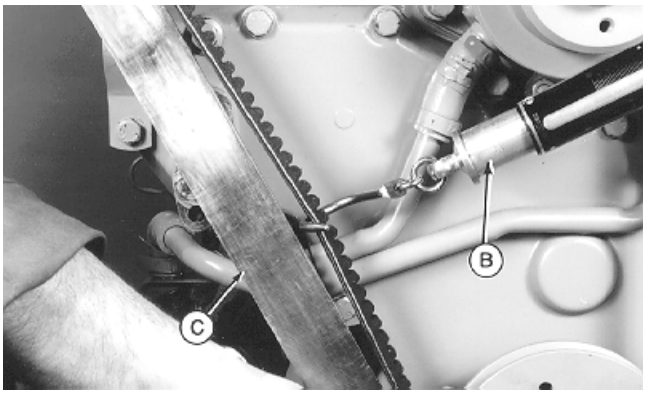
IMPORTANT: Do not pry against the alternator rear frame. Do not tighten or loosen belts while they are hot.

3. Tighten alternator bracket nuts firmly.

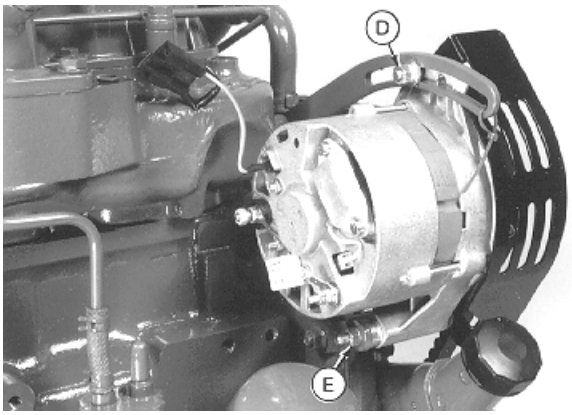
4. Run engine for 10 minutes then recheck belt tension.



-UN-04MAY98
CD30644



-UN-04MAY98
CD30645

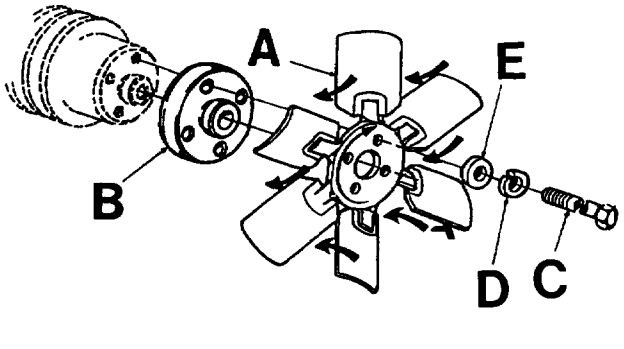


-UN-04MAY98
CD30646

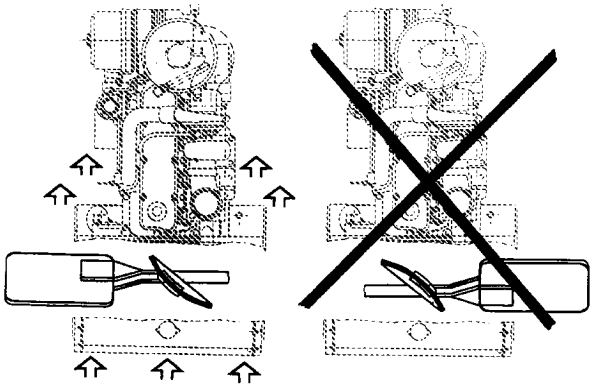
**Belts are considered used after 10 minutes of operation.*

CD,CTM125,166 -19-28JUN99

INSTALL FAN



CD30647 -UN-16JUN98



CD30648 -UN-16JUN98

Suction fan (top view)

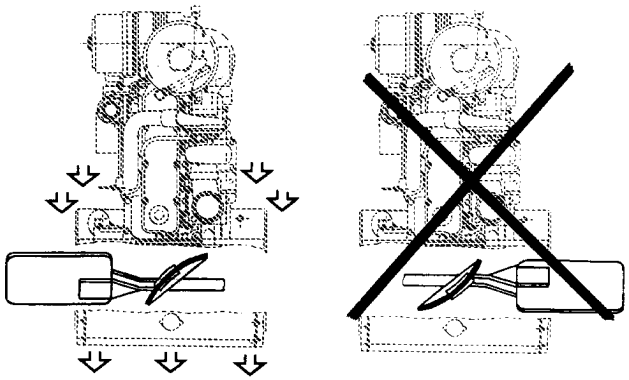
1. Inspect fan blades for bent or damaged condition. Bent blades reduce cooling system efficiency and throw the fan out of balance. Replace if necessary.

NOTE: Depending on application, engine may be equipped with either suction-type or blower-type fan. Take care not to install the fan wrongly. Refer to illustrations to identify the fan type and the corresponding installation.

2. On water pump with hub, install first the sheet metal pulley.

3. Install fan (A) with spacer (B) when required.

4. Install cap screws (C) with new lock washers (D) and, when required, flat washers (E). Tighten as follows:
- 5/16 in. cap screws .....30 N·m (22 lb-ft)
- 3/8 in. cap screws .....50 N·m (35 lb-ft)



CD30649 -UN-16JUN98

Blower fan (top view)

CD,CTM125,167 -19-01DEC97

INSTALL ENGINE FAN PULLEY ON 2054 AND 2254 COMBINES (WITH CD6060HZ001 ENGINES)

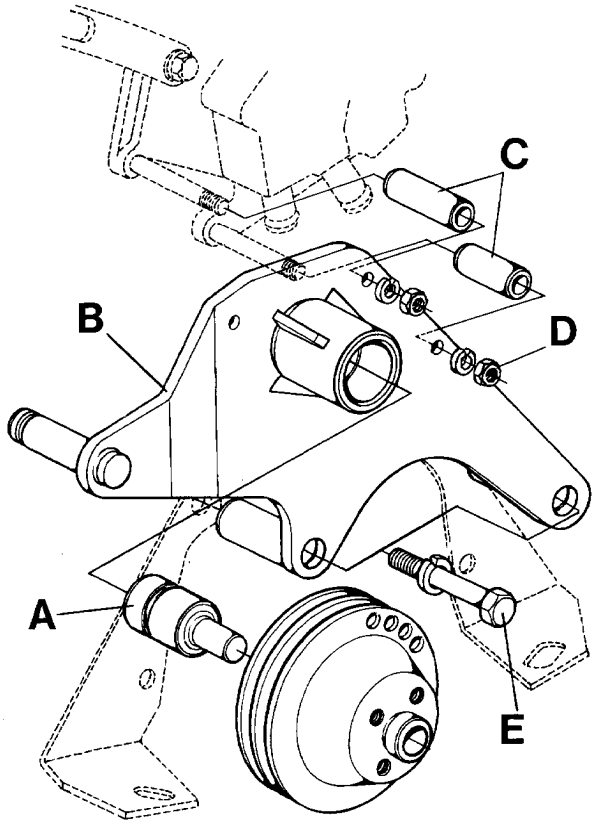
1. Press bearing shaft (A) into fan bracket (B) until bearing face is flush with bracket end face.

2. Place fan bracket under a press so that the thrust when pressing on pulley is received only by the bearing shaft end (F). Press pulley until the distance (G) is obtained.

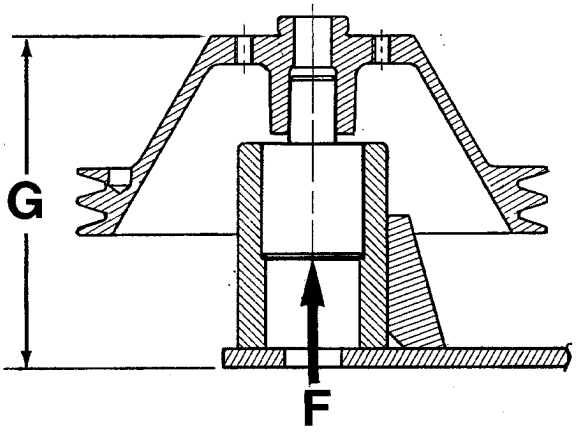
Distance (G) . . . . . 174.5 mm (6.87 in.)

3. Install fan bracket onto engine. Tighten as follows:

Cap screws (E) . . . . . 300 N·m (220 lb-ft)
Nuts (D) . . . . . 50 N·m (35 lb-ft)



CD30721 -UN-23FEB99



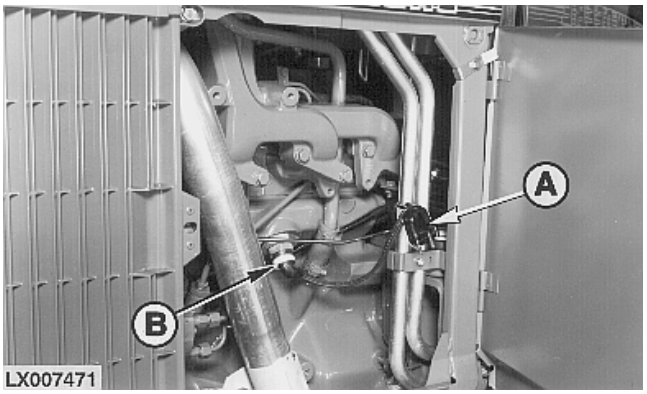
CD30722 -UN-22FEB99

CD,3274,G30,49 -19-04JAN99

COOLANT HEATER OPERATION (4 AND 6 CYL. ENGINES)

The 1000 W electrical heater element (B) heats engine coolant resulting in a better starting performance. Furthermore, the engine will reach its operating temperature more quickly.
At an ambient temperature of -15˚C (-4˚F), the heating process takes approximatively 2 hours. Extend heating period if ambient temperature is lower.

For operating, connect plug (A) to a 110 or 220 V electrical power source depending on the coolant heater element.



A—Plug
B—Coolant heater

CD,3274,G30,37 -19-04JAN99

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REPLACING THE COOLANT HEATER (4 AND 6 CYL. ENGINES)

1. Unplug heater from electrical power source.

2. Drain cooling system.

3. Remove electrical cord, hold heater element (F) in place to prevent that it rotates, then loosen nut (B). Remove adapter (C) then pull heater element out of block.

4. Check for heating operation of the element.

CAUTION: Energize coolant heater only when heater element is immersed in coolant. Heater element could burst and result in personal injury.

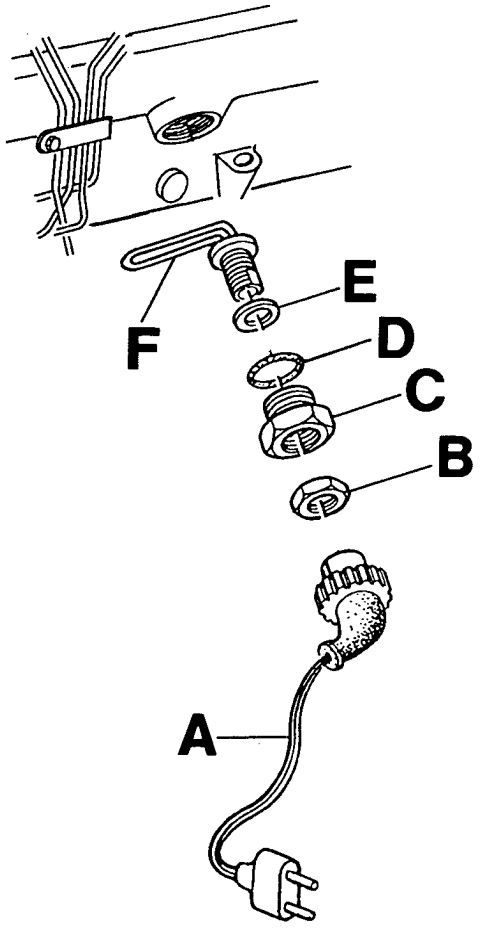
NOTE: The heater element cannot be repaired. If defective, replace it.

5. Assemble coolant heater (110 or 220 V) as shown in illustration.

6. Place heater element in block with flats on thread in vertical position. The element must not touch internal walls of the block.

7. Tighten nut to 35 N·m (25 lb-ft).

NOTE: Heater element may have a tapered surface instead of a thread. In this case position heater element properly, then tap into place with a rubber mallet.



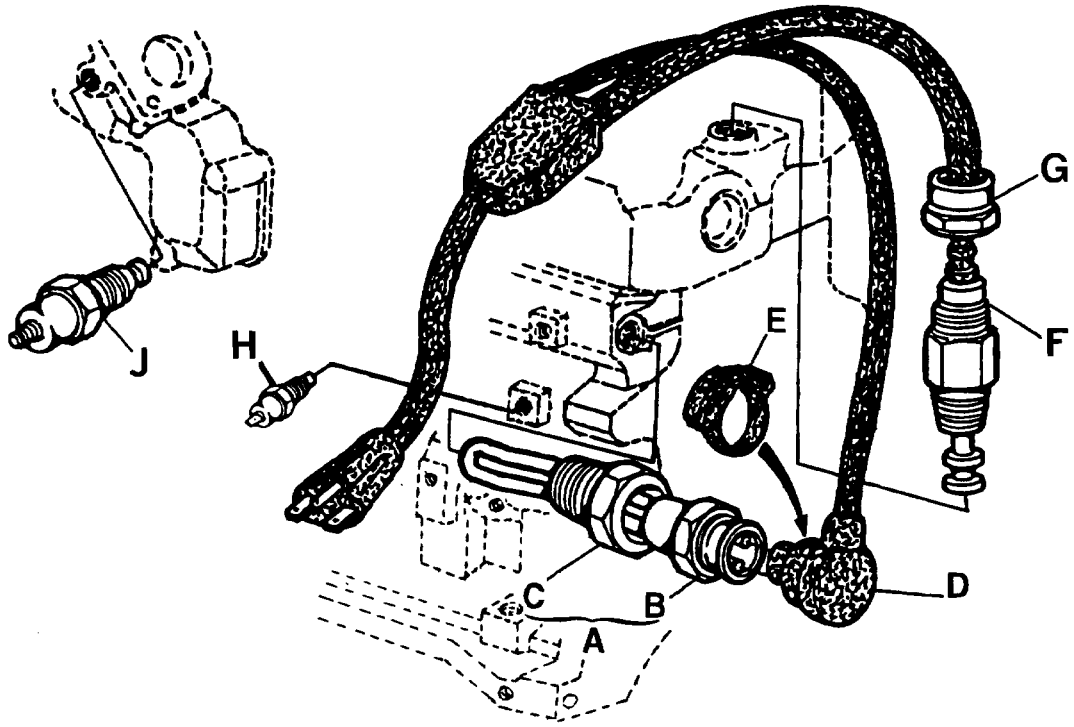
CD30426

CD30426 -UN-10MAY95

A—Cord
B—Nut
C—Adapter
D—O-Ring
E—Gasket
F—Heater element

CD,3274,G30,19 -19-04JAN99

COOLANT HEATER OPERATION (ALL ENGINES)



CD30723 -UN-23FEB99

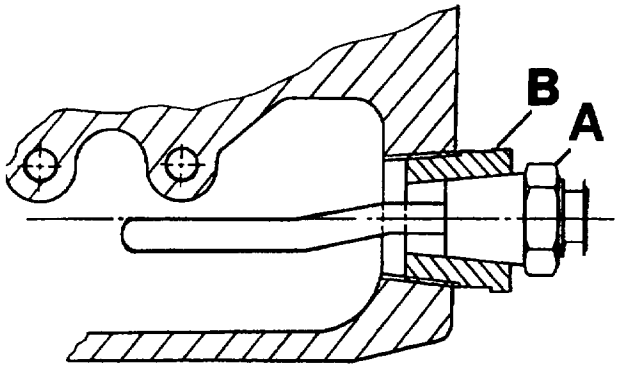
A—Coolant heater
B—Heater element
RE64803 for 3 and 4 cyl. (240 V, 1000 W)
RE64804 for 6 cyl. (240 V, 1500 W)
C—Adapter
D—Electrical cord
E—Clamp
F—Coolant temperature sensor for heater regulation
G—Hexagonal cap
H—Engine coolant temperature sensor in cyl. block
J—Engine coolant temperature sensor in thermostat housing

This coolant heater is installed at the rear of cylinder block coolant gallery.

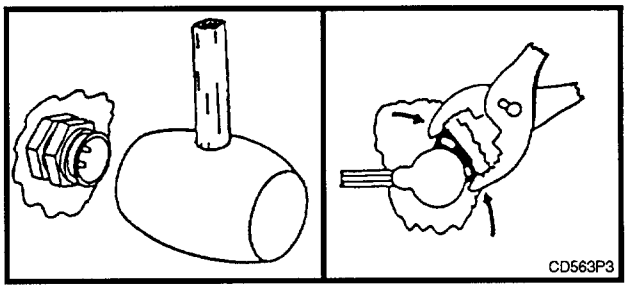
The coolant heater keeps the temperature between 26˚C (80˚F) and 37˚C (100˚F). A temperature sensor (F), located at the rear of the cylinder head, allows to leave the coolant heater on power supply indefinitely.

NOTE: Due to the location of the coolant temperature sensor for heater regulation at the rear of the cylinder head, the engine coolant temperature sensor is located either in cyl. block (H) or in thermostat housing (J).

CD,3274,G30,50 -19-04JAN99



CD30651 -UN-16JUN98



CD563P3 -UN-31OCT96

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.

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.

CD,CTM125,169 -19-01DEC97

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SPECIFICATIONS

	DIMENSIONS OF NEW PARTS	WEAR LIMIT
Turbocharger boost pressure, minimum (at rated engine power and speed)	60 kPa (0.6 bar - 9 psi)	
Exhaust adapter end play	0.8—1.6 mm (0.03—0.06 in.)	
Radial bearing end play:		
• GARRETT Turbocharger:		
—TA25 (3-cylinder engines)	0.06—0.13 mm (0.0024—0.005 in.)	
—TA31 (4-cylinder engines)	0.08—0.18 mm (0.003—0.007 in.)	
—TA34 (4/6-cylinder engines)	0.08—0.18 mm (0.003—0.007 in.)	
—TA38 (6-cylinder engines)	0.08—0.18 mm (0.003—0.007 in.)	
—T300 (4-cylinder engines)	0.08—0.18 mm (0.003—0.007 in.)	
—T350 (6-cylinder engines)	0.08—0.18 mm (0.003—0.007 in.)	
• SCHWITZER Turbocharger		
—S2A Model	0.74—0.81 mm (0.029—0.032 in.)	
Rotating assembly axial end play:		
• GARRETT Turbocharger:		
—TA25 (3-cylinder engines)	0.025—0.09 mm (0.001—0.0035 in.)	
—TA31 (4-cylinder engines)	0.025—0.10 mm (0.001—0.004 in.)	
—TA34 (4/6-cylinder engines)	0.025—0.10 mm (0.001—0.004 in.)	
—TA38 (6-cylinder engines)	0.025—0.10 mm (0.001—0.004 in.)	
—T300 (4-cylinder engines)	0.025—0.10 mm (0.001—0.004 in.)	
—T350 (6-cylinder engines)	0.025—0.10 mm (0.001—0.004 in.)	
• SCHWITZER Turbocharger		
—S2A Model	0.09—0.14 mm (0.0035—0.0055)	

TURBOCHARGER MODELS:

Machine Model No.	Engine Model	Turbocharger Model
• Mannheim Tractors:		
3400/3410	CD4039TRT35	GARRETT TA31
3410/3410 X	CD4039TRT35	GARRETT TA31
6200	CD4039TL001/TL004 (-120440CD)	GARRETT T300
	CD4039TL001/TL004 (120441CD-227584CD)	SCHWITZER S2A
	CD4039TL001/TL004 (227585CD-)	GARRETT T300
6300	CD4039TL003/TL006 (-143092CD)	GARRETT T300
	CD4039TL003/TL006 (143093CD-227584CD)	SCHWITZER S2A
	CD4039TL003/TL006 (227585CD-)	GARRETT T300
6400	CD4045TL001/TL003	GARRETT T300
6500	CD4045TL004	GARRETT T300
6600	CD6059TL001	GARRETT T350
6800	CD6068TL001	GARRETT T350
6900	CD6059TL002	GARRETT T350

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CD,3274,G35,1 -19-04JAN99

SPECIFICATIONS-CONTINUED

TURBOCHARGER MODELS (Cont'd):

Machine Model No.	Engine Model	Turbocharger Model
• 5000-Series Tractors: (Agritalia-built)		
5400/5400N	CD3029TAT02	GARRETT TA25
5500/5500N	CD4039TAT01	GARRETT T300
• 5000-Series Tractors: (Augusta-built)		
5400N	CD3029TLV01	GARRETT TA25
5500N	CD4039TLV01	GARRETT T300
• 7000-Series Tractors:		
7600	T06068TRW01	GARRETT T350
• 4000-Series Telescopic Handlers:		
4400 and 4500	CD4039TF005	GARRETT TA31
• 2000-Series Combines:		
2054 and 2254	CD6068HZ001	GARRETT T350

Engine Model	Turbocharger Model
• Engines for Chinese Combines:	
CD6059TYC01 and CD6059TYC02	GARRETT TA34
• Engines for GOLDONI Tractors:	
CD3029TFG21	GARRETT TA25

(Continued on next page)

CD,3274,G35,16 -19-04JAN99

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SPECIFICATIONS-CONTINUED

TURBOCHARGER MODELS (Cont'd):

Saran OEM Engines	Option Codes	Turbocharger Model
• CD3029TF	6501, 6502, 6506, 6511	GARRETT TA25
• CD3029TF001	6501, 6502, 6504, 6506	GARRETT TA25
• CD3029TF002	6503, 6520	GARRETT TA25
• CD3029TF031	6501, 6502, 6504, 6506, 6511	GARRETT TA25
• CD3029TF032	6504	GARRETT TA25
• CD3029TF033	6504	GARRETT TA25
• CD3029TF120	6501, 6502, 6504, 6506, 6507	GARRETT TA25
• CD3029TF121	6506, 6507	GARRETT TA25
• CD3029TF123	6507	GARRETT TA25
• CD3029TF160	6501, 6502, 6504, 6506, 6507	GARRETT TA25
• CD3029TF161	6507, 6560	GARRETT TA25
• CD3029TF162	6507	GARRETT TA25
• CD3029TF163	6507, 6560	GARRETT TA25

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CD,3274,G35,17 -19-04JAN99

SPECIFICATIONS-CONTINUED

TURBOCHARGER MODELS (Cont'd):

Saran OEM Engines	Option Codes	Turbocharger Model
• CD4039TF	6501	GARRETT TA34
	6506, 6512	GARRETT TA31
• CD4039TF001	6501	GARRETT TA34
	6506, 6512, 6513	GARRETT TA31
• CD4039TF002	6501	GARRETT TA34
• CD4039TF003	6501	GARRETT TA34
• CD4039TF004	6501	GARRETT TA34
• CD4039TF005	6513	GARRETT TA31
• CD4039TF006	6501	GARRETT TA34
• CD4039TF007	6576	SCHWITZER S2A
• CD4039TF008	6576	SCHWITZER S2A
• CD4039TF031	6501	GARRETT TA34
	6506, 6513	GARRETT TA31
• CD4039TF032	6513	GARRETT TA31
• CD4045TF001	6517	GARRETT TA31
	6521	GARRETT TA34
• CD4045TF002	6521	GARRETT TA34
• CD4045TF003	6521	GARRETT TA34
• CD4045TF008	6573	GARRETT T300
• CD4045TF031	6517	GARRETT TA31
	6521	GARRETT TA34

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CD,3274,G35,18 -19-04JAN99

SPECIFICATIONS-CONTINUED

TURBOCHARGER MODELS (Cont'd):

Saran OEM Engines	Option Codes	Turbocharger Model
• CD6059TF	6501, 6506, 6515	GARRETT TA34
• CD6059TF001	6501, 6502, 6503, 6506, 6515	GARRETT TA34
• CD6059TF002	6505, 6515	GARRETT TA34
• CD6059TF003	6505, 6515	GAREETT TA34
• CD6059TF004	6502, 6515	GARRETT TA34
• CD6059TF005	6515	GARRETT TA34
• CD6059TF006	6515	GARRETT TA34
• CD6059TF007	6506	GARRETT TA34
• CD6059TF008	6515	GARRETT TA34
• CD6068TF001	6506, 6512	GARRETT TA38
• CD6068TF002	6506, 6512	GARRETT TA38
• CD6068TF003	6505	GARRETT TA34
• CD6068TF004	6505	GARRETT TA34
• CD6068TF008	6569	GARRETT T350
• CD6068TF009	6569	GARRETT T350

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CD,3274,G35,19 -19-04JAN99

TORQUES FOR HARDWARE

Intake manifold to cylinder head	50 N·m (35 lb-ft)
Exhaust manifold to cylinder head	50 N·m (35 lb-ft)
Turbocharger and exhaust elbow to exhaust manifold, cap screws:	
• 3-cylinder engines	30 N·m (20 lb-ft)
• 4/6-cylinder engines	50 N·m (35 lb-ft)
Oil inlet line to turbocharger, cap screws or fitting	25 N·m (18 lb-ft)
Oil return line to turbocharger, cap screws or fitting:	
• GARRETT Turbocharger:	
—TA25	80 N·m (60 lb-ft)
—TA31, TA34, TA38	30 N·m (20 lb-ft)
—T300, T350	30 N·m (20 lb-ft)
• SCHWITZER Turbocharger:	
—S2A	30 N·m (20 lb-ft)
Turbine housing to center housing, cap screws:	
• GARRETT Turbocharger:	
—TA25	26 N·m (19 lb-ft)
—TA31, TA34, TA38	18 N·m (13 lb-ft)
—T300, T350	18 N·m (13 lb-ft)
• SCHWITZER Turbocharger:	
—S2A (V-Clamp)	7 N·m (5 lb-ft)
Compressor housing backplate to compressor housing, cap screws:	
• GARRETT Turbocharger:	
—TA31, TA34, TA38	17 N·m (12.5 lb-ft)
—T300, T350	17 N·m (12.5 lb-ft)

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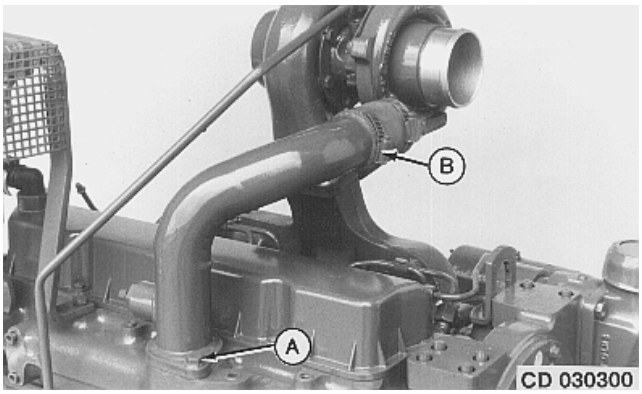
CD,3274,G35,2 -19-01FEB94

INTAKE MANIFOLD INSPECTION



-UN-17FEB95
CD30300

1. On engines with turbocharger, loosen hose clamp (B).

2. Remove cap screws (A) attaching intake manifold to cylinder head and lift off manifold.

3. Inspect intake manifold for serviceability and repair or replace, if it is cracked or otherwise damaged.

4. Inspect machined mating surfaces of cylinder head and intake manifold. Clean as required, using a scraper and/or wire brush and compressed air.

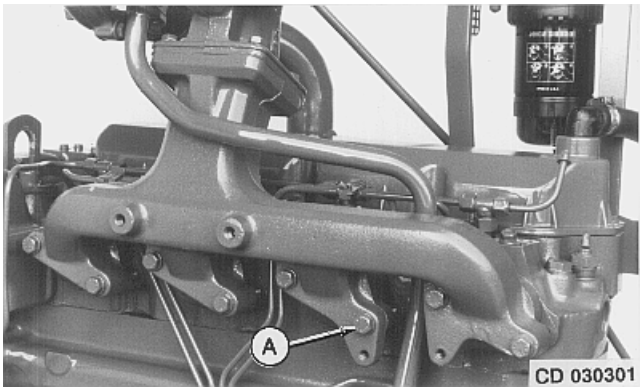
5. To install intake manifold, reverse removal procedure and use new gaskets.

6. Make sure that air intake hose is in good condition. Tighten hose clamps securely (turbocharged engines only).

7. Tighten intake manifold attaching cap screws to 50 N·m (35 lb-ft).

CD,3274,G35,3 -19-13APR92

EXHAUST MANIFOLD INSPECTION



-UN-17FEB95
CD30301

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.

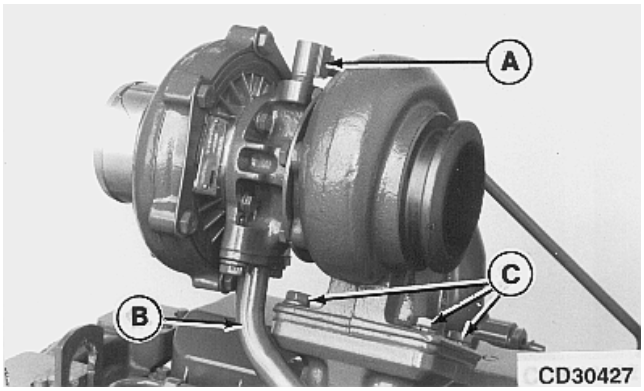
4. To install exhaust manifold, reverse removal procedure and use new gaskets.

NOTE: When using gaskets with one steel-backed side, the non-steel backed side must face toward the cylinder head.

5. Tighten exhaust manifold attaching cap screws to 50 N·m (35 lb-ft).

CD,3274,G35,4 -19-13APR92

TURBOCHARGER REMOVAL



1. Thoroughly clean exterior of turbocharger and surrounding area.

2. Remove muffler extension and muffler elbow.

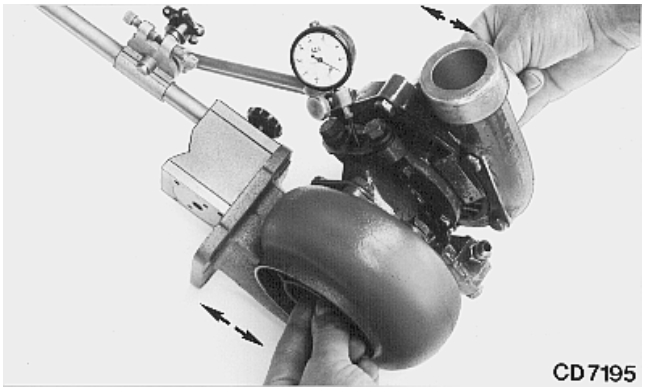
3. Disconnect oil inlet line (A) and return line (B) and plug immediately. Remove air cleaner to turbocharger hose.

IMPORTANT: Immediately plug all openings to prevent dirt from entering the turbocharger.

4. Remove the four cap screws (C) and lift out turbocharger assembly.

CD,3274,G35,5 -19-01FEB94

RADIAL BEARING END PLAY CHECK (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, range of travel should not exceed:
—TA25: 0.06—0.13 mm (0.0024—0.005 in.)
—TA31: 0.08—0.18 mm (0.003—0.007 in.)
—TA34: 0.08—0.18 mm (0.003—0.007 in.)
—TA38: 0.08—0.18 mm (0.003—0.007 in.)
—T300: 0.08—0.18 mm (0.003—0.007 in.)
—T350: 0.08—0.18 mm (0.003—0.007 in.)

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CD,3274,G35,6 -19-01FEB94

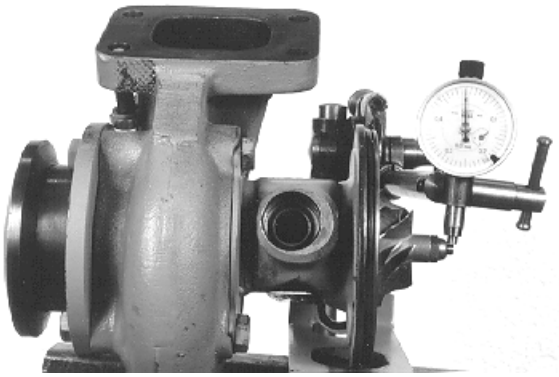
CHECK RADIAL BEARING CLEARANCE (SCHWITZER TURBOCHARGER)

1. Remove compressor cover.

2. Install a dial indicator against shaft end.

2. Move shaft alternately toward and away from indicator. Range of travel should be within 0.74—0.81 mm (0.029—0.032 in.)

If radial clearance is not within specifications, replace turbocharger.



CD30658 -UN-04MAY98

CD,3274,G35,20 -19-04JAN99

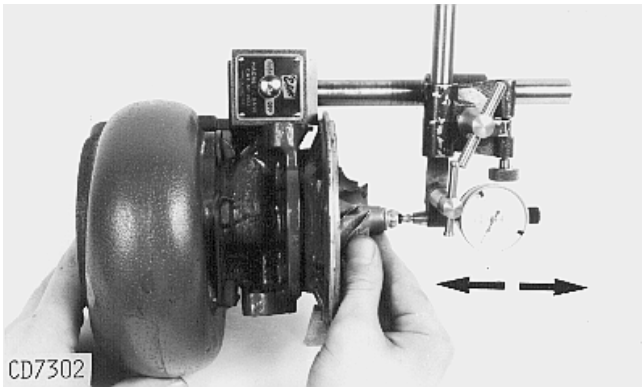
AXIAL END PLAY CHECK

1. Using a dial indicator with indicator rod against shaft, measure axial end play.

2. Move shaft axially back and forth by hand. Indicator reading should be within:

• **GARRETT TURBOCHARGER**
—TA25: 0.025—0.09 mm (0.001—0.0035 in.)
—TA31: 0.025—0.10 mm (0.001—0.004 in.)
—TA34: 0.025—0.10 mm (0.001—0.004 in.)
—TA38: 0.025—0.10 mm (0.001—0.004 in.)
—T300: 0.025—0.10 mm (0.001—0.004 in.)
—T350: 0.025—0.10 mm (0.001—0.004 in.)

• **SCHWITZER TURBOCHARGER**
—S2A: 0.09—0.14 mm (0.0035—0.0055 in.)



CD7302 -UN-23MAY95

CD,3274,G35,7 -19-04JAN99

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TURBOCHARGER REPAIR

IMPORTANT: Repairing a turbocharger requires special tooling and highly specialized personnel and thus it is not recommended that the turbocharger be disassembled completely.

Turbochargers cannot be serviced, they must be replaced as a complete assembly. If, after testing, a turbocharger is found to be defective, replace it.

CD,3274,G35,8 -19-01FEB94

TURBOCHARGER DISASSEMBLY

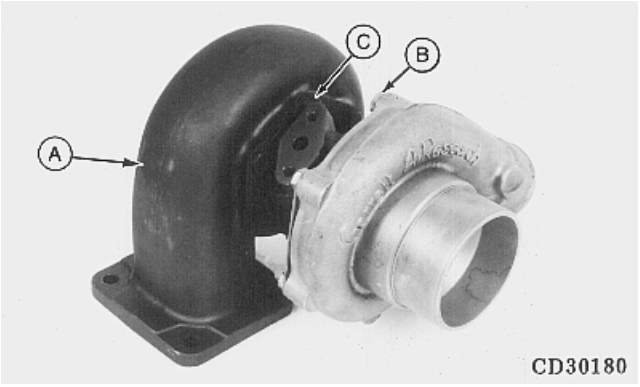
1. Plug all openings and clean the exterior before disassembly.

2. Put locating marks on the turbine housing (A) and compressor housing (B) in relation to any location on the central housing (C) (e.g. lube oil inlet or outlet) to enable proper indexing of new center housing/rotating shaft assembly when turbocharger is assembled.

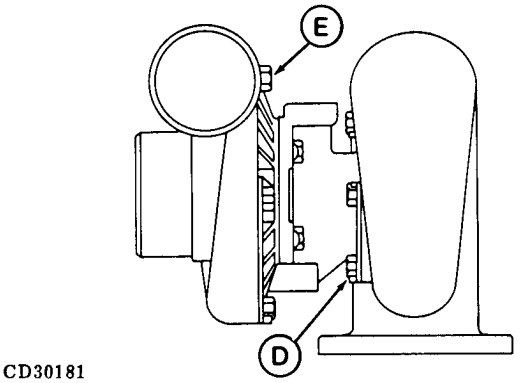
3. Remove turbine housing cap screws (D) with lock plates and clamps.
Gently tap the housing with a soft hammer if removal is difficult.

4. Remove compressor housing snap ring or cap screw (E) with lock plates and clamps and lift off the housing.

IMPORTANT: If turbocharger failed because of foreign material entering the air intake system, be sure to examine the system and clean as necessary to prevent a repeat failure. Also replace the air filter.



-UN-07MAR95 CD30180



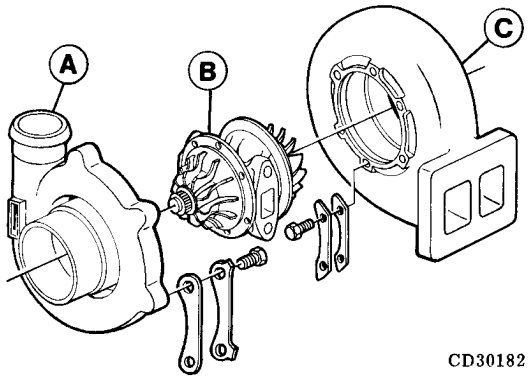
-UN-07MAR95 CD30181

CD,3274,G35,9 -19-01FEB94

TURBOCHARGER REASSEMBLY

1. Attach compressor housing (A) to center housing/rotating shaft assembly (B) with cap screws, lock plates and clamps or with snap ring.
Use the locating marks made during disassembly, orientate compressor housing to center housing and tighten cap screws (E) to:

- Models TA31, TA34, TA38 . . . . . 17 N·m (12.5 lb-ft)
- Models T300, T350 . . . . . 17 N·m (12.5 lb-ft)

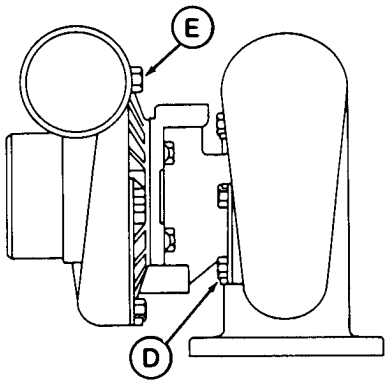


CD30182 -UN-07MAR95

2. Attach turbine housing (C) to center housing (B), correctly orientate the turbine housing and tighten cap screws (D) to:

- Model TA25 . . . . . 26 N·m (19 lb-ft)
- Models TA31, TA34, TA38 . . . . . 18 N·m (13 lb-ft)
- Models T300, T350 . . . . . 18 N·m (13 lb-ft)

Bend all locking tabs against heads of cap screws.



CD30181 -UN-07MAR95

3. If not already performed, prime turbocharger lubrication system prior to installing turbocharger on the engine. Fill center housing with new engine oil through the oil drain hole. Turn the rotating assembly by hand to lubricate the bearings.

CD,3274,G35,10 -19-01FEB94

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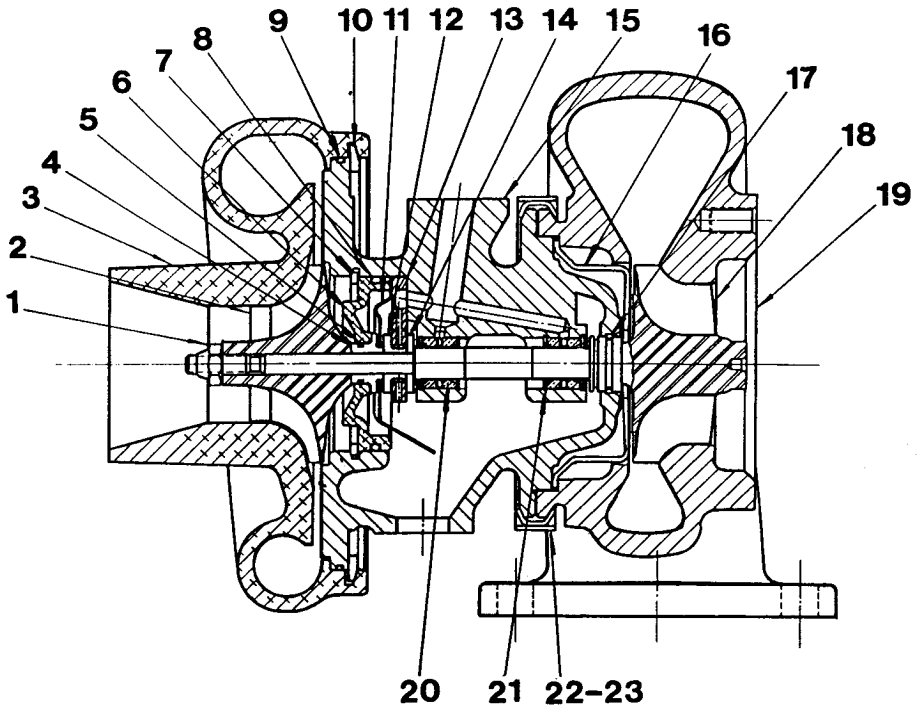
SCHWITZER TURBOCHARGER MODEL S2A



CD30428

CD30428 -UN-10MAY95

1—Locknut	7—Snap ring	13—Thrust bearing	19—Turbine housing
2—Compressor wheel	8—O-Ring	14—Thrust ring	20—Bearing
3—Compressor cover	9—O-Ring (optional)	15—Central housing	21—Snap ring
4—Flinger sleeve	10—Snap ring	16—Backplate	22—V-clamp
5—Piston ring	11—Oil deflector	17—Piston ring	23—Lock nut
6—Insert	12—Thrust collar	18—Shaft & wheel assy.	

Disassembly

1. Mark the relative position of the compressor cover and turbine housing to the central housing.

2. Remove the large snap ring (10) securing the compressor cover.

3. Lift off the compressor cover.

4. Remove the V-clamp (22-23) securing the turbine housing.

5. Lift the central housing assembly out of the turbine housing.

Reassembly

1. Attach compressor cover to central housing assembly with the snap ring (bevelled edge towards the turbine).

2. Fit the central housing assembly into the turbine housing, orientate to the marks, fit the V-clamp and tighten the lock nut to 7 N·m (5 lb-ft).

3. Fill central housing with clean engine oil through the oil drain hole. Turn rotating assembly by hand to lubricate the bearings.

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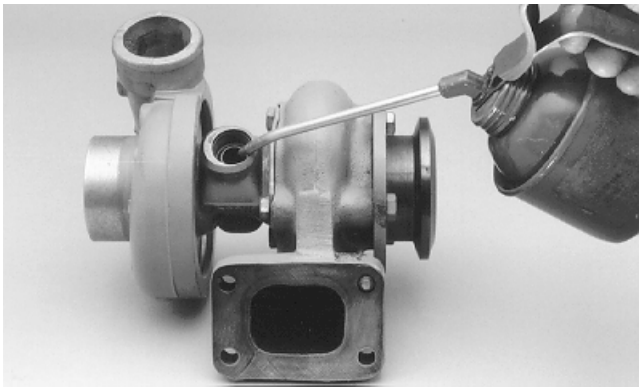
12

CD,3274,G35,14 -19-01FEB94

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

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TURBOCHARGER INSTALLATION

1. Connect air inlet hose to compressor housing and install turbocharger (E) with new gasket. Tighten cap screws (F) to:

- GARRETT TA25 . . . . . 30 N·m (20 lb-ft)
- GARRETT TA31, TA34, TA38 . . . . . 50 N·m (35 lb-ft)
- GARRETT T300, T350 . . . . . 50 N·m (35 lb-ft)
- SCHWITZER S2A . . . . . 50 N·m (35 lb-ft)

Tighten clamp (A) on air inlet hose.

2. If used, install new gaskets. Connect lubrication oil inlet line (B) to the turbocharger and tighten to 25 N·m (18 lb-ft).

IMPORTANT: Check turbocharger lubrication oil supply hose for damage or cracks. If necessary, replace hose.

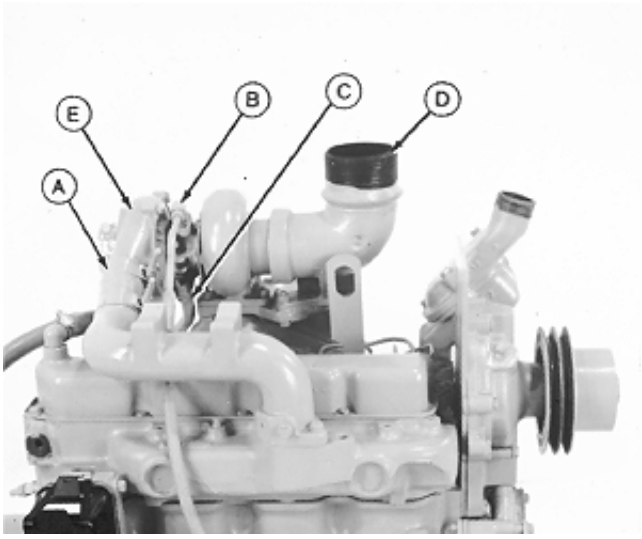
3. Connect oil return line (C) and tighten to:

- GARRETT TA25 . . . . . 80 N·m (60 lb-ft)
- GARRETT TA31, TA34, TA38 . . . . . 30 N·m (20 lb-ft)
- GARRETT T300, T350 . . . . . 30 N·m (20 lb-ft)
- SCHWITZER S2A . . . . . 30 N·m (20 lb-ft)

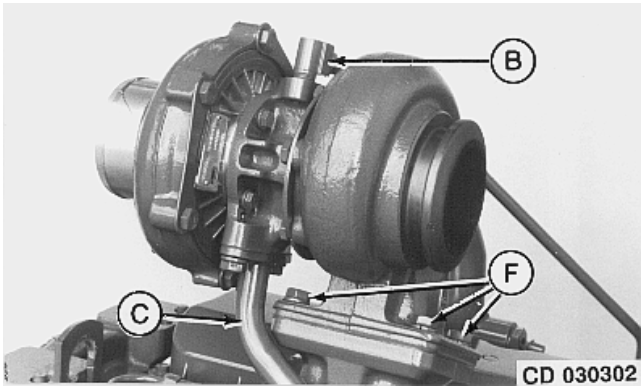
4. If used, install exhaust adapter and exhaust elbow (D). Exhaust elbow must have an end play of 0.8—1.6 mm (0.03—0.06 in.). Tighten exhaust elbow cap screws to 50 N·m (35 lb-ft).

IMPORTANT: Since the greatest suction force occurs between air cleaner and turbocharger, it is essential to ensure that the hose connections are tight to prevent entry of dirt into the engine.

A—Hose clamp
B—Oil inlet line
C—Oil return line
D—Exhaust elbow
E—Turbocharger
F—Cap screws

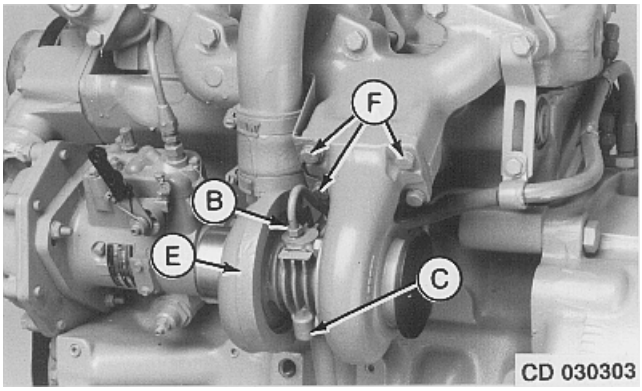


RG5660 -UN-12APR90



CD30302 -UN-10MAY95

T300 Turbocharger



CD30303 -UN-17FEB95

TA25 Turbocharger in low-profile version

CD,3274,G35,11 -19-01FEB94

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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,3274,G35,12 -19-13APR92

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,3274,G35,15 -19-01FEB94

SPECIAL OR ESSENTIAL TOOLS

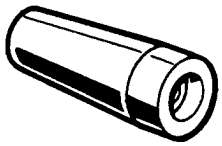
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

DX,TOOLS -19-20JUL95

CD30304 -UN-08MAR95

Seal installing tool JD-258

To install carbon stop seal on nozzle.

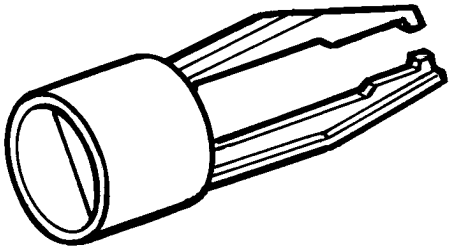


CD 030304

CD,JD258 -19-04AUG92

Nozzle Puller Adapter JDG716

Use with JDE38-2 and JDE38-3 to pull Stanadyne 9.5 mm injection nozzles.



CD 030338

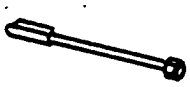
CD30338 -UN-07MAR95

CD,JDG716 -19-12NOV92

RG5084 -UN-23AUG88

Nozzle Bore Cleaning Tool JDE39

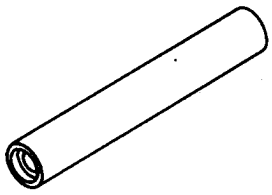
Clean injection nozzle bores in cylinder head.



RG,JDE39 -19-14FEB92

Driver JDF15

Used to install tappet seals in fuel supply pumps. (In-line fuel injection pump)



RG2017

RG2017 -UN-30NOV88

CD,JDF15 -19-04JAN99

RG5154 -UN-23AUG88

3/4 in. Special Crowsfoot Wrench JDF22

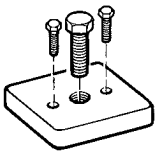
Tighten injection lines at pump and nozzles.

S53,JDF22 -19-10JUL89

CD30306 -UN-08MAR95

Injection pump removal tool JDG670A

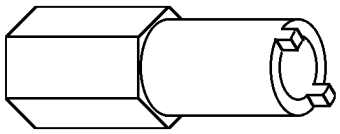
NOTE: Can be used on all engine types.



CD,JDG670A -19-04AUG92

Injection Nozzle Wrench JDG949

Used to loosen or tighten lift adjusting screws on injec



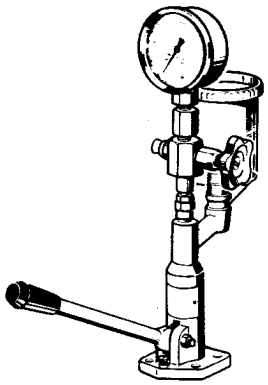
-UN-23NOV97

RG7644

CD,JDG949 -19-04JAN99

Injection nozzle tester (R. BOSCH) JT25510

Check nozzle opening pressure.



CD 030307

-UN-07MAR95

CD30307

CD,JT25510 -19-27APR92

CD30308 -UN-08MAR95

Fuel pressure line KJD10109

To connect injection nozzle to BOSCH tester.

CD 030308

CD,KJD10109 -19-27APR92

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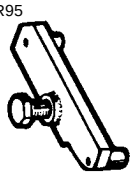
CD30309 -UN-08MAR95

Injection pump removal tool KJD10159

To remove injection pump on all engines except for engine with 37 kW auxiliary drive (Use JDG670A).

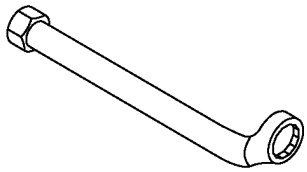


CD 030309

CD,KJD10159 -19-27APR92

Special Wrench KJD10213

Used to loosen and tighten in-line injection pump (MICO) nuts.



RG9116 -UN-19MAY98

CD,KJD10213 -19-04JAN99

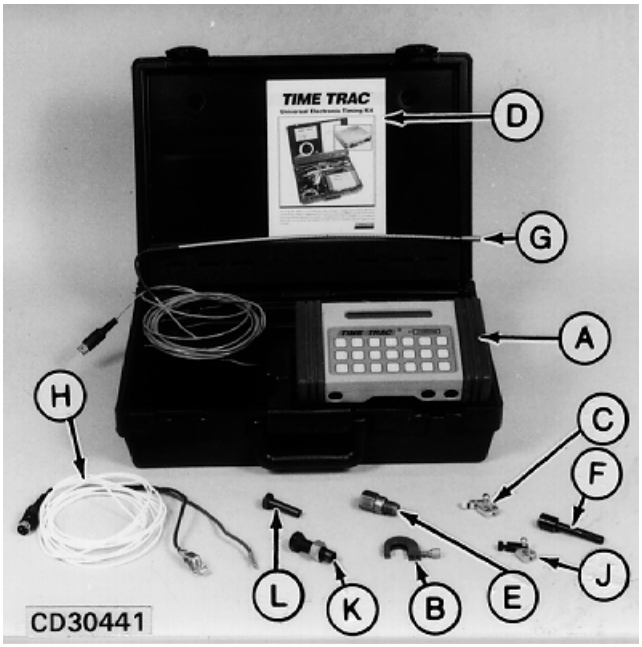
"TIME-TRAC" diesel engine timing tester . . . . . FKM10429A (or JT07158)

To perform the dynamic timing of engines.

NOTE: FKM10429A contains the following components:
A-FKM10429-1 Meter
B-FKM10429-4 Sensor clamp
C-FKM10429-5 6mm 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

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.

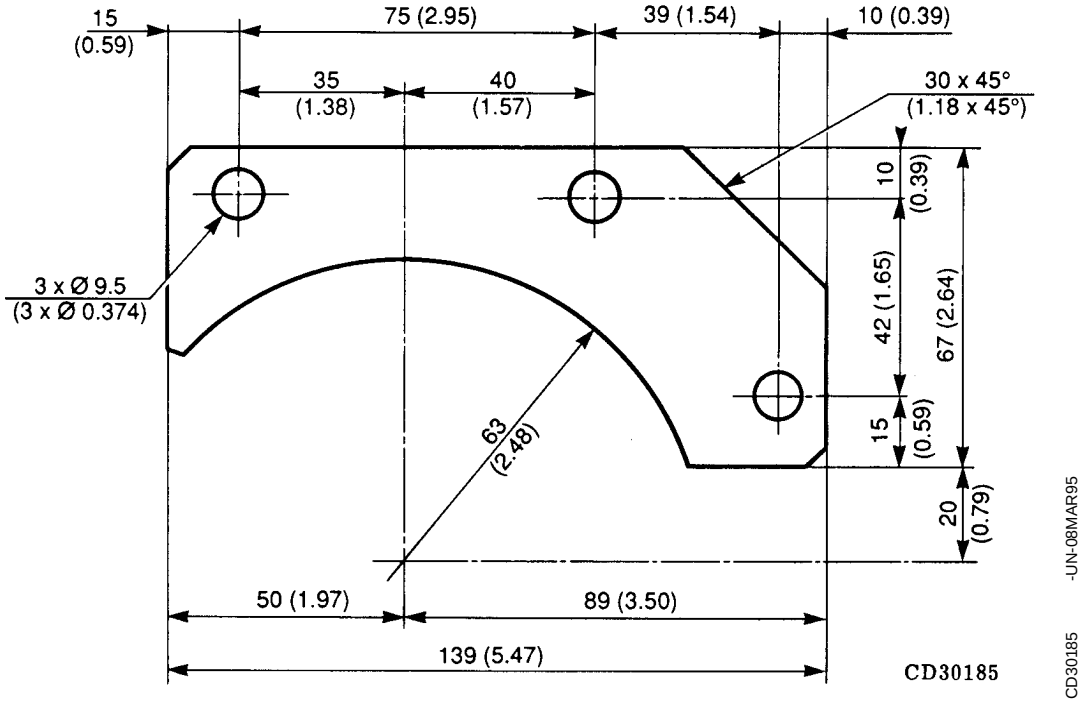
Timing light is not requested for recent engines. However timing light is still available under part number FKM10429-2.



CD30441 -UN-10MAY96

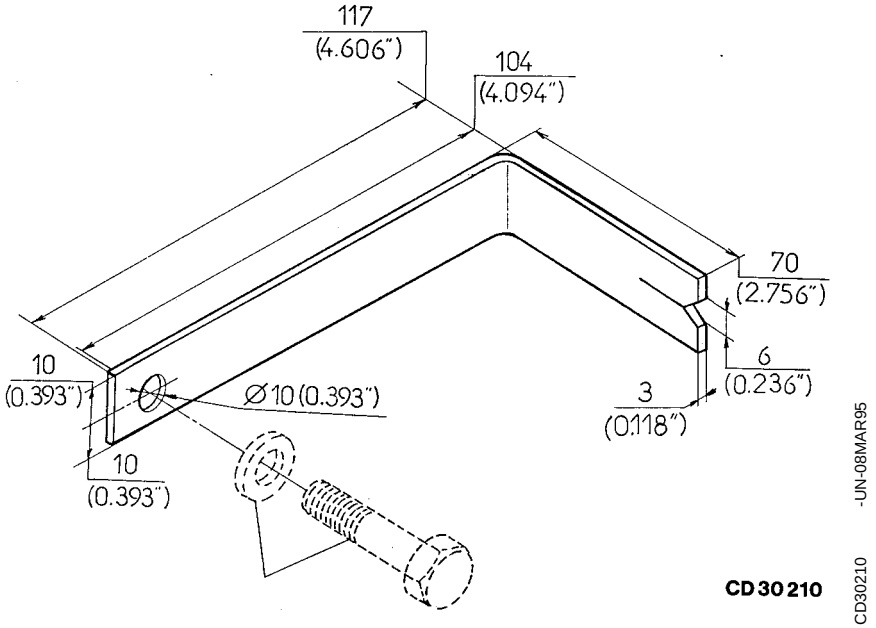
CD,FKM10429A,1 -19-19FEB98

SELF-MANUFACTURED TOOL
TEMPLATE FOR FRONT PLATE REPLACEMENT



CD,3274,G40,1 -19-27APR92

SELF-MANUFACTURED TOOL
EXAMPLE OF STATIONARY POINTER FOR DYNAMIC TIMING



CD,3274,G40,2 -19-27APR92

SPECIFICATIONS

Fuel injection pump static timing:

• Lucas CAV injection pumps	Align marks on pump flange and engine front plate
• STANADYNE DM4 injection pumps	Align marks on cam ring and governor weight retainer with engine at TDC
• STANADYNE DB2 and DB4 injection pumps	Align marks on pump flange and engine front plate if any, or align internal marks on cam ring and governor weight retainer with engine at TDC
• MICO in-line injection pump	Align marks on pump flange and engine front plate if any, or centre the pump within the flange slots

CD,3274,G40,3 -19-04JAN99

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing at full load rated speed:

• Mannheim tractors:

TRACTOR MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
3100	CD3029DRT65	RE61468 (DP200)	RE65134 (DP200)	2350	850	2550	17
		RE65134 (DP200)		2350	850	2550	17
3110	CD3029DRT65	RE65134 (DP200)		2350	850	2550	17
3200/X	CD4039DRT35	RE61492 (DP200)		2350	850	2550	17
3210/X	CD4039DRT35	RE61492 (DP200)		2350	850	2550	17
3300/X	CD4045DRT35	RE61496 (DP200)	RE501884 (DB2)	2350	850	2550	17
		RE501884 (DB2)*		2350	850	2550	17
3310/X	CD4045DRT35	RE61496 (DP200)	RE501884 (DB2)	2350	850	2550	17
		RE501884 (DB2)*		2350	850	2550	17
3400/X	CD4039TRT35	RE61494 (DP201)	RE501886 (DB4)	2350	850	2550	13
		RE501886 (DB4)*		2350	850	2550	15
3410/X	CD4039TRT35	RE61494 (DP201)	RE501886 (DB4)	2350	850	2550	13
		RE501886 (DB4)*		2350	850	2550	15
6100	CD4045DL001	RE46123 (DPA2)		2300	885	2495	15
	CD4045DL002						
6200	CD4039TL001	RE47706 (DPA4)		2300	875	2495	15
	CD4039TL004						
6300	CD4039TL003	RE50593 (DPA4)		2300	875	2495	15
	CD4039TL006	RE50593 (DPA4)	RE57671 (DPA4)				
	CD4039TL006	RE57671 (DPA1)		2300	875	2495	15
6400	CD4045TL001	RE46122 (DPA4)		2300	875	2495	15
	CD4045TL003						
6506	CD6068DL001	RE64419 (DP201)		2300	925	2495	15
6600	CD6059TL001	RE53414 (DP201)	RE58168 (DP201)	2300	875	2495	15
		RE58168 (DP201)		2300	875	2495	15
6800	CD6068TL001	RE53415 (DP201)	RE58169 (DP201)	2100	875	2290	15
		RE58169 (DP201)		2100	875	2290	15
6900	CD6068TL002	RE61860 (DP201)		2100	875	2290	15

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CD,3274,G40,96 -19-04JAN99

SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

- **5000-Series tractors:**
  (Agritalia-built)

TRACTOR MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
5300/N	CD3029DAT01	RE57288 (DP200)		2400	775	2605	18
5400/N	CD3029TAT02	RE67453 (DP200)		2400	775	2605	13
5500/N	CD4039TAT01	RE60818 (DP200)		2400	825	2605	17

- **5000-Series tractors:**
  (Augusta-built)

TRACTOR MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
5400N	CD3029TLV01	RE45521 (DPA2)	RE57287 (DP200)	2400	775	2605	14
		RE57287 (DP200)	RE70172 (DB2)	2400	775	2605	14
		RE70172 (DB2)		2400	775	2605	14
5500N	CD4039TLV01	RE60818 (DP200)	RE70174 (DB2)	2400	825	2605	17
		RE70174 (DB2)		2400	825	2605	17

- **5000-Series tractors:**
  (For India)

TRACTOR MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
5300	CD3029DPY01	RE501590 (MICO)		2400	900	2605	14

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CD,3274,G40,66 -19-04JAN99

SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• 7000-Series tractors:

TRACTOR MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
7600	T06068TRW01	RE43020 (DB4)		2100	850	2275	15

• 4000-Series telescopic handlers:

TELESC. HANDLER MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
4400/ 4500	CD4039TF005	RE55565 (DB4) RE69326 (DB4)	RE69326 (DB4)	2200 2200	800 800	2390 2390	13 13

• 2000-Series combines:

COMBINE MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
2054/ 2254	CD6068HZ001	RE52901 (DB4)		2200	1250	2390	12

• Engines for Chinese combines:

	ENGINE MODEL	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
	CD6059TYC01 CD6059TYC02	RE69258 (DB4)* RE501723 (DB4)*		2500 2500	800 800	2710 2710	13 13

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CD,3274,G40,97 -19-04JAN99

SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Engines for Goldoni tractors:

ENGINE MODEL	ORIGINAL INJ: PUMP Part No.(Model)	REPLACED BY Part No.(Model)	RATED SPEED. rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD3029DFG21	RE66492 (DP200)	RE503017 (DB2	2300	800	2495	17
	RE503017 (DB2)*		2300	800	2495	18
CD3029DFG22	RE57288 (DP200)	RE503019 (DB2)	2300	800	2495	18
	RE503019 (DB2)*		2300	800	2495	17
CD3029TFG21	RE66496 (DP200)	RE503021 (DB2)	2300	800	2495	15
	RE503021 (DB2)*		2300	800	2495	15

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CD,3274,G40,97A-19-02JUL99

SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD3029DF	1632	RE51940 (DB2)*		2200	800	2390	17
CD3029DF001	1602	RE53785 (DB2)*		2500	800	2710	17
	1603	RE53786 (DB2)*		1800		1880	15
	1641	RE53787 (DB2)*	RE64241	1500		1565	15
	1641	RE64241 (DB2)*		1500		1565	15
	1644**	RE41939 (DB2)*		1800		1880	15
	1648**	RE41941 (DB2)*	RE64242	1500		1565	15
	1648**	RE64242 (DB2)*		1500		1565	15
	1650	RE41938 (DB2)*		2500	800	2710	17
CD3029DF005	1603	RE53786 (DB2)*		1800		1880	17
	1620	RE53787 (DB2)*	RE64241	1500		1565	15
	1620	RE64241 (DB2)*		1500		1565	15
CD3029DF031	1602	RE53785 (DB2)*		2500	800	2710	17
	1632	RE51940 (DB2)*		2200	800	2390	17
	1650	RE41938 (DB2)*		2500	800	2710	17
	1654	RE63523 (DB2)*		2400	800	2605	17
CD3029DF032	1602	RE53785 (DB2)*		2500	800	2710	17
CD3029DF033	1632	RE51940 (DB2)*		2200	800	2390	17
CD3029DF034	1654	RE63523 (DB2)*		2400	800	2605	17

(Continued on next page)

CD,3274,G40,67 -19-04JAN99

SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD3029DF120	1602	RE53785 (DB2)*		2500	800	2710	17
	1603	RE53786 (DB2)*		1800		1880	15
	1641	RE64241 (DB2)*		1500		1565	15
	1642**	RE67271 (DB2)*		2500	800	2710	17
	1644**	RE41939 (DB2)*		1800		1880	15
	1645	RE97003 (DB2)*		2500	850	2710	17
	1648**	RE64242 (DB2)*		1500		1565	15
	1650	RE41938 (DB2)*		2500	800	2710	17
	1655	RE53785 (DB2)*		2500	1700	2710	15
CD3029DF121	1602	RE53785 (DB2)*		2500	800	2710	17
	1650	RE41938 (DB2)*		2500	800	2710	17
CD3029DF122	1603	RE53786 (DB2)*		1800		1880	15
	1641	RE64241 (DB2)*		1500		1565	15
	1644**	RE41939 (DB2)*		1800		1880	15
	1648**	RE64242 (DB2)*		1500		1565	15
CD3029DF123	16BS	RE53785 (DB2)*		2500	800	2710	17
CD3029DF124	1641	RE64241 (DB2)*		1500		1565	15
CD3029DF160	1602	RE53785 (DB2)*		2500	800	2710	17
	1632	RE51940 (DB2)*		2200	800	2390	17
	1643**	RE67271 (DB2)*		2500	800	2710	17
	1650	RE41938 (DB2)*		2500	800	2710	17
CD3029DF161	1602	RE53785 (DB2)*		2500	800	2710	17
CD3029DF162	1632	RE51940 (DB2)*		2200	800	2390	17
CD3029DF163	1654	RE63523 (DB2)*		2400	800	2605	17
CD3029DF164	16DV	RE53785 (DB2)*		2500	800	2710	17
	1602	RE53785 (DB2)*		2500	800	2710	17
CD3029DF165	1602	RE53785 (DB2)*		2500	800	2710	17

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD3029TF	1633 1640	RE51979 (DB4)* RE53958 (DB4)*		2200 2500	800 800	2390 2710	17 11
CD3029TF001	1602 1632** 1640	RE53783 (DB4)* RE58903 (DB4)* RE53958 (DB4)*		2500 2500 2500	800 800 800	2710 2710 2710	11 11 11
CD3029TF002	1645	RE58413 (DB4)*		2100	850	2285	10
CD3029TF031	1602 1632** 1633 1634 1640	RE53783 (DB4)* RE58903 (DB4)* RE51979 (DB4)* RE53783 (DB4)* RE53958 (DB4)*		2500 2500 2200 2500 2500	800 800 800 800 800	2710 2710 2390 2710 2710	11 11 17 11 11
CD3029TF032	1634	RE53783 (DB4)*		2500	800	2710	11
CD3029TF033	1633	RE51979 (DB4)*		2200	800	2390	17
CD3029TF120	1602 1632** 1640	RE53783 (DB4)* RE58903 (DB4)* RE53958 (DB4)*		2500 2500 2500	800 800 800	2710 2710 2710	11 11 11
CD3029TF121	1602 1632**	RE53783 (DB4)* RE58903 (DB4)*		2500 2500	800 800	2710 2710	11 11
CD3029TF123	16BT	RE53783 (DB4)*		2500	800	2710	11
CD3029TF160	1602 1632** 1633 1634 1640	RE53783 (DB4)* RE58903 (DB4)* RE51979 (DB4)* RE53783 (DB4)* RE53958 (DB4)*		2500 2500 2200 2500 2500	800 800 800 800 800	2710 2710 2390 2710 2710	11 11 17 11 11
CD3029TF161	16EV 1634	RE53958 (DB4)* RE53783 (DB4)*		2500 2500	800 800	2710 2710	11 11
CD3029TF162	1633	RE51979 (DB4)*		2200	800	2390	17
CD3029TF163	1602	RE53783 (DB4)*		2500	800	2710	11

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD4039DF	1602	RE37927 (DPA2)	RE42348 (DB2)	2500	800	2710	15
	1602	RE42348 (DB2)*	RE47133 (DB2)	2500	800	2710	17
	1602	RE47133 (DB2)*	RE49360 (DB2)	2500	800	2710	17
	1602	RE49360 (DB2)*		2500	800	2710	15
	1603	RE42351 (DB2)*	RE47134 (DB2)	1800		1880	15
	1603	RE47134 (DB2)*		1800		1880	15
	1609	RE52749 (DB2)*		2300	800	2495	15
	1614	RE52822 (DB2)*		2900	800	3100	13
	1620**	RE47176 (DB2)*		1800		1880	15
	1623**	RE50778 (DB2)*	RE42349 (DB2)	2500	800	2710	15
	1623**	RE42349 (DB2)*	RE47798 (DB2)	2500	800	2710	15
	1623**	RE47798 (DB2)*	RE50778 (DB2)	2500	800	2710	15
	1623**	RE50778 (DB2)*		2500	800	2710	15
	1624	RE49360 (DB2)*		2500	800	2710	15
	1641	RE42353 (DB2)*	RE50828 (DB2)	1500		1565	15
	1641	RE50828 (DB2)*	RE64243 (DB2)	1500		1565	15
	1641	RE64243 (DB2)*		1500		1565	15
	1643**	RE45358 (DB2)*		2500	800	2710	17
	1645	RE42354 (DB2)*	RE50829 (DB2)	1500		1565	15
	1645**	RE50829 (DB2)*	RE64244 (DB2)	1500		1565	15
	1645**	RE64244 (DB2)*		1500		1565	15
	1646	RE42352 (DB2)*		1800		1880	15
	1664	RE49360 (DB2)*		2500	1600	2710	15
CD4039DF001	1602	RE49360 (DB2)*		2500	800	2710	15
	1603	RE47134 (DB2)*		1800		1880	15
	1614	RE52822 (DB2)*		2900	800	3100	13
	1620**	RE47176 (DB2)*		1800		1880	15
	1623**	RE50778 (DB2)*		2500	800	2710	15
	1641	RE42353 (DB2)*	RE50828 (DB2)	1500		1565	15
	1641	RE64243 (DB2)*		1500		1565	15
	1645**	RE64244 (DB2)*		1500		1565	15
	1664	RE49360 (DB2)*		2500	1600	2710	15

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD4039DF002	1602 1623**	RE49360 (DB2)* RE50778 (DB2)*		2500 2500	800 800	2710 2710	15 15
CD4039DF004	1603 1618 1620**	RE47134 (DB2)* RE47134 (DB2)* RE47176 (DB2)*		1800 1800 1800		1880 1880 1880	15 15 15
CD4039DF005	1603 1620** 1641 1645**	RE47134 (DB2)* RE47176 (DB2)* RE64243 (DB2)* RE64244 (DB2)*		1800 1800 1500 1500		1880 1880 1565 1565	15 15 15 15
CD4039DF006	1641	RE64243 (DB2)*		1500		1565	15
CD4039DF007	1641 or 16KG	RE64243 (DB2)*		1500		1565	15
CD4039DF031	1602 1609 1623**	RE49360 (DB2)* RE52749 (DB2)* RE50778 (DB2)*		2500 2300 2500	800 800 800	2710 2495 2710	15 15 15
CD4039DF032	1609	RE52749 (DB2)*		2300	800	2495	15

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD4039TF	1601	RE48484 (DM4)		1800	800	1950	13
	1602	RE26858 (DM4)*	RE47135 (DB4)	2500	800	2710	13
	1602	RE47135 (DB4)*		2500	800	2710	13
	1603	RE21515 (DM4)*	RE48154 (DB4)	1800		1880	13
	1603	RE48154 (DB4)*		1800		1880	13
	1605	RE47909 (DM4)*		2900	800	3140	11
	1610	RE52750 (DB4)*		2300	800	2495	13
	1611**	RE55565 (DB4)*		2200	800	2390	13
	1619**	RE47177 (DB4)*		2500	800	2710	13
	1620**	RE48155 (DB4)*		1800		1880	13
	1623	RE31765 (DM4)*		2500	800	2710	15
	1625	RE47135 (DB4)*		2500	800	2710	13
	1635	RE31759 (DM4)*	RE50808 (DB4)	1500		1565	14
	1635**	RE50808 (DB4)*		1500		1565	14
	1636	RE31766 (DM4)*		1800		1880	13
	1641	RE29471 (DM4)*	RE50909 (DB4)	1500		1565	14
	1641	RE50809 (DB4)*		1500		1565	14
	1643	RE45356 (DM4)*		2500	800	2710	15
	1650	RE38946 (DM4)*	RE50866 (DB4)	2500	800	2710	13
	1650**	RE50866 (DB4)*		2500	800	2710	13
	1651	RE38947 (DM4)*	RE50867 (DB4)	2500	800	2710	13
	1651**	RE50867 (DB4)*		2500	800	2710	13
CD4039TF001	1601	RE48484 (DM4)*		1800	800	1950	13
	1602	RE47135 (DB4)*		2500	800	2710	13
	1603	RE48154 (DB4)*		1800		1880	13
	1605	RE47909 (DM4)*		2900	800	3140	11
	1611**	RE55565 (DB4)*		2200	800	2390	13
	1619**	RE47177 (DB4)*		2500	800	2710	13
	1620**	RE48155 (DB4)*		1800		1880	13
	1635**	RE50808 (DB4)*		1500		1565	14
	1641	RE50809 (DB4)*		1500		1565	14
	1650**	RE50866 (DB4)*		2500	800	2710	13
	1651**	RE50867 (DB4)*		2500	800	2710	13

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD4039TF002	1602 1619**	RE47135 (DB4)* RE47177 (DB4)*		2500 2500	800 800	2710 2710	13 13
CD4039TF003	1603 1620** 1635** 1641	RE48154 (DB4)* RE48155 (DB4)* RE50808 (DB4)* RE50809 (DB4)*		1800 1800 1500 1500		1880 1880 1565 1565	13 13 14 14
CD4039TF004	1603 1620**	RE48154 (DB4)* RE48155 (DB4)*		1800 1800		1880 1880	13 13
CD4039TF005	1611 1611	RE55565 (DB4)* RE69326 (DB4)*	RE69326 (DB4)	2200 2200	800 800	2390 2390	13 13
CD4039TF006	1641	RE50809 (DB4)*		1500		1565	14
CD4039TF007	1641 or 16KH	RE50809 (DB4)*		1500		1565	14
CD4039TF031	1602 1610 1619** 1650** 1651	RE47135 (DB4)* RE52750 (DB4)* RE47177 (DB4)* RE50866 (DB4)* RE50867 (DB4)*		2500 2300 2500 2500 2500	800 800 800 800 800	2710 2495 2710 2710 2710	13 13 13 13 13
CD4039TF032	1610	RE52750 (DB4)*		2300	800	2495	13

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD4045DF001	1602	RE47179 (DB2)*		2400	800	2605	14
	1626	RE55079 (DB2)*		2200	800	2390	15
	1635	RE68444 (DB4)*		2200	800	2390	14
CD4045DF031	1602	RE47179 (DB2)*		2400	800	2605	14
	1636	RE68444 (DB4)*		2200	800	2390	14
CD4045TF001	1602	RE47180 (DB4)*		2400	800	2605	11
	1603	RE64298 (DB4)*		2400	800	2605	11
	1620	RE57647 (DB4)*	RE66266 (DB4)	1500		1565	14
	1620	RE66266 (DB4)*		1500		1565	14
	1625	RE58882 (DB4)*		2200	800	2390	14
	1627	RE55080 (DB4)*		2200	800	2390	15
	1628	RE48156 (DB4)*		1800		1880	14
	1629	RE52015 (DB4)*		2400	800	2605	15
	1630	RE57717 (DB4)*		2400	800	2605	15
	1637	RE68454 (DB4)*		2400	800	2605	11
	1638	RE68455 (DB4)*		2400	800	2605	11
	1639	RE68456 (DB4)*		1500		1565	14
	1640	RE68457 (DB4)*	RE65035 (DB4)	1800		1880	14
	1640	RE65035 (DB4)*		1800		1880	14
	1641	RE68458 (DB4)*		2400	800	2605	15
	1642	RE68459 (DB4)*		2400	800	2605	15
CD4045TF002	1620	RE66266 (DB4)*		1500		1565	14
	1628	RE48156 (DB4)*		1800		1880	14
	1639	RE68456 (DB4)*		1500		1565	14
	1640**	RE65035 (DB4)*		1800		1880	14
CD4045TF003	1620	RE66266 (DB4)*		1500		1565	14
CD4045TF031	1602	RE47180 (DB4)*		2400	800	2605	11
	1631	RE52015 (DB4)*		2400	800	2605	15
	1632	RE57717 (DB4)*		2400	800	2605	15
	1643	RE64298 (DB4)*		2400	800	2605	11
	1644	RE68454 (DB4)*		2400	800	2605	11
	1645	RE68458 (DB4)*		2400	800	2605	15
	1646	RE68459 (DB4)*		2400	800	2605	15

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD6059DF	1602	RE37935 (DPA2)	RE52159 (DB2)	2500	800	2710	15
	1602	RE52159 (DB2)*		2500	800	2710	17
	1603	RE37933 (DPA2)		1800		1880	14
	1623	RE37935 (DPA2)	RE52160 (DB2)	2500	800	2710	15
	1623**	RE52160 (DB2)*		2500	800	2710	17
	1636	RE37933 (DPA2)		2500	800	2710	14
	1638	RE37934 (DPA2)		1500		1565	13
	1641	RE37934 (DPA2)		1500		1565	13
CD6059DF001	1602	RE52159 (DB2)*		2500	800	2710	17
	1603	RE37933 (DPA2)		1800		1880	14
	1623**	RE52160 (DB2)*		2500	800	2710	17
	1636	RE37933 (DPA2)		2500	800	2710	14
	1638	RE37934 (DPA2)		1500		1565	13
	1641	RE37934 (DPA2)		1500		1565	13
CD6059DF002	1602	RE52159 (DB2)*		2500	800	2710	17
	1623**	RE52160 (DB2)*		2500	800	2710	17
CD6059DF003	16BZ**	RE52160 (DB2)*		2500	800	2710	17
CD6059TF	1602	RE19914 (DM4)*	RE47137 (DB4)	2500	800	2710	13
	1602	RE47137 (DB4)*		2500	800	2710	13
	1603	RE19981 (DM4)*	RE48159 (DB4)	1800		1880	14
	1603	RE48159 (DB4)*		1800		1880	14
	1619**	RE47178 (DB4)*		2500	800	2710	13
	1624**	RE48160 (DB4)*		1800		1880	16
	1636	RE31760 (DM4)*	RE50886 (DB4)	1500		1565	17
	1636**	RE50886 (DB4)*		1500		1565	15
	1641	RE29472 (DM4)*	RE50885 (DB4)	1500		1565	17
	1641	RE50885 (DB4)*		1500		1565	15
	1644	RE48157 (DB4)*		1800		1880	14
	1645**	RE48158 (DB4)*		1800		1880	14
	1646	RE50892 (DB4)*		1500		1565	13
	1647**	RE50893 (DB4)*		1500		1565	13

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD6059TF001	1602	RE47137 (DB4)*		2500	800	2710	13
	1603	RE48159 (DB4)*		1800		1880	14
	1619**	RE47178 (DB4)*		2500	800	2710	13
	1624**	RE48160 (DB4)*		1800		1880	16
	1636**	RE50886 (DB4)*		1500		1565	15
	1641	RE50885 (DB4)*		1500		1565	15
	1644	RE48157 (DB4)*		1800		1880	14
	1645**	RE48158 (DB4)*		1800		1880	14
	1646	RE50892 (DB4)*		1500		1565	13
	1647**	RE50893 (DB4)*		1500		1565	13
	1652	RE56483 (DB4)*		2500	800	2710	13
	1653**	RE56484 (DB4)*		2500	800	2710	13
CD6059TF002	1603	RE48159 (DB4)*		1800		1880	14
	1624**	RE48160 (DB4)*		1800		1880	16
CD6059TF003	1644	RE48157 (DB4)*		1800		1880	14
	1645**	RE48158 (DB4)*		1800		1880	14
CD6059TF004	1602	RE47137 (DB4)*		2500	800	2710	13
	1619**	RE47178 (DB4)*		2500	800	2710	13
CD6059TF005	1641	RE50892 (DB4)*		1500		1565	13
	1644	RE48157 (DB4)*		1800		1880	14
	1645**	RE48158 (DB4)*		1800		1880	14
	1646	RE50892 (DB4)*		1500		1565	13
	1647**	RE50893 (DB4)*		1500		1565	13
CD6059TF006	1603	RE48159 (DB4)*		1800		1880	14
	1624**	RE48160 (DB4)*		1800		1880	16
	1636**	RE50886 (DB4)*		1500		1565	15
	1641	RE50885 (DB4)*		1500		1565	15
CD6059TF007	1619**	RE47178 (DB4)*		2500	800	2710	13
CD6059TF008	1646	RE50892 (DB4)*		1500		1565	13

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing (cont'd):

• Saran OEM engines:

ENGINE MODEL	OPTION CODE	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
CD6068DF001	1622 1623	RE47182 (DB4)* RE47183 (DB4)*		2400 2400	800 800	2605 2605	18 18
CD6068TF001	1642** 1643	RE47184 (DB4)* RE47185 (DB4)*		2400 2400	800 800	2605 2605	14 14
CD6068TF002	1643	RE47185 (DB4)*		2400	800	2605	14
CD6068TF003	1605 1646	RE65342 (DB4)* RE67761 (DB4)*		1500 1500		1565 1565	15 15
CD6068TF004	1605	RE65342 (DB4)*		1500		1565	15

** Pump dynamically timed at the factory. Use dynamic timing when the pump is overhauled or replaced.*

*** Can be used with JP5/JP8 Fuel.*

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SPECIFICATIONS - CONTINUED

Fuel injection pump dynamic timing at no-load (for following combine engine):

• Zweibrücken combines:

COMBINE MODEL	ENGINE MODEL	ORIGINAL INJ. PUMP Part No.(model)	REPLACED BY Part No.(model)	RATED SPEED rpm	SLOW IDLE rpm	FAST IDLE rpm	DYNAMIC TIMING deg
2054/ 2254	6068HZ001	RE52901 (DB4)*		2200	1250	2350	12

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** Pump dynamically timed at the factory. Use dynamic timing when the pump is overhauled or replaced.*

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SPECIFICATIONS - CONTINUED

Aneroid adjustment:

• Lever lift-off pressure	76—102 mm Hg (3—4 in. Hg) 10—14 kPa (0.10—0.14 bar/1.5—2 psi)
• Lever full travel pressure	330—380 mm Hg (13—15 in. Hg) 44—51 kPa (0.44—0.51 bar/6.4—7.4 psi)

Fuel injection nozzles	**All 3029D All 4039D All 6059D 4039TAT01 4039TLV01 (-308582CD) 6068DL001**	**All 3029T All 4039T except 4039TAT01 and 4039TLV01 (-308582CD) All 4045D All 4045T All 6059T All 6068D except 6068DL001 All 6068T**
• Opening pressure of a new or reconditioned nozzle with new internal parts	22300—23200 kPa (223—232 bar; 3233—3364 psi)	25750—26600 kPa (257.5—266 bar; 3734—3857 psi)
• Opening pressure of an used nozzle	20400—21800 kPa (204—218 bar; 2958—3161 psi)	23500—25200 kPa (235—252 bar; 3407—3654 psi)
• Maximum opening pressure difference between cylinders	700 kPa (7 bar; 100 psi)	700 kPa (7 bar; 100 psi)
• Number of nozzle tip orifices	4	4
• Diameter of nozzle tip orifice	0.27 mm (0.0106 in.)	0.29 mm (0.0116 in.)
Seat tightness condition at test pressure of 2800 to 3500 kPa (28 to 35 bar; 400 to 500 psi) below opening pressure	Tip dry after a period of 5 seconds (a slight dampness is permissible on used nozzles)	Tip dry after a period of 5 seconds (a slight dampness is permissible on used nozzles)
Return leakage at test pressure of 10300 kPa (103 bar; 1500 psi)	14 drops per 30 seconds	14 drops per 30 seconds
Valve lift specifications (based on zero valve lift)	1/2 turn counter-clockwise	3/4 turn counter-clockwise

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TORQUES FOR HARDWARE

Pump drive gear-to-pump shaft, hex. nut:
- Lucas CAV (all models) . . . . . 80 N·m (60 lb-ft)
- Stanadyne (model DB2):
  — with 8 mm thick nut . . . . . 60 N·m (44 lb-ft)
  — with 10 mm thick nut . . . . . 125 N·m (150 lb-ft)
- Stanadyne (models DB4 and DM4) . . . . . 200 N·m (150 lb-ft)
- MICO in-line pump . . . . . 85 N·m (62 lb-ft)

Fuel injection pump-to-cylinder block front plate:
- MICO in-line pump . . . . . 50 N·m (35 lb-ft)
- Other . . . . . 25 N·m (18 lb-ft)

Fuel pressure lines to injection pump:
- Lucas CAV (all models) . . . . . 30 N·m (23 lb-ft)
- Stanadyne (all models) . . . . . 25 N·m (18 lb-ft)
- MICO in-line pump . . . . . 25 N·m (18 lb-ft)

Fuel pressure lines to nozzles . . . . . 30 N·m (23 lb-ft)

Fuel supply line to injection pump:
- MICO in-line pump . . . . . 25 N·m (18 lb-ft)
- Other . . . . . 30 N·m (23 lb-ft)

Fuel return line to injection pump:
- MICO in-line pump . . . . . 25 N·m (18 lb-ft)
- Other . . . . . 16 N·m (12 lb-ft)

Injection pump cover, cap screws:
- Lucas CAV (all models) . . . . . 3.5 N·m (2.5 lb-ft)
- Stanadyne (all models) . . . . . 2 N·m (17 lb-in.)

Shut-off solenoid valve:
- Lucas CAV (all models) . . . . . 15—20 N·m (11—15 lb-ft)

Adjusting screw for slow and fast idle
speeds, hex. nuts . . . . . 4.5 N·m (3.5 lb-ft)

Fuel injection nozzles:
- Lock nut of pressure adjusting screw . . . . . 10 N·m (7 lb-ft)
- Lock nut of lift adjusting screw . . . . . 5 N·m (3.5 lb-ft)
- Fuel injection nozzle to cylinder head, cap screw . . . . . 37 N·m (27 lb-ft)
- Fuel leak-off, hex. nut . . . . . 5 N·m (3.5 lb-ft)

Oil supply line to injection pump (MICO in-line pump) . . . . . 15 N·m (11 lb-ft)

CD,3274,G40,7 -19-04JAN99

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23

RECTANGULAR FUEL FILTER ELEMENT REPLACEMENT

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

Remove drain plug and drain filter.

Release the filter element retaining spring and pull off element.

Before installing new filter element, inspect the filter plate where element makes contact. This location must be completely void of dirt or other contaminants. If contaminants are found, clean carefully.

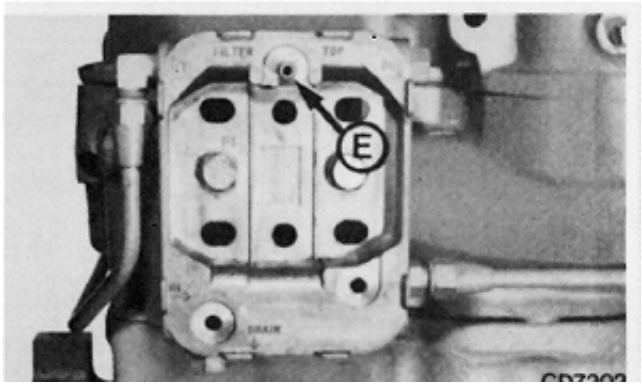
IMPORTANT: Any dirt lodged in spring pin groove or at end of spring pin during cleaning will be washed into the injection system. This may result in severe damage to the fuel injection pump or nozzles.

Push new element over the spring pin. Hook the top end of retaining spring first, then hook the bottom end.

After changing the element, install and tighten drain plug in filter plate.

Bleed fuel system.

CD7201 -UN-26JUL89



CD7202 -UN-26JUL89

A—Bleed plug
B—Filter element
C—Retaining spring
D—Drain plug
E—Spring pin

CD,3274,G40,8 -19-01FEB94

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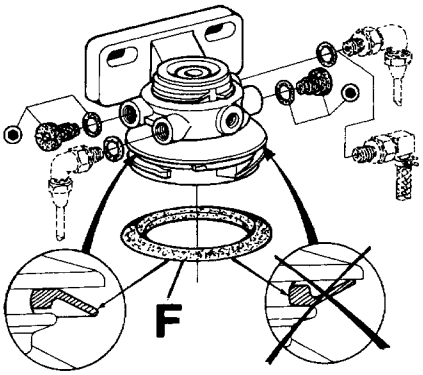
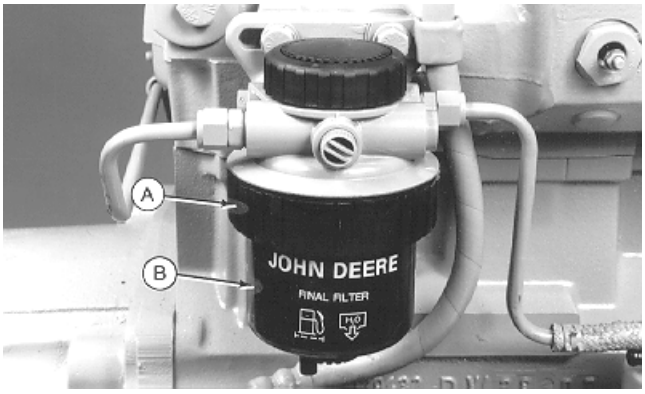
24

REPLACE ROUND FUEL FILTER ELEMENT





-UN-17JUN98 CD30667

-UN-04MAY98 CD30664

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

1. If equipped, rotate the fuel inlet valve to the closed position.

2. Unfasten filter retaining ring (A) and remove filter element (B).

NOTE: For a cleaner service, obturate the previous element with the plug provided with the new element.

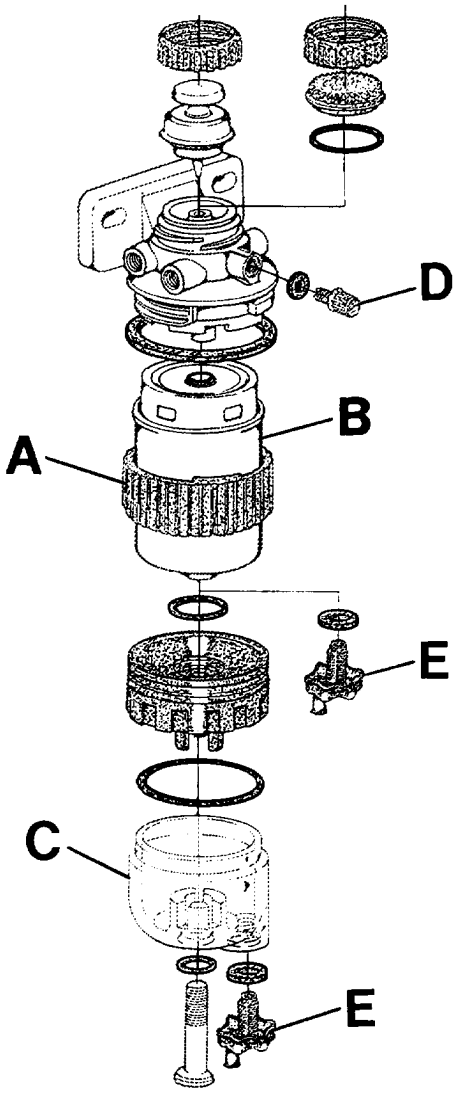
3. If equipped, remove sediment glass bowl (C) from filter element and reinstall it onto the new element.

4. Install dust seal (F) as shown.

5. Position new element in proper location then tighten about 1/3 turn until retaining ring fits into the detent. DO NOT overtighten.

6. Bleed fuel system.

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



-UN-16JUN98 CD30665

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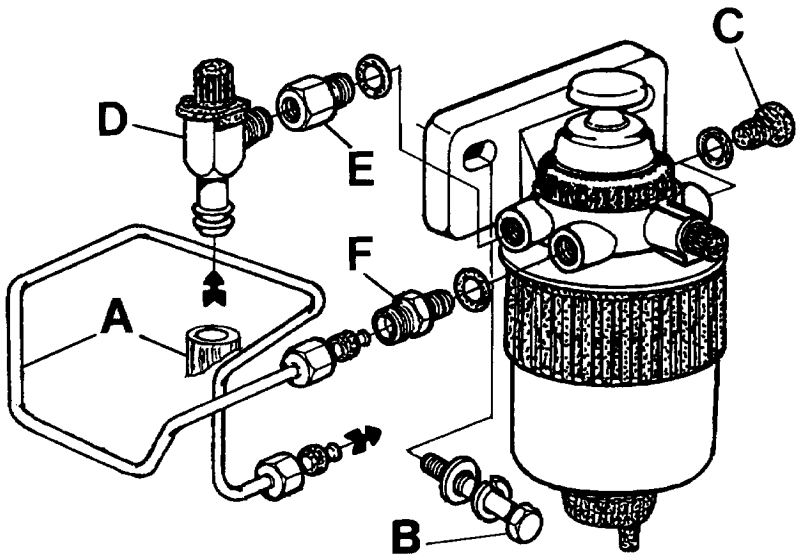
CD,3274,G40,9 -19-04JAN99

REPLACE ROUND FUEL FILTER ASSEMBLY



CD30666 -UN-16JUN98

1. Disconnect fuel lines (A).

2. Unscrew bolts (B) and remove fuel filter assembly.

3. Replace parts as necessary, then tighten bolts (B) to 50 N·m (37 lb-ft).

4. Install plugs (C) on filter head and tighten to 5 N·m (3.5 lb-ft).

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 30 N·m (23 lb-ft).

CD,3274,G40,76 -19-04JAN99

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26

FUEL PUMP REPLACEMENT

1. Disconnect fuel lines and plug both connections on fuel pump and fuel lines.

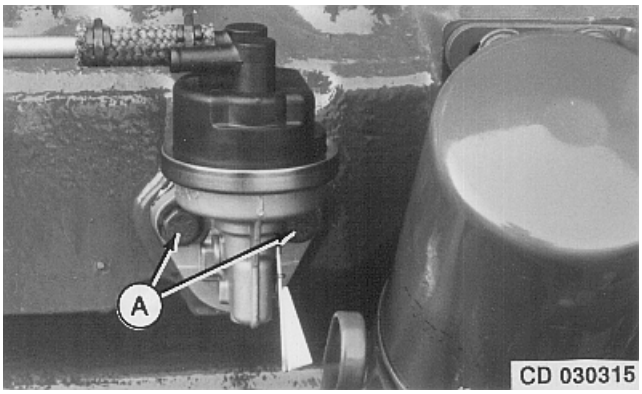
2. Remove cap screws (A) and lift out fuel pump.

NOTE: Fuel pump is not repairable, replace if defective.

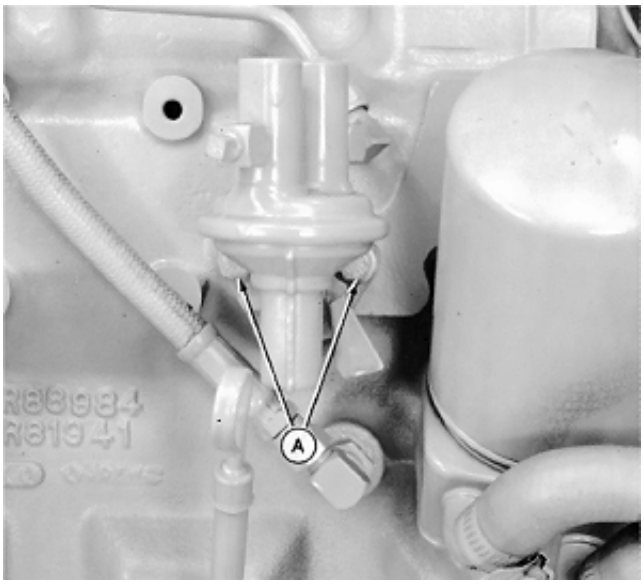
3. Install new gasket.

4. Apply sealing compound on thread of cap screws and attach the fuel pump to cylinder block. Tighten to 30 N·m (23 lb-ft).

5. Reconnect fuel lines and bleed fuel system.



"SOFABEX" fuel pump



"AIRTEX" fuel pump

CD,3274,G40,10 -19-01FEB94

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LUCAS CAV FUEL INJECTION PUMP REMOVAL

IMPORTANT: Never steam clean or pour cold water on a fuel injection pump while the pump is running or while it is warm.

Clean the fuel injection pump, lines and area around the pump with cleaning solvent or a steam cleaner.

Disconnect shut-off system and speed control rod.
Disconnect fuel return line (A).
Disconnect fuel supply line (B).
Disconnect fuel injection lines (C).

IMPORTANT: When loosening fuel pressure lines at fuel injection pump, be sure not to turn fuel injection pump fittings. Turning of these fittings may cause internal pump damage.

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

Remove plug or cover from mounting hole in timing gear cover.

Remove nut (D) and washer securing the fuel injection pump drive gear to pump shaft.

Attach special tool JDG670A to gear (or KJD10159 to timing gear cover). Remove the three nuts attaching fuel injection pump to engine front plate.

Turn cap screw of special tool clockwise until pump shaft is loosened from conical seat of drive gear. On engine with 37 kW auxiliary drive only, remove the center forcing screw from JDG670A tool and tighten the two cap screws until gear is pulled against cover. This will avoid that gear becomes disengaged from upper idler gear.

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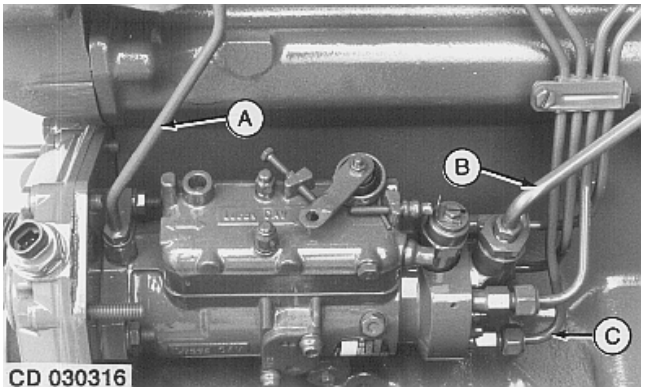
Check for the presence of timing marks. If necessary, mark both the pump and the front plate.

Pull the fuel injection pump backward from the three studs.

NOTE: When removing fuel injection pump be careful not to lose pump shaft Woodruff key.



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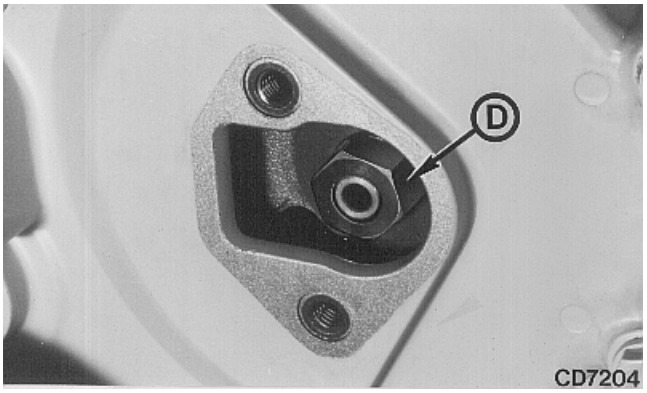

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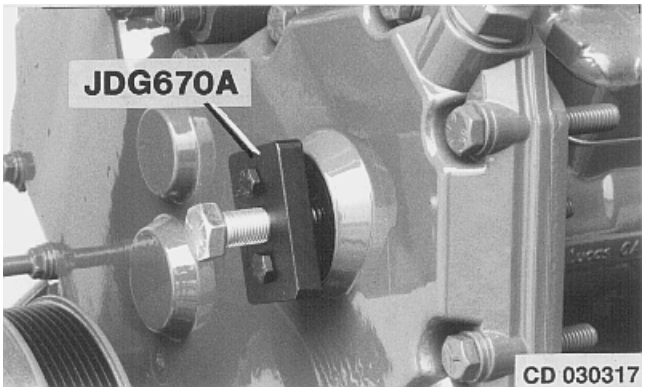

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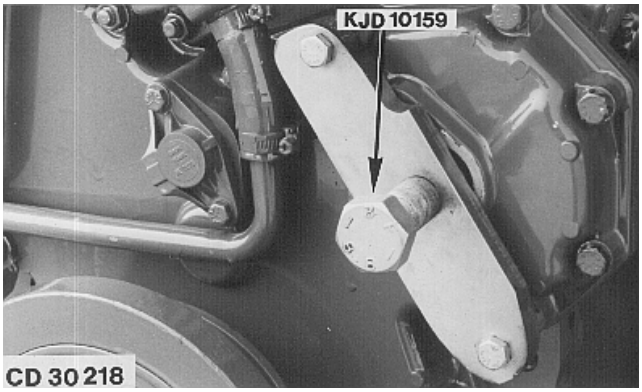

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CD,3274,G40,11 -19-01FEB94

REPAIRS TO FUEL INJECTION PUMP

Do not disassemble the Lucas CAV fuel injection pump further than necessary for installing available parts, not even for cleaning.

Send fuel injection pump to a specialized workshop for proper checking and adjustment.

CD,3274,G40,12 -19-27APR92

LUCAS CAV FUEL INJECTION PUMP INSTALLATION

Fit a new gasket or O-ring on pump housing and slide housing onto the three studs.

Guide pump drive shaft into bore of drive gear. Tighten drive gear hex. nut (D) to 80 N·m (60 lb-ft).

NOTE: Make sure that Woodruff key is properly installed.

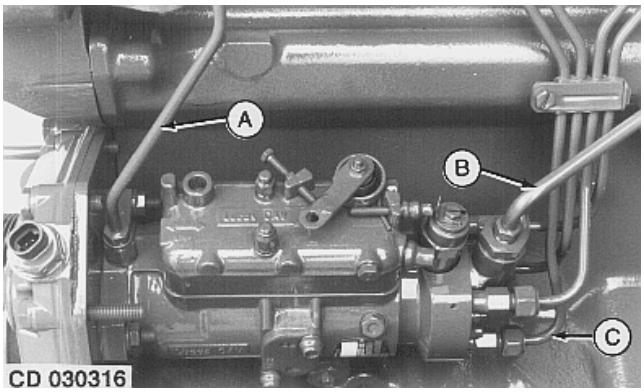
Screw hex. nuts onto the three studs and tighten fingertight only at this stage. Adjust pump (see “Fuel Injection Pump Static Timing” in this group).

Connect fuel injection lines (C). Commence with outlet (E) and continue around the pump head in counter-clockwise direction, attaching lines in same order as engine firing (1-5-3-6-2-4 on 6 cyl. engines, 1-3-4-2 on 4 cyl. engines and 1-2-3 on 3 cyl. engines).

Tighten fuel pressure lines at pump to 30 N·m (23 lb-ft).

IMPORTANT: When tightening fuel pressure lines at fuel injection pump, be sure not to turn fuel injection pump fittings. Turning of these fittings may cause internal pump damage.

Connect fuel return line (A), fuel supply line (B), shut-off system and speed control rod.



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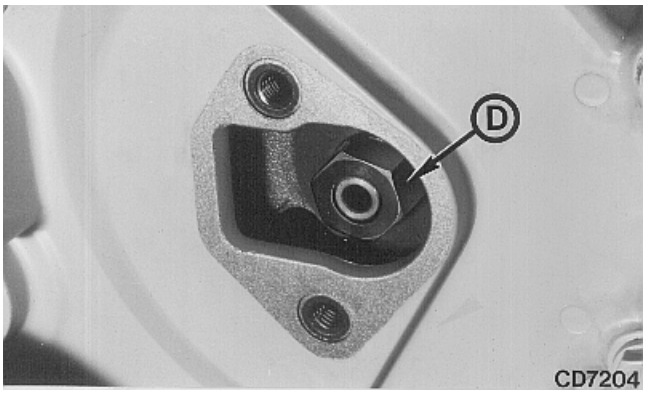
CD30316



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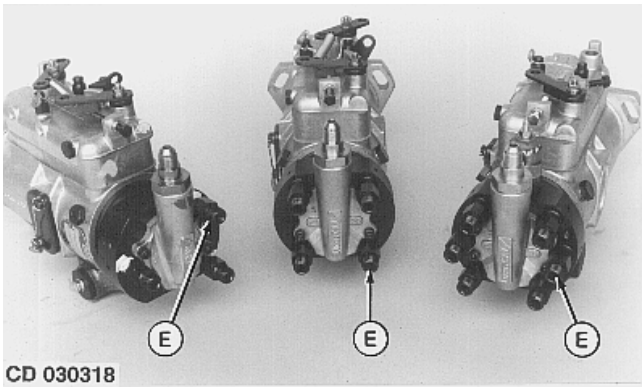

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CD30318

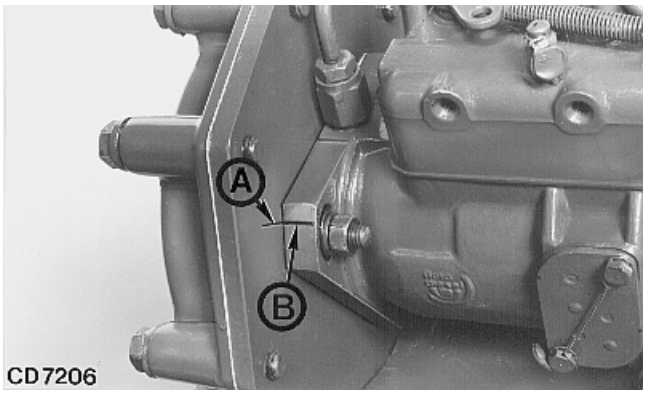
CD,3274,G40,13 -19-01FEB94

LUCAS CAV FUEL INJECTION PUMP STATIC TIMING

Loosen attaching hex. nuts of fuel injection pump and pivot pump housing away from cylinder block as far as slots will allow. Then pivot it back again, but only as far as necessary to align timing mark on pump flange (B) with timing mark on cylinder block front plate (A).

Tighten the three hex. nuts securing the pump to the front plate to 25 N·m (18 lb-ft).

See also “Dynamic timing” in this Group.



CD,3274,G40,14 -19-28APR92

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STANADYNE DB2 OR DB4 FUEL INJECTION PUMP REMOVAL

IMPORTANT: Never steam clean or pour cold water on a fuel injection pump while the pump is running or while it is warm.

Clean the fuel injection pump, lines and area around the pump with cleaning solvent or a steam cleaner.

Disconnect shut-off system and speed control rod.
Disconnect fuel return line (A).
Disconnect fuel supply line (B).
Disconnect fuel injection lines (C).

IMPORTANT: When loosening fuel pressure lines at fuel injection pump, be sure not to turn fuel injection pump fittings. Turning of these fittings may cause internal pump damage.

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

Remove plug or cover from mounting hole in timing gear cover.

Remove nut (D) and washer securing the fuel injection pump drive gear to pump shaft.

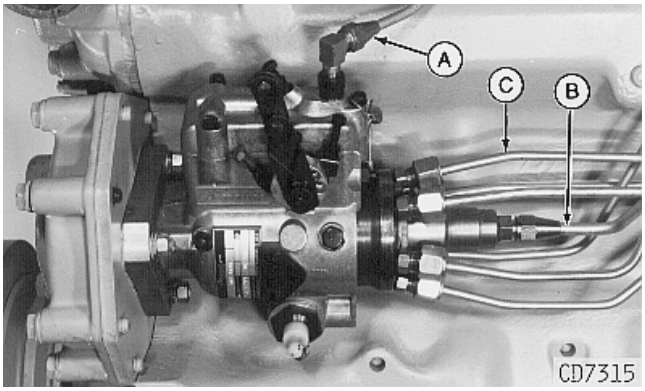
Attach special tool JDG670A to gear (or KJD10159 to timing gear cover). Remove the three nuts attaching fuel injection pump to engine front plate.

Turn cap screw of special tool clockwise until pump shaft is loosened from conical seat of drive gear. On engine with 37 kW auxiliary drive only, remove the center forcing screw from JDG670A tool and tighten the two cap screws until gear is pulled against cover. This will avoid that gear becomes disengaged from upper idler gear.

Check for the presence of timing marks. If necessary, mark both the pump and the front plate.

Pull the fuel injection pump backward from the three studs.

NOTE: When removing fuel injection pump be careful not to lose pump shaft Woodruff key.



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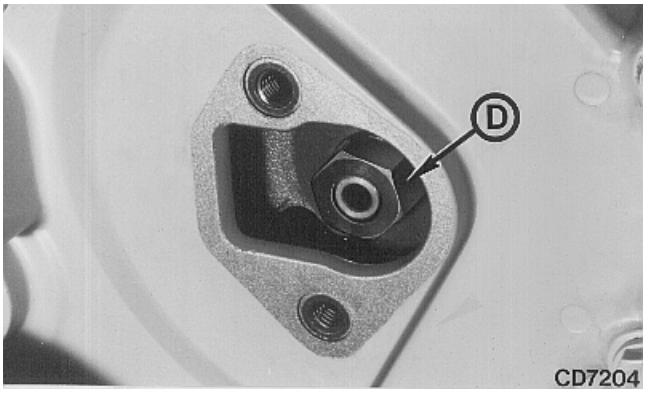

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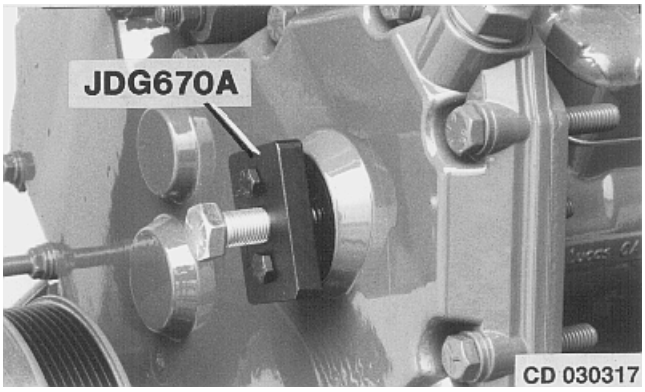

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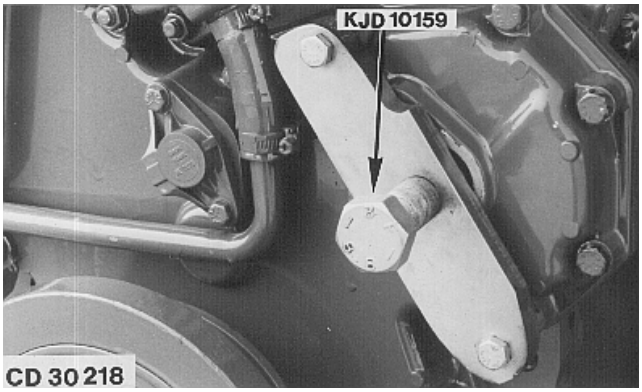


-UN-07MAR95 CD30218

CD,3274,G40,17 -19-01FEB94

REPAIRS TO FUEL INJECTION PUMP

Do not disassemble the Stanadyne fuel injection pump further than necessary for installing available parts, not even for cleaning.

Send fuel injection pump to a specialized workshop for proper checking and adjustment.

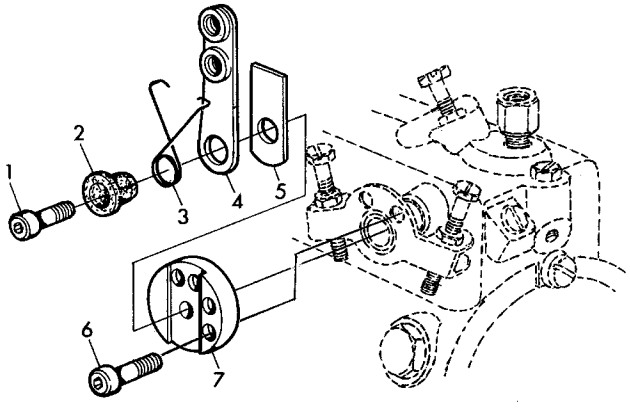
CD,3274,G40,18 -19-27APR92

REPLACE THROTTLE LEVER (STANADYNE)

1. Remove parts.

2. Inspect parts. Replace as necessary.

3. Tighten position screw (6) to 3—3.5 N·m (2.2—2.6 lb-ft) and spring screw (1) to 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

CD,3274,G40,77 -19-04JAN99

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STANADYNE DB2 OR DB4 FUEL INJECTION PUMP INSTALLATION

Using a new gasket or a new O-ring, slide housing onto three studs, inserting pump drive shaft in drive gear bore.

NOTE: Make sure that Woodruff key is seated properly.

Screw the three hex. nuts onto studs and tighten finger-tight only at this stage.

Tighten drive gear hex. nut (A) to the following torque:

Chrome finish nut with a thickness
of 8 mm (0.315 in.) . . . . . 60 N·m (45 lb-ft)

Black finish nut with a thickness
of 10 mm (0.370 in.) . . . . . 200 N·m (145 lb-ft)

IMPORTANT: Do not try to tighten the chrome finish nut to 200 N·m (145 lb-ft), thread of nut will be damaged.

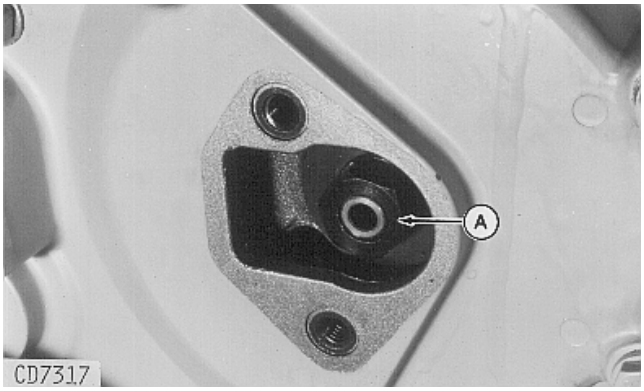
NOTE: It is recommended, during the refitting, to replace the chrome finish nut by the black finish nut, then tighten to 200 N·m (145 lb-ft).

Connect injection pump pressure lines (C). Commence with outlet (B) and continue around the pump head in counter-clockwise direction, attaching lines in same order as engine firing (1-5-3-6-2-4 on 6 cyl. engines, 1-3-4-2 on 4 cyl. engines and 1-2-3 on 3 cyl. engines).

Tighten fuel pressure lines at pump to 25 N·m (18 lb-ft) torque, using line wrench JDF22.

IMPORTANT: When tightening fuel pressure lines at fuel injection pump, be sure not to turn fuel injection pump fittings. Turning of these fittings may cause internal pump damage.

Connect fuel supply line (E), return line (D), shut-off cable and speed control rod.



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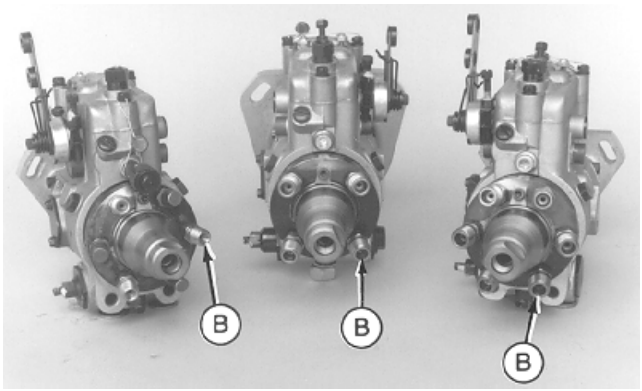

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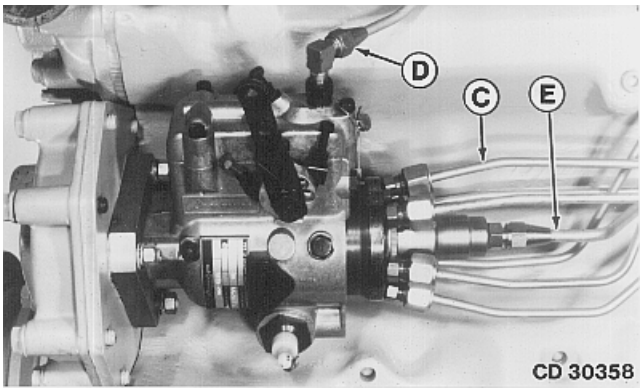

-UN-07MAR95 CD30358

A—Drive gear lock nut
B—Outlet connection to no.1 cylinder
C—Fuel pressure lines
D—Fuel return line
E—Fuel supply line

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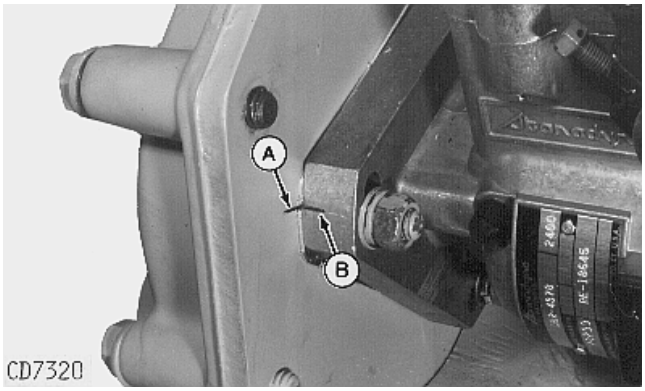
CD,3274,G40,19 -19-04JAN99

STANADYNE DB2 OR DB4 FUEL INJECTION PUMP STATIC TIMING

Static timing with external marks

Loosen attaching hex. nuts of fuel injection pump and pivot pump housing away from cylinder block as far as slots will allow. Then pivot it back again, but only far enough to align timing mark on pump flange (B) exactly with timing mark on cylinder block front plate (A). Tighten the three hex. nuts securing the pump to front plate to 25 N·m (18 lb-ft).

See also “Dynamic Timing” in this Group.



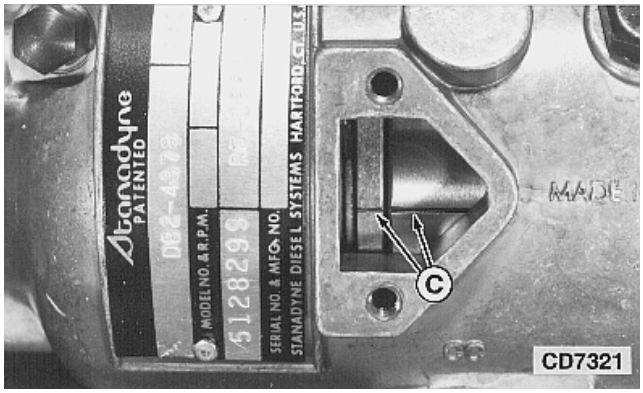
-UN-23MAY95 CD7320

Static timing without timing marks

Make sure piston no. 1 is at TDC on compression stroke and remove timing hole cover from injection pump.

With attaching hex. nuts finger-tight, pivot the pump housing away from block as far as slots will allow. Then pivot it back until the timing marks (C) on cam ring and governor weight retainer are aligned. Tighten pump attaching nuts to 25 N·m (18 lb-ft).

See also “Dynamic Timing” in this Group.



-UN-23MAY95 CD7321

CD,3274,G40,20 -19-28APR92

ENGINE FRONT PLATE REPLACEMENT

NOTE: The front plate available as a spare part is not provided with a timing mark.

IMPORTANT: Before any front plate replacement, proceed as follows:

Remove timing hole cover from injection pump and rotate engine until no. 1 piston is at TDC on its compression stroke.

Check whether both the cam ring and governor weight retainer have timing marks (A).
If yes, proceed to disassembly.
If no and mark only visible on cam ring (1), pencil a reference line across the governor cage (2) using the cam ring mark as reference. Only then proceed to disassembly.

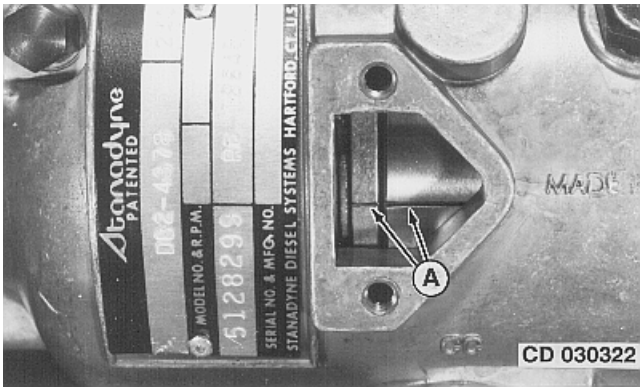
NOTE: The front plate shows several injection pump stud locations for the various possible engine applications. Use holes marked (B).

Insert the studs into the holes corresponding to the required application and plug the remaining holes.

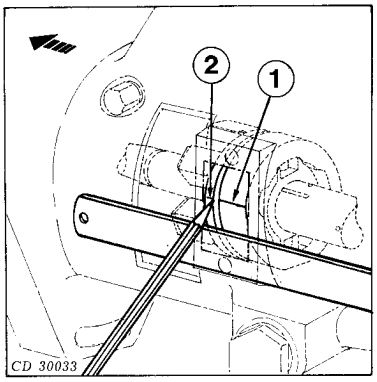
Reinstall front plate and injection pump onto engine (see "STANADYNE DB2 OR DB4 FUEL INJECTION PUMP INSTALLATION" in this group).

Transfer timing mark to new front plate. Install timing hole cover on injection pump and reassemble engine parts removed.

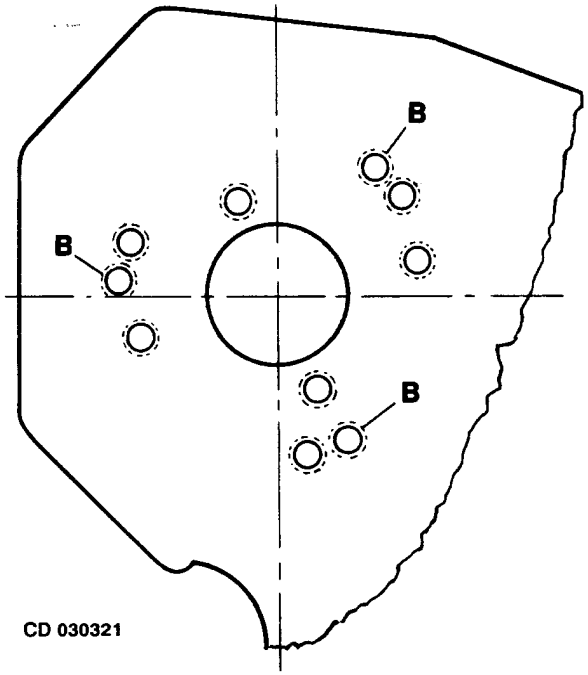
A—Fuel injection pump timing marks
B—Threaded holes for STANADYNE DB2 or DB4



CD030322 -UN-17FEB95



CD30033 -UN-07MAR95



CD030321 -UN-08MAR95

CD,3274,G40,21 -19-27APR92

STANADYNE DM4 FUEL INJECTION PUMP REMOVAL

IMPORTANT: Never steam clean or pour cold water on a fuel injection pump while the pump is running or while it is warm.

Clean the fuel injection pump, lines and area around the pump with cleaning solvent or a steam cleaner.

Remove the timing hole cover.

Rotate the engine until timing mark on governor weight retainer is in line with timing mark on cam ring.

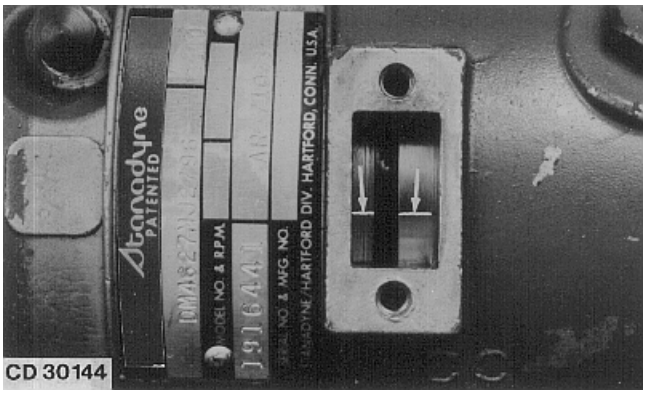
Disconnect speed control rod and shut-off system. Disconnect fuel return line (A) and fuel supply line (B). Disconnect injection lines (C), using line wrench JDF22.

IMPORTANT: When removing injection lines to nozzles, do not turn outlet fittings in the pump. Turning these fittings may cause internal injection pump damage.

Remove mounting hole cover in timing gear cover. Remove hex. nut and washer securing injection pump drive gear to pump shaft. Remove hex. nuts (D). Remove fuel injection pump, taking care not to lose the Woodruff key.

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

A—Fuel return line
B—Fuel supply line
C—Fuel pressure lines
D—Pump attaching nuts



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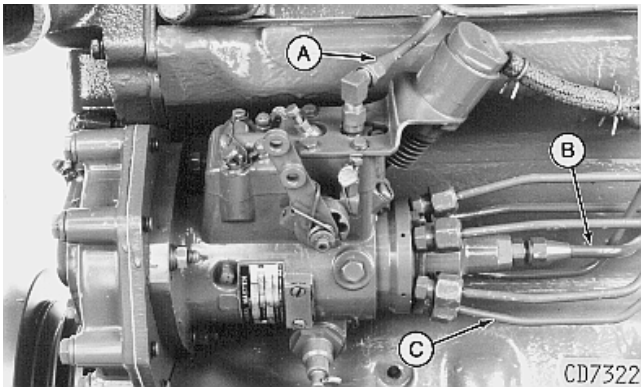

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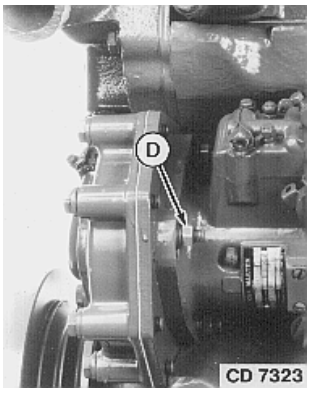

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CD,3274,G40,23 -19-01FEB94

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REPAIRS TO FUEL INJECTION PUMP

Do not disassemble the Stanadyne fuel injection pump further than necessary for installing available parts, not even for cleaning.

Send fuel injection pump to a specialized workshop for proper checking and adjustment.

CD,3274,G40,22 -19-27APR92

STANADYNE DM4 FUEL INJECTION PUMP INSTALLATION AND TIMING

Make sure no. 1 piston is at TDC on compression stroke.

Rotate pump drive shaft and align timing mark on governor weight retainer hub with timing mark on cam ring.

Check pump mounting flange packing for damage and replace, when necessary.

Install injection pump on engine, making sure Woodruff key enters gear.
Install pump attaching nuts (A) finger-tight.

Install washer and hex. nut on pump shaft and tighten to 200 N·m (145 lb-ft).

Rotate pump counter-clockwise (as seen from flywheel end) and then in opposite direction until timing marks on cam ring and governor weight retainer are aligned.

Tighten pump attaching nuts (A) to 25 N·m (18 lb-ft).

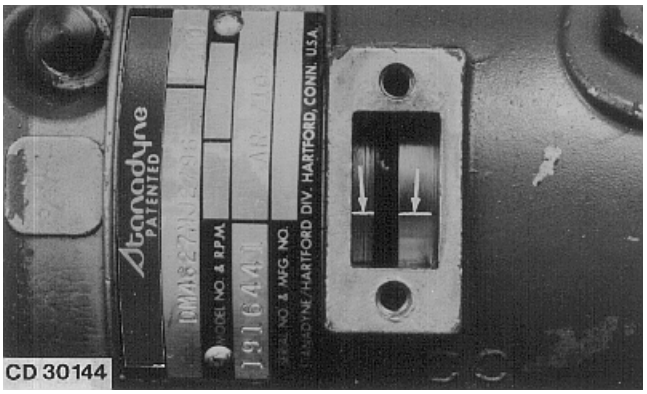
Connect injection pump pressure lines (B). Start with outlet (E) and continue around pump head in counterclockwise direction, attaching lines in same order as engine firing (1-5-3-6-2-4 on 6-cylinder engines and 1-3-4-2 on 4-cylinder engines).

Tighten fuel pressure lines at pump to 25 N·m (18 lb-ft), using line wrench JDF22.

IMPORTANT: When tightening fuel pressure lines at fuel injection pump, be sure not to turn fuel injection pump fittings. Turning of these fittings may cause internal pump damage.

Connect fuel supply line (C), return line (D), shut-off system and speed control rod.

A—Pump attaching nuts
B—Fuel pressure lines
C—Fuel supply line
D—Fuel return line
E—Outlet connection to cylinder no. 1
F—Engine block side



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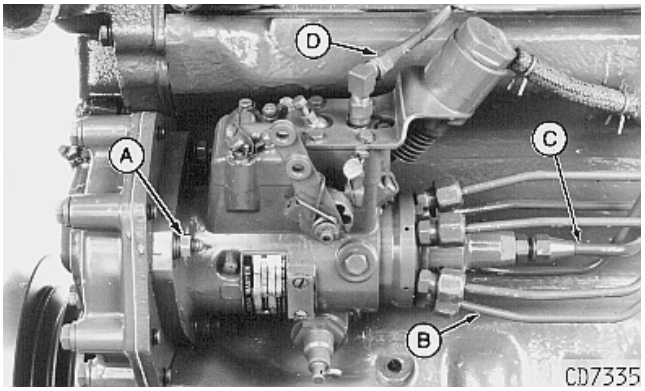

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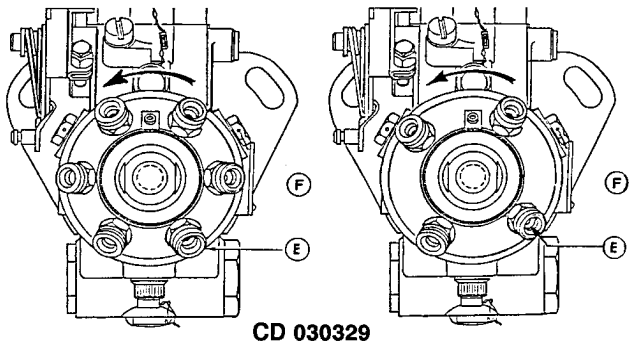

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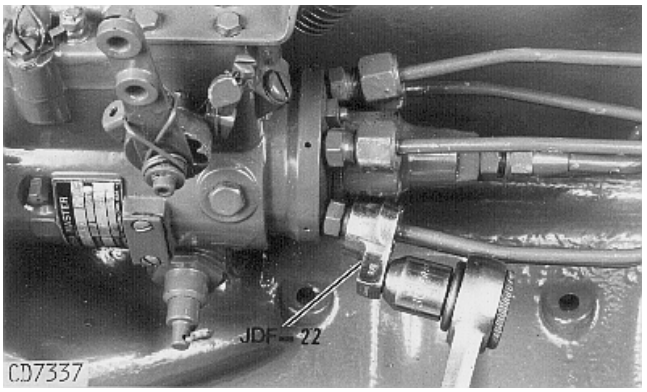

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CD,3274,G40,24 -19-01FEB94

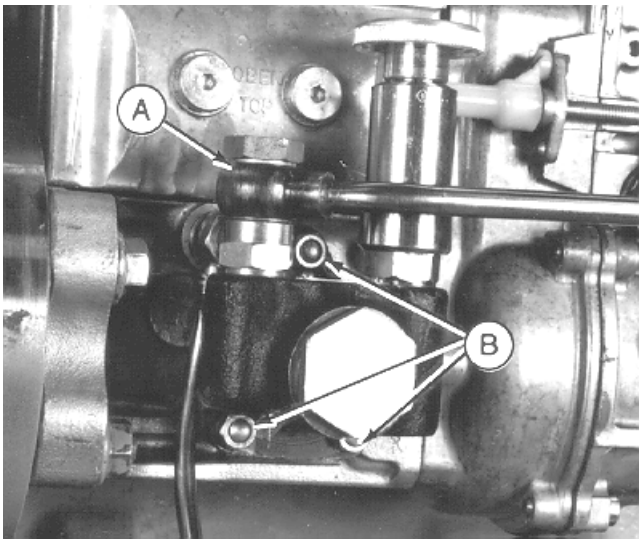
REMOVE FUEL SUPPLY PUMP ON MICO IN-LINE FUEL INJECTION PUMP

Thoroughly clean exterior of supply pump. Also clean around supply pump mounting area on injection pump housing.

1. Disconnect fuel inlet line (removed on picture) and outlet line (A). Cap all line openings so contaminates do not enter fuel system.

2. Remove mounting nuts (B).

3. Pull fuel supply pump straight out from injection pump housing. Cover supply pump mounting bore so debris cannot enter injection pump.



CD,3274,G40,78 -19-04JAN99

TEST MICO FUEL SUPPLY PUMP FOR LEAKS

1. Connect compressed air line (A) to a pressure gauge (B) and to supply inlet fitting. Air line should have a regulating valve to control pressure.

2. Cap or plug supply pump outlet fitting (C).

3. Submerge supply pump in a container of clean diesel fuel. Regulate air pressure to 200 kPa (2 bar; 29 psi).

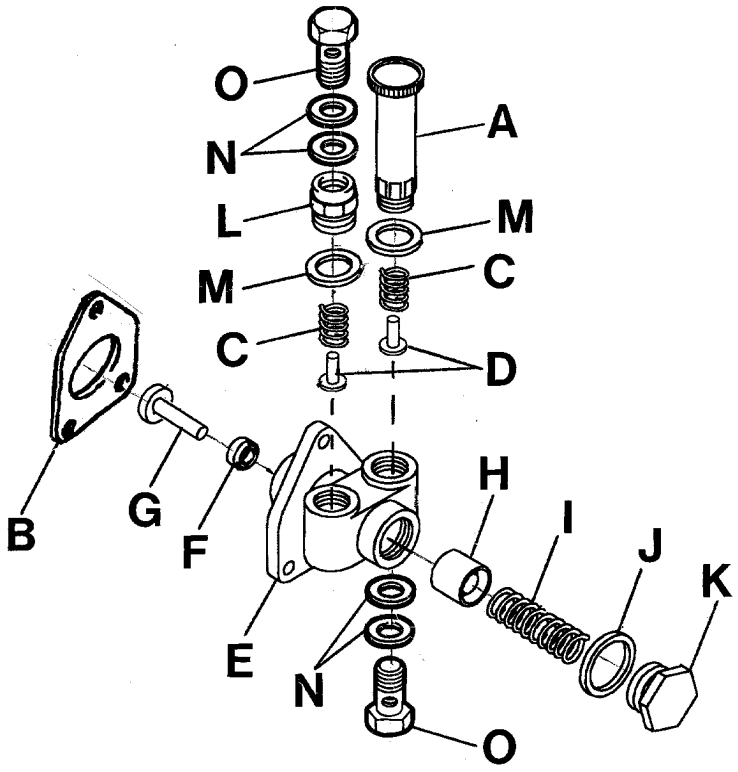
4. Move tappet in and out by hand. No air bubbles should appear around tappet.

NOTE: If bubbles appear, it is an indication that either the seal is defective or tappet is worn.

IMPORTANT: Serious injection pump or engine damage could occur, if enough diesel fuel leaks past tappet and seal. Fuel leakage past tappet dilutes engine oil.

CD,3274,G40,79 -19-04JAN99

DISASSEMBLE MICO FUEL SUPPLY PUMP



CD30727 -UN-24FEB99

A—Hand primer
B—Gasket
C—Spring (2 used)
D—Valve (2 used)
E—Pump housing
F—Tappet seal
G—Tappet
H—Plunger
I—Spring
J—Seal washer
K—Plug
L—Fitting
M—Seal washer (2 used)
N—Copper washer (4 used)
O—Banjo screw (2 used)

Check parts for excessive wear. If necessary, replace complete supply pump or individual parts when available.

CD,3274,G40,80 -19-04JAN99

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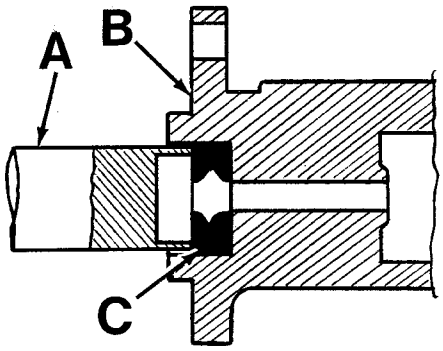
ASSEMBLE MICO FUEL SUPPLY PUMP

IMPORTANT: Hands should be wet with diesel fuel when assembling internal components of fuel supply pump.

1. Install new seal (C) into pump housing (B) using JDF15 Driver (A). Be sure seal is started straight in housing bore and drive until driver contacts housing.

2. To assemble supply pump, reverse disassembly procedure using new seal washers.



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CD30728

CD,3274,G40,81 -19-04JAN99

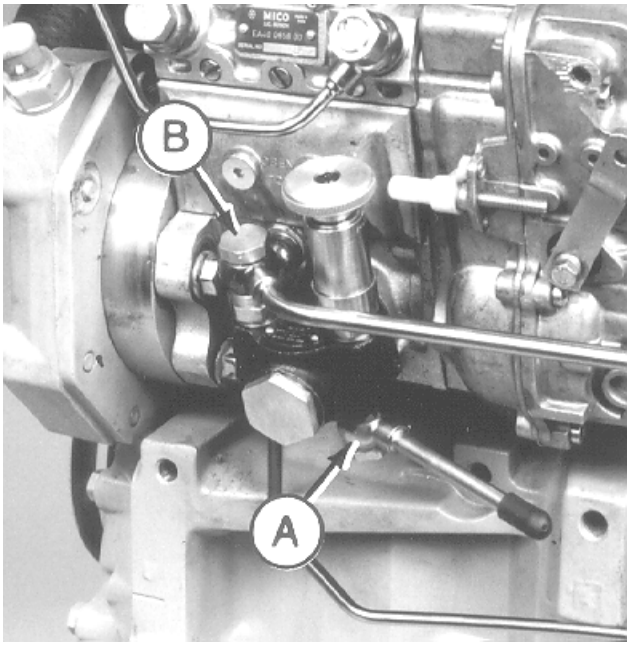
INSTALL FUEL SUPPLY PUMP ON IN-LINE FUEL INJECTION PUMP

1. Install a new gasket on injection pump flange.

2. Position pump over mounting studs. Tighten nuts to 5—7 N·m (4—5 lb-ft).

3. Install fuel inlet (A) and outlet (B) lines. Tighten banjo screws to 25 N·m (18 lb-ft).

4. Bleed fuel system.



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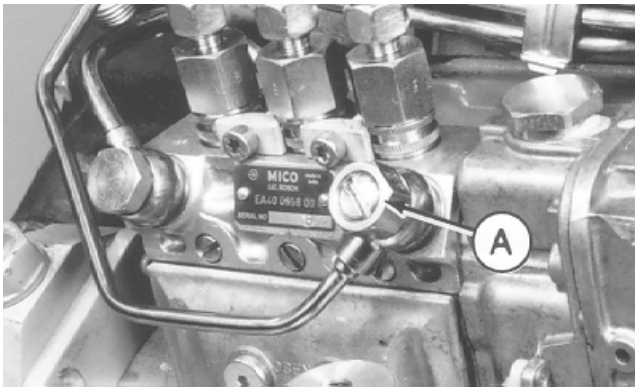
CD30729

CD,3274,G40,82 -19-04JAN99

SERVICE INJECTION PUMP OVERFLOW VALVE (IN-LINE INJECTION PUMP)

The overflow valve (A) cannot be adjusted. Replace valve in case of leakage or bad operation.



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CD,3274,G40,83 -19-04JAN99

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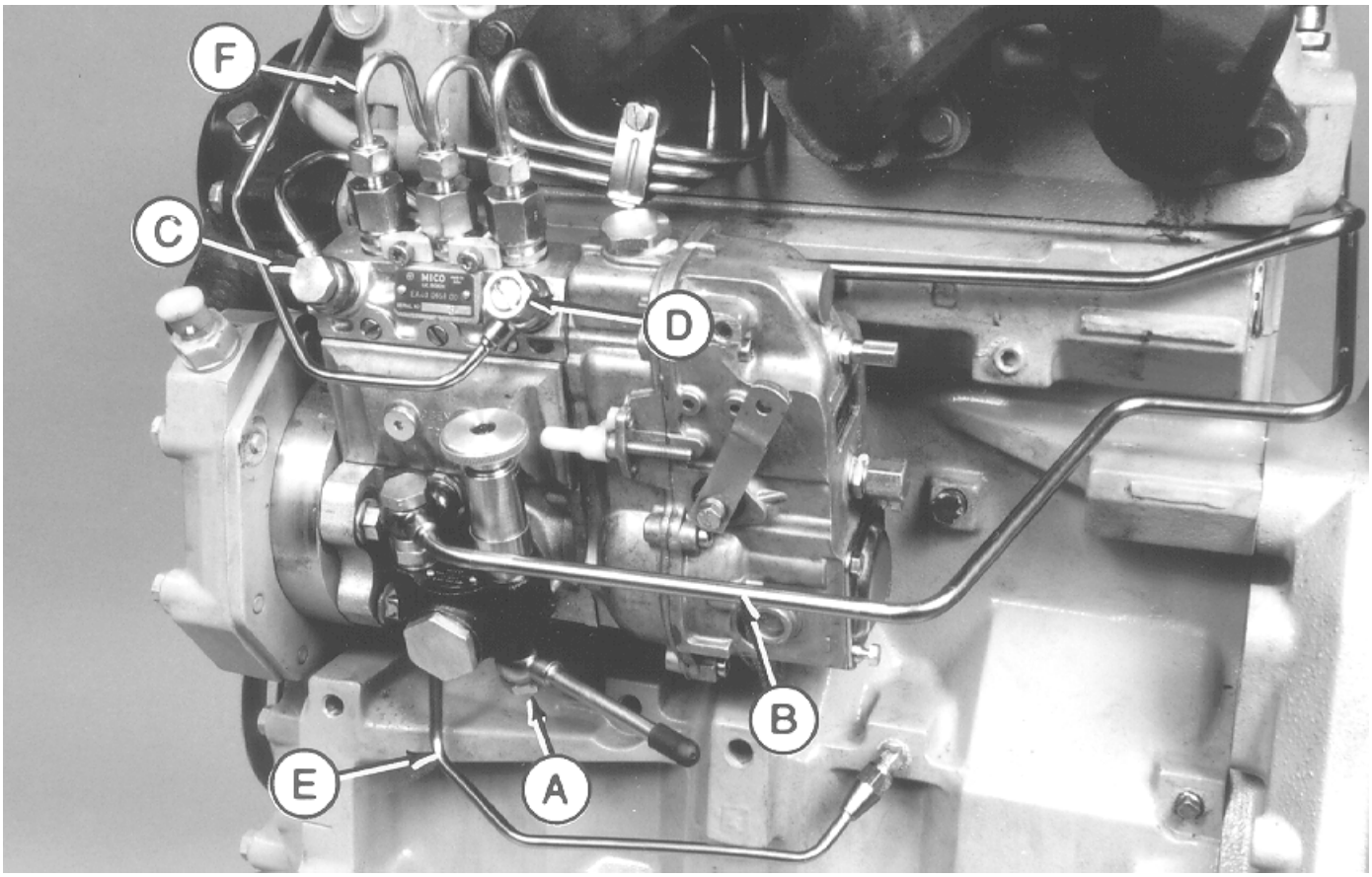
REMOVE MICO IN-LINE INJECTION PUMP



IMPORTANT: Never steam clean or pour cold water on a running or warm fuel injection pump. Seizure of internal components can occur.

1. Clean fuel injection pump, lines and area around pump with cleaning solvent or a steam cleaner.

2. Check for the presence of timing marks on front plate, spacer and injection pump flange. If necessary, mark parts before removal.

3. Disconnect the following elements:
- Shut-off system and speed control linkage
- Fuel inlet line (A) on supply pump
- Fuel outlet line (B) on supply pump
- Fuel supply line (C) on injection pump
- Fuel return line (D)
- Oil supply line (E)
- Fuel injection lines (F)

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

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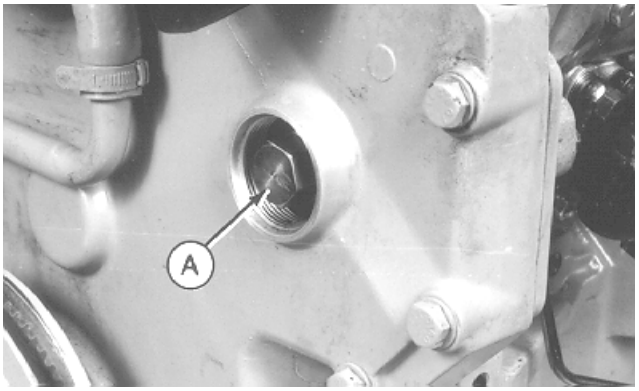
CD,3274,G40,84 -19-04JAN99

5. Remove plug from mounting hole in timing gear cover.

6. Remove special nut (A) securing the fuel injection pump drive gear to pump shaft.

7. Using KJD10213 special wrench, loosen the four nuts holding fuel injection pump to engine front plate.



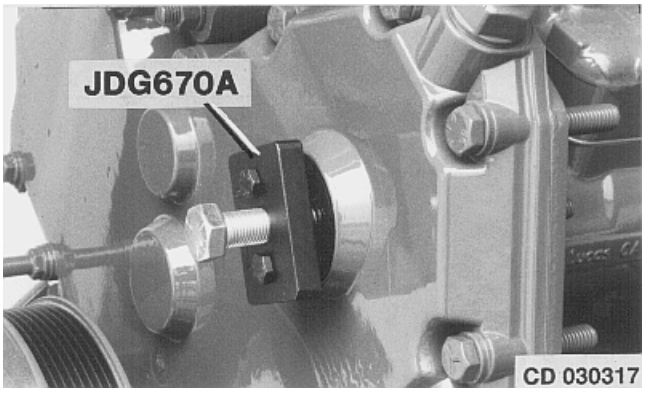
CD,3274,G40,85 -19-04JAN99

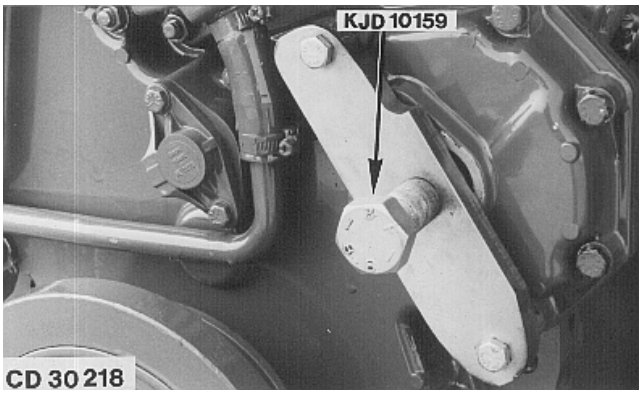
8. Install KJD10159 or JDG670A (after modification) special tool.

9. Turn forcing screw of special tool clockwise until pump shaft is loosened from conical seat of drive gear.

10. Remove nuts from studs and pull fuel injection pump backward. Remove the spacer and O-ring.

NOTE: When removing fuel injection pump, be careful not to lose the shaft key.





CD,3274,G40,86 -19-04JAN99

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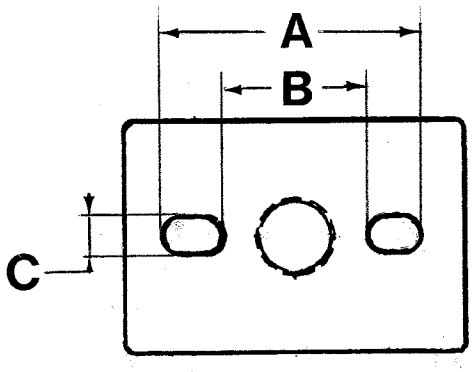
JDG670A MODIFICATION

JDG670A special tool can be used to remove the MICO in-line injection pump when modified as indicated.

A—40 mm (1.57 in.)
B—23 mm (0.90 in.)
C—7 mm (0.27 in.)



CD,3274,G40,87 -19-04JAN99

REPAIR MICO IN-LINE FUEL INJECTION PUMP

IMPORTANT: Do not disassemble fuel injection pump further than necessary for installing available service parts, not even for cleaning.

Be sure that injection pump serial number tag is in place and that all identification numbers are legible so that pump is set to the correct specifications for its intended use.

For injection pump repair and testing, have an authorized diesel injection repair station perform the work. Unauthorized repairs made to the injection pump will void warranty.

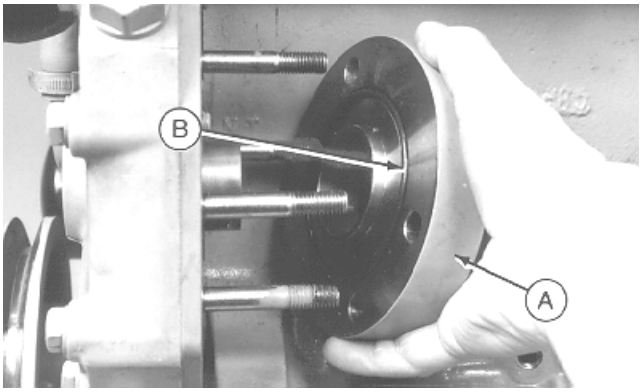
CD,3274,G40,88 -19-04JAN99

INSTALL MICO IN-LINE FUEL INJECTION PUMP

1. Slide spacer (A) with O-ring (B) over the four studs.

2. Slide injection pump over studs, inserting shaft in drive gear.

NOTE: Make sure that the shaft key is seated properly.



CD,3274,G40,89 -19-04JAN99

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3. Screw the four nuts (B) onto studs and hand-tighten at this stage.

4. Push drive gear firmly onto shaft taper. Install special nut (A) then tighten to 85 N·m (62 lb-ft). Install mounting plug onto timing gear cover.

5. Align timing marks on pump flange, spacer and front plate then, using KJD10213 special wrench, tighten nuts to 50 N·m (35 lb-ft).

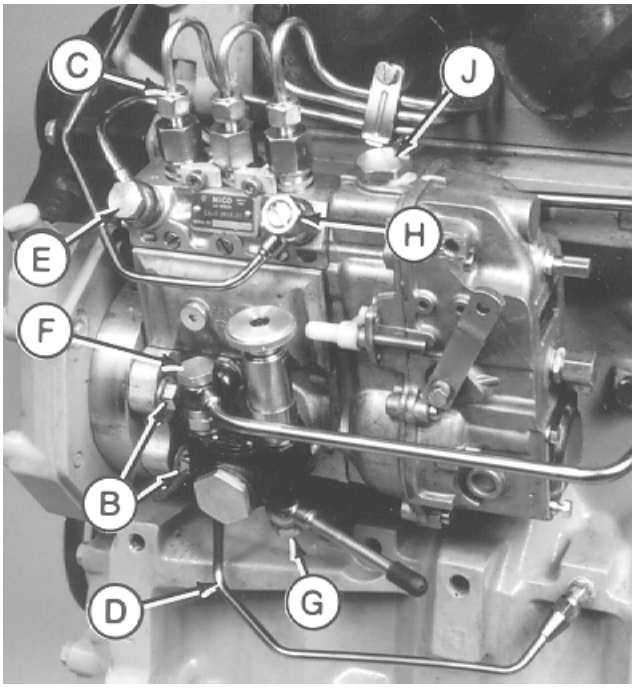
NOTE: In case of replacement of injection pump, install injection pump with studs in middle of flange slots. Then perform a dynamic timing.

6. Connect injection lines. Commence with line No.1 (C) and continue in same order as engine firing (1-2-3). Tighten to 25 N·m (18 lb-ft).

IMPORTANT: DO NOT move delivery valve fittings while tightening line nuts, injection pump delivery will be altered. The injection pump will have to be recalibrated on a test stand by an authorized diesel injection pump repair station.

7. Connect:
• Oil supply line (D). Tighten banjo screw to 15 N·m (11 lb-ft).
• Fuel supply line (E) on injection pump. Tighten banjo screw to 25 N·m (18 lb-ft).
• Fuel outlet line (F) on supply pump. Tighten banjo screw to 25 N·m (18 lb-ft).
• Fuel inlet line (G) on supply pump. Tighten banjo screw to 25 N·m (18 lb-ft).
• Fuel return line (H) on injection pump. Tighten banjo screw to 25 N·m (18 lb-ft).
• Shut-off system and speed control linkage.

8. Remove oil fill plug (J) from governor housing and add 300 ml (10.14 fl oz) of clean engine oil.



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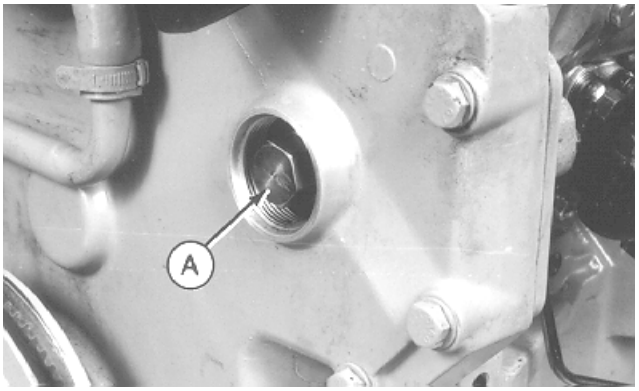

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CD,3274,G40,90 -19-04JAN99

DYNAMIC TIMING (ALL PUMP TYPES)

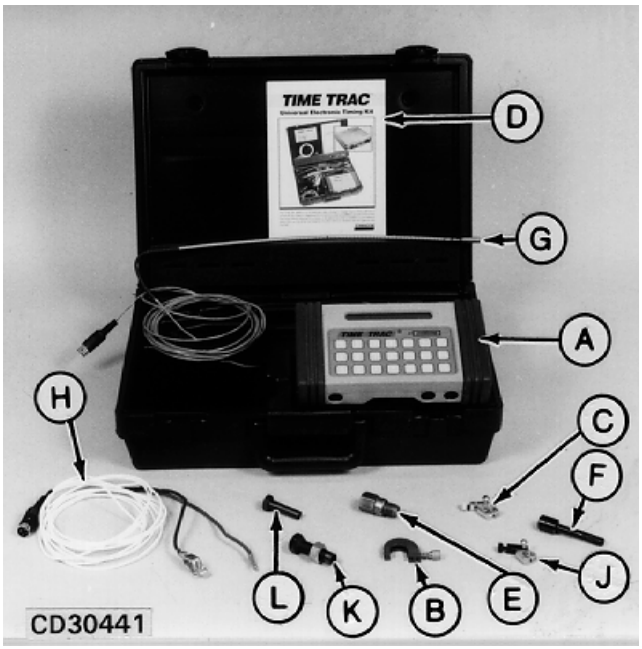
Two types of dynamic timing are used:

• Dynamic timing at full load rated speed when engine can be connected to a dynamometer (e.g. tractors). This method is more appropriate, as it corresponds more closely to the realistic use of the engine.

• Dynamic timing at no-load when engine cannot be connected to dynamometer (e.g. combines).

NOTE: Stroboscopic lamp (M) can be used for all engines while the magnetic probe can be used on recent engines (214170CD-) only.

A—Meter
B—Sensor clamp
C—6 mm clamp-on transducer
D—Instruction manual
E—Timing sensor
F—Timing pin
G—Magnetic probe
H—Transducer cable
J—1/4“ clamp-on transducer
K—Magnetic probe adapter
L—Magnetic probe adapter
M—Stroboscopic lamp



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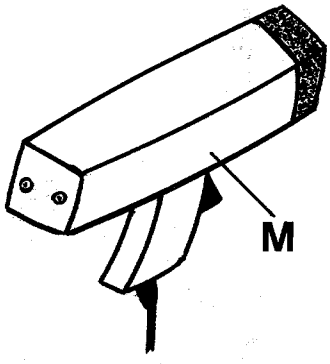

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CD,3274,G40,91 -19-04JAN99

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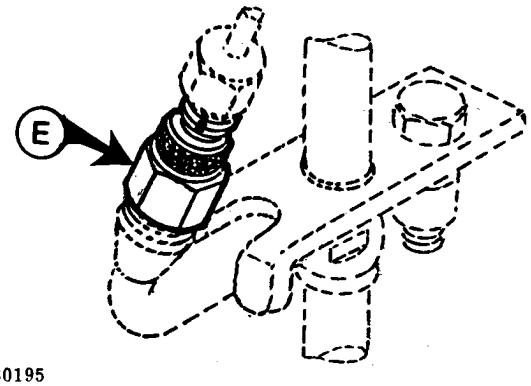
INSTALL TIMING SENSOR

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.



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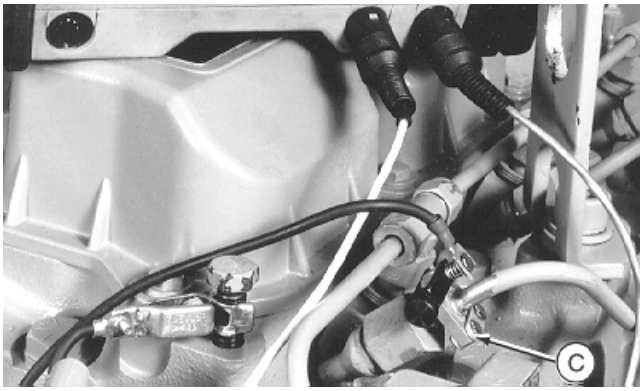

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CD,FKM10429A,2 -19-23FEB98

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47

INSTALL MAGNETIC PROBE (FOR USE WITHOUT STROBOSCOPIC LAMP)

IMPORTANT: Use JDG81-4 timing pin (A) in flywheel housing timing hole (B) to ensure engine is NOT stopped at TOP DEAD CENTER. If this is not done, flywheel timing hole will damage the magnetic probe (D) when engine is started.

Installation in flywheel housing with tapped timing hole:

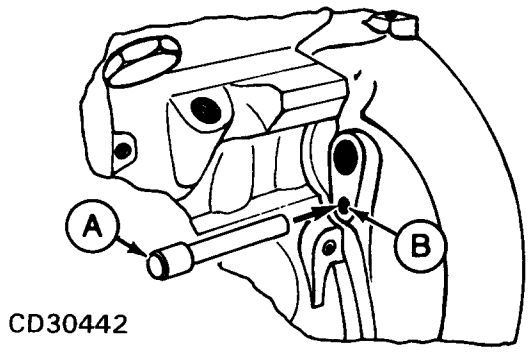
1. Install JDG793 magnetic probe adapter (C) into flywheel housing tapped hole (B) until it bottoms.

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

Installation in 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 it contacts flywheel. Pull magnetic probe back out to provide 0,65 mm (0.025 in.) recommended air gap.



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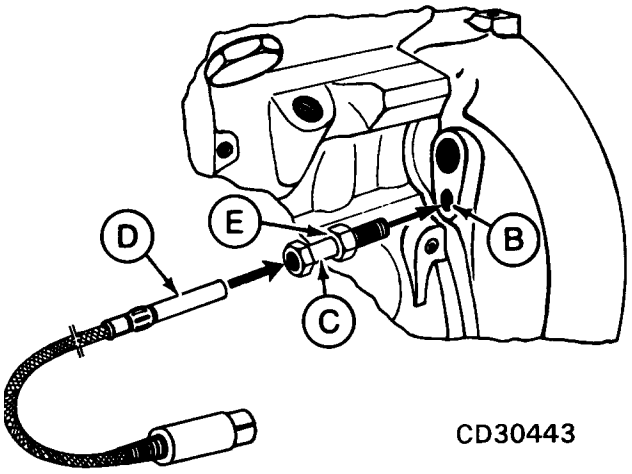

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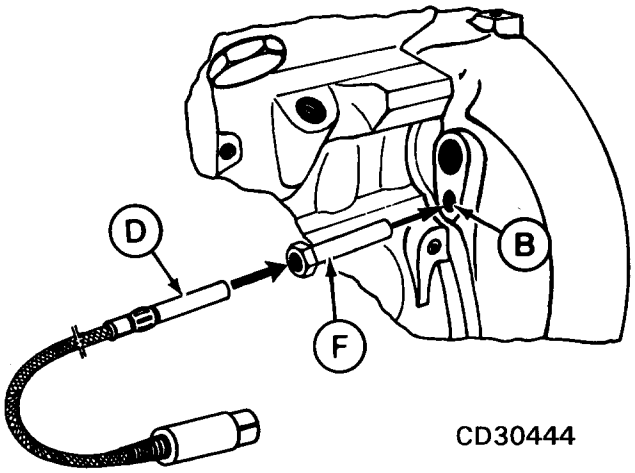

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CD,3274,G40,92 -19-04JAN99

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INSTALL STATIONARY POINTER (FOR USE WITH STROBOSCOPIC LAMP)

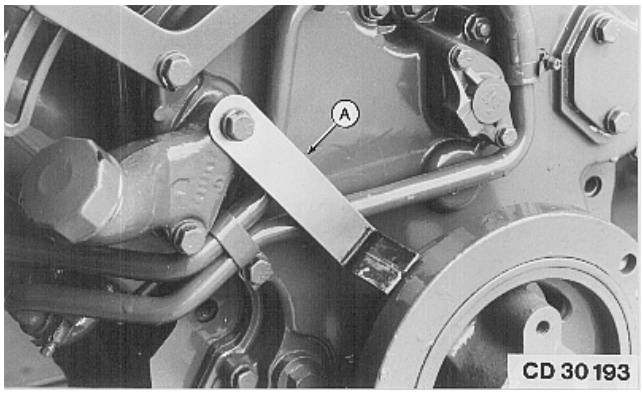
1. Install stationary pointer (A) on timing gear cover so that it can be aligned with pulley (e.g. on filler neck screw).

CAUTION: Take great care to avoid contact with moving parts.
DANGER OF SERIOUS ACCIDENTS

2. Rotate engine clockwise (as seen from water pump end) and position No. 1 piston at top dead center (TDC).

3. Using a scriber, make a TDC mark (B) on the pulley (C) in line with stationary pointer.

A—Stationary pointer
B—TDC mark
C—Pulley



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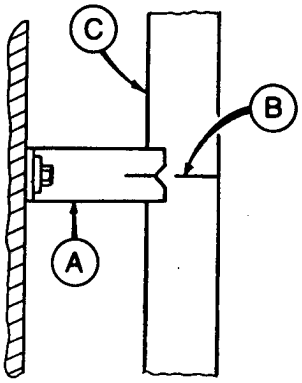

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CD,3274,G40,27 -19-04JAN99

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TIMING SENSOR AND MAGNETIC PROBE CONNECTION

1. Connect timing sensor (A) or clamp-on transducer to meter socket “SR” (B) with FKM10429-4 sensor clamp (C) and FKM10465-2 transducer cable (D).

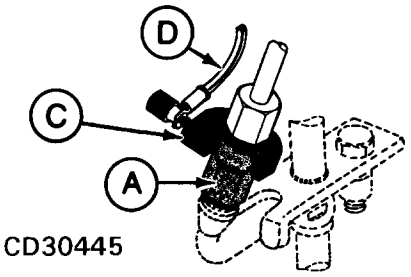
2. Connect ground cable.

3. Connect magnetic probe (E) to meter socket “MP” (F) or connect stroboscopic lamp to meter socket “TL” (G).

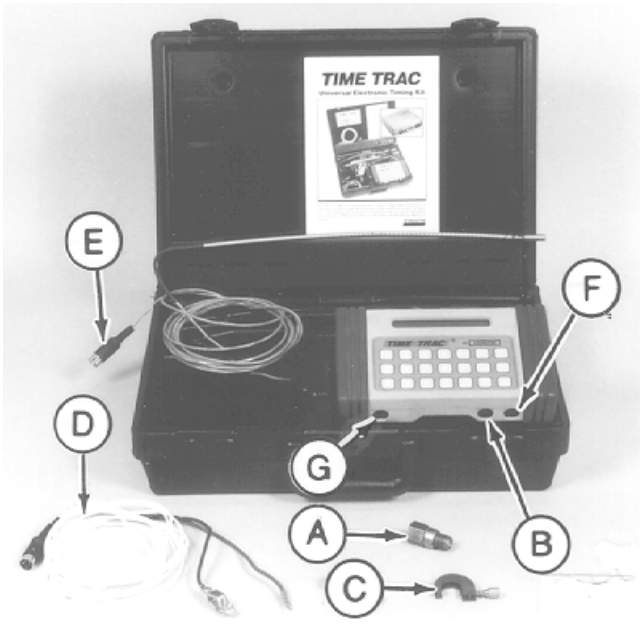
4. Connect power cable to vehicle battery as follows:
   —red to positive
   —black to negative

CAUTION: Observe correct polarity to avoid possible damage to unit.

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”)
G—Meter socket for stroboscopic lamp (marked “TL”)



-UN-10MAY96
CD30445



-UN-23FEB99
CD30736

CD,3274,G40,29 -19-04JAN99

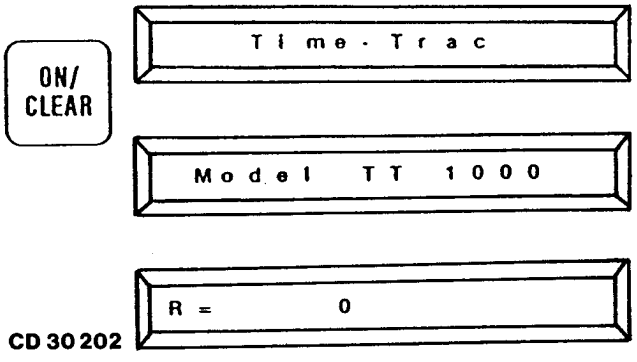
DYNAMIC TIMING AT FULL LOAD RATED SPEED USING MAGNETIC PROBE

NOTE: To check dynamic timing using stroboscopic lamp, refer to “DYNAMIC TIMING AT NO-LOAD”.

1. Switch meter on 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 a tachometer.

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

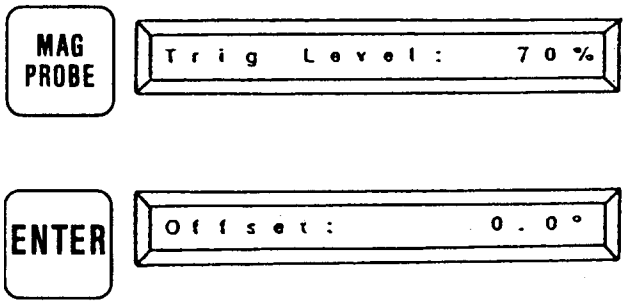


-UN-07MAR95
CD30202

CD,3274,G40,30 -19-04JAN99

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.

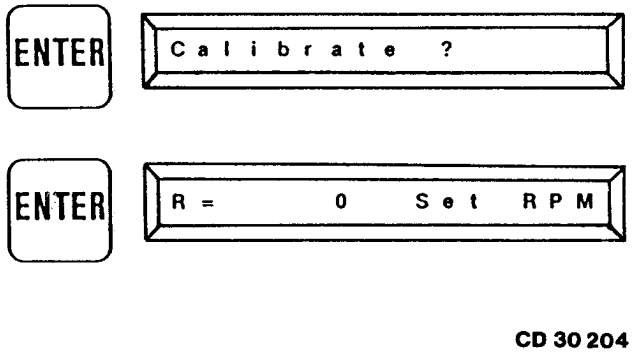
4. A default “Offset” value of 20.0° will now appear. Type in 0.0 to enter a 0.0° “Offset” value and press the “ENTER” key.



CD,FKM10429A,6 -19-02MAY96

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

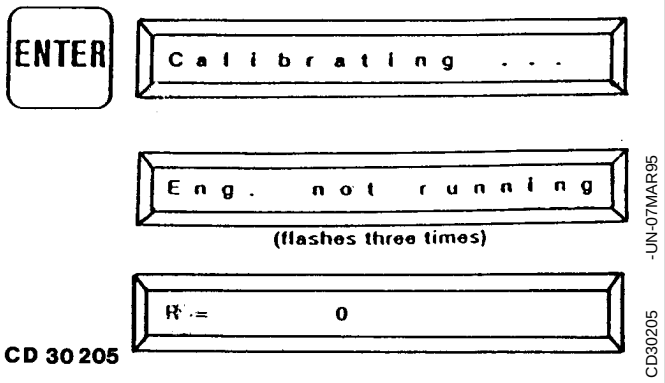
6. Press “ENTER” to perform calibration. Run engine at 1300 rpm. The display will automatically show the engine speed.



CD,FKM10429A,7 -19-02MAY96

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).



CD,FKM10429A,8 -19-02MAY96

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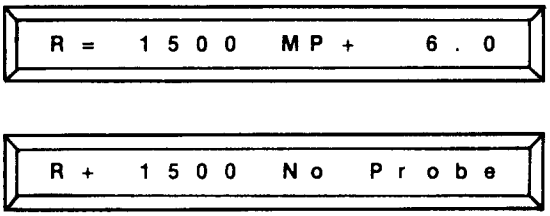
51

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 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 in.)] 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

CD30448

CD,FKM10429A,9 -19-02MAY96

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.

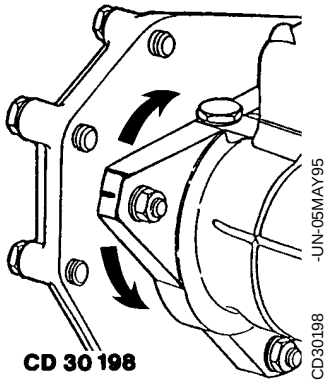
IMPORTANT: Stop engine prior to making timing adjustments. Injection pump can seize if adjustment is made with engine running.

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.



CD 30 198

-UN-05MAY95

CD30198

CD30449

-UN-10MAY96

CD30449

CD,FKM10429A,10-19-02MAY96

DYNAMIC TIMING AT NO-LOAD

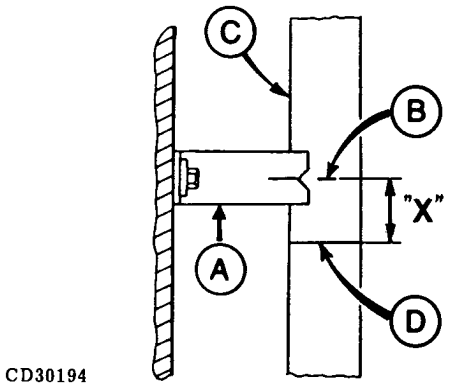
NOTE: Dynamic timing at no-load can be checked only by using the stroboscopic lamp while the stroboscopic lamp can be used also to check dynamic timing at full-load.

1. As the value for dynamic timing at no-load is close to 0˚ and since the timing meter is less accurate for these values, an additional mark (D) with a 10˚ offset angle should be made counterclockwise from the TDC mark. The specifications for “No-load” in this group include this 10˚ angle.

Value for “X” according to pulley diameter:

Dia. 142 mm (5.59 in.) . . . . . X = 12.4 mm (0.49 in.)
Dia. 168 mm (6.61 in.) . . . . . X = 14.6 mm (0.57 in.)
Dia. 222 mm (8.74 in.) . . . . . X = 19.4 mm (0.76 in.)
Dia. 250 mm (9.84 in.) . . . . . X = 21.8 mm (0.86 in.)

NOTE: If the pulley diameter is not listed in the above chart, use the following formula to calculate “X”: “X” = diameter x 0.087.



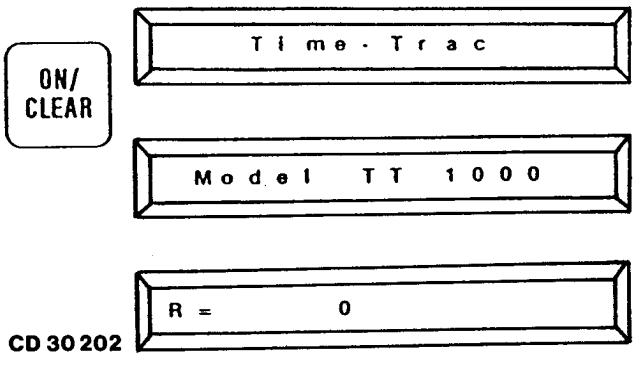
A—Stationary pointer
B—TDC mark
C—Pulley
D—Additional mark

CD,3274,G40,57 -19-04JAN99

2. Switch meter on 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 a tachometer.

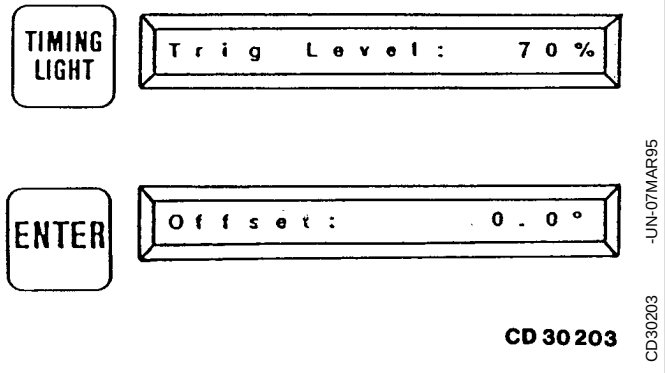
3. Start the engine and run for 10 minutes to reach the operating temperature.



CD,3274,G40,58 -19-04JAN99

4. Press “TIMING LIGHT” 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.

5. 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.

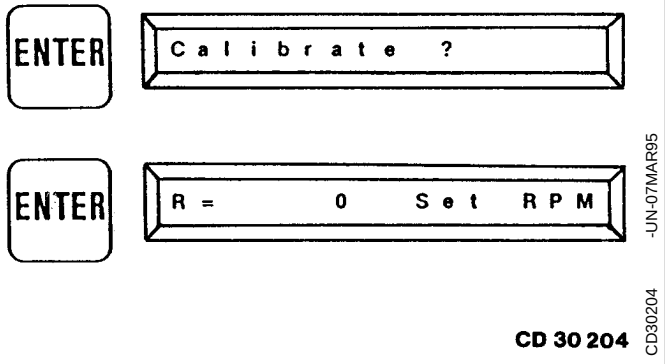


CD 30203

CD,3274,G40,59 -19-27APR92

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

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



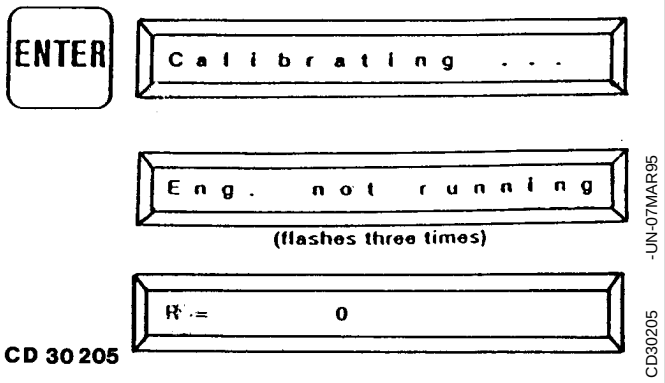
CD 30204

CD,3274,G40,60 -19-04JAN99

8. 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 “TIMING LIGHT” key (step 4).

9. Run engine at fast idle. Adjust fast idle if necessary (see “SPECIFICATIONS”).



CD 30205

CD,3274,G40,61 -19-04JAN99

NOTE: For dynamic timing at no-load, go directly to step 11.

10. Load engine down gradually to rated speed (see “SPECIFICATIONS”) using dynamometer or any other system allowing to load engine.

CD,3274,G40,93 -19-04JAN99

11. Aim stroboscope timing light at pulley, then press the timing light push button up (A) or down (B) as necessary to align stationary pointer with reference timing marks and read the timing degree value on the display.

12. 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

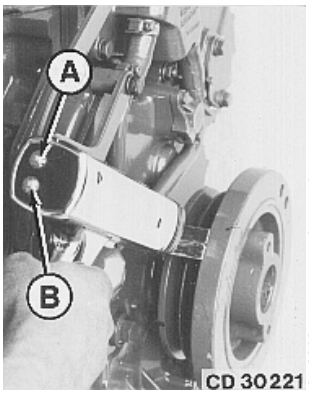
CAUTION: Do not rotate the injection pump as long as the engine is running. This may cause the pump to seize and cause severe damage.

NOTE: 1 mm (0.04 in.) offset on the injection pump flange corresponds to 2˚ on the meter display.

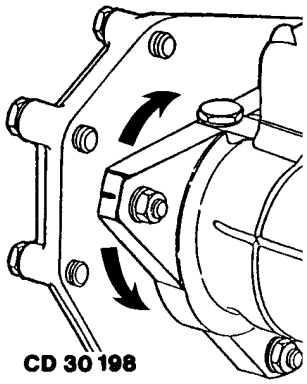
13. Recheck timing until specified timing is obtained.

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

NOTE: If the injection pump dynamically timed 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 an injection pump dynamically timed, perform a dynamic timing adjustment.



-UN-07MAR95
CD30221



-UN-05MAY95
CD30198

CD 30 211

-UN-07MAR95
CD30211

CD,3274,G40,62 -19-04JAN99

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ANEROID REPLACEMENT

NOTE: It is not necessary to remove fuel injection pump when replacing an aneroid.

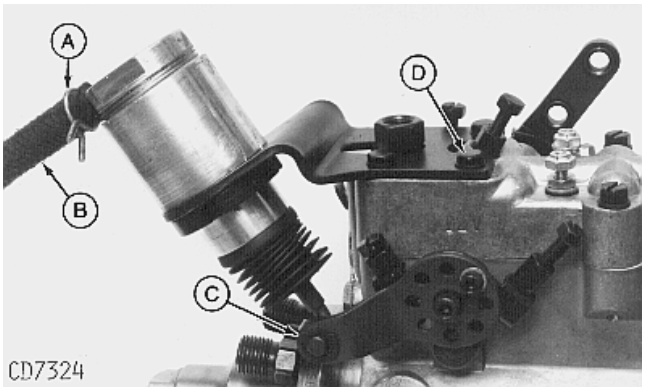
1. Remove clamp (A) and hose (B). Remove retaining ring (C) and attaching screws (D).

2. Remove aneroid and bracket assembly from pump.

3. Prepare and adjust new aneroid (see “Aneroid 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 5 N·m (45 lb-in.).

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



-UN-23MAY95
CD7324

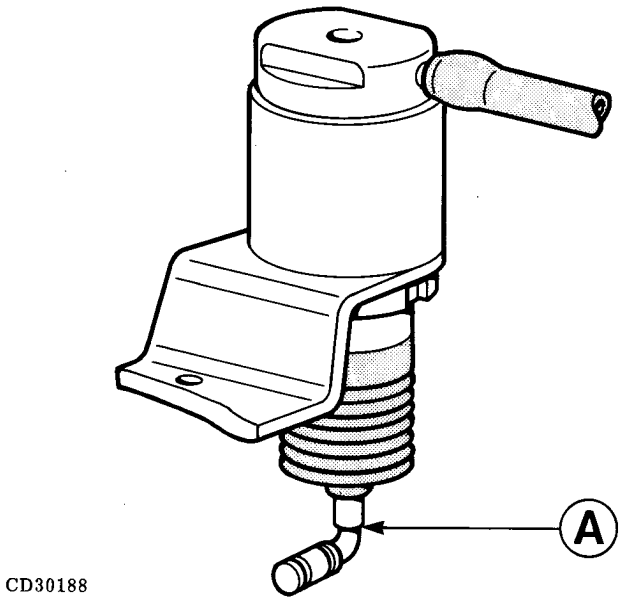
CD,3274,G40,35 -19-28APR92

ANEROID FIELD ADJUSTMENT

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.



-UN-08MAR95
CD30188

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CD,3274,G40,36 -19-27APR92

ANEROID WORKSHOP ADJUSTMENT

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.

4. Pressure specifications are:

Lever lift-off . . . . . 76—102 mm Hg (3—4 in. Hg)
10—14 kPa (1.5—2.0 psi)

Lever at full travel . . . . . 330—380 mm Hg (13—15 in. Hg)
44—51 kPa (6.4—7.4 psi)

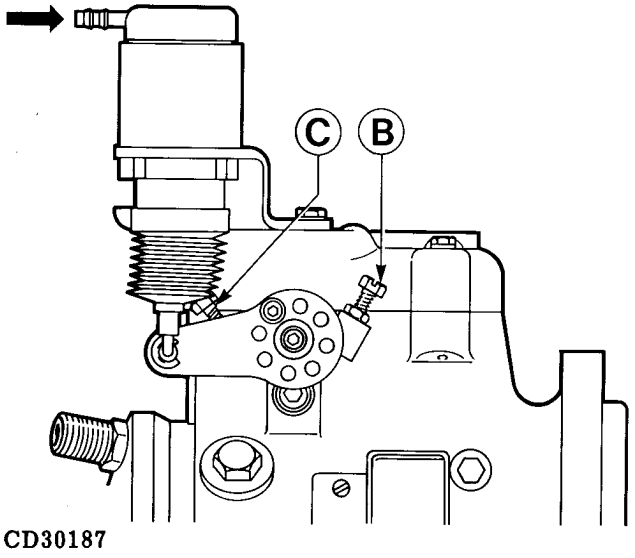
NOTE: Lift-off pressure can be checked by inserting a shim of 0.05 mm (0.002 in.) thickness between lever and front screw; the shim will slip out as soon as the lever starts to move.

5. If lever travel requires more pressure than specified, lengthen the operating rod; if less pressure is required, shorten operating rod.

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

7. Install injection pump on engine.

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



CD,3274,G40,37 -19-27APR92

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58

FUEL INJECTION NOZZLE REMOVAL

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:

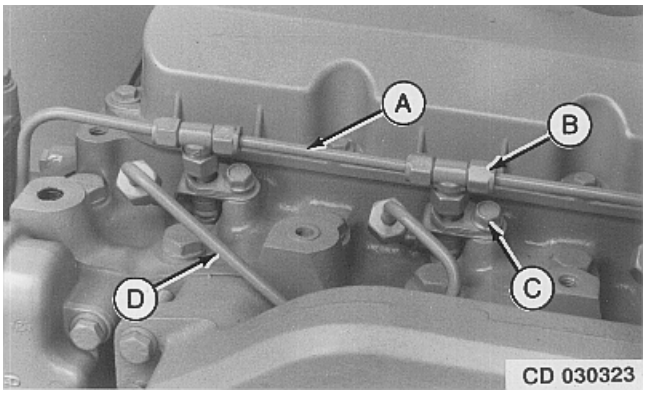
1. Loosen nuts (B) to remove leak-off lines (A) and T-fittings.

2. Disconnect fuel injection lines (D) from nozzles.

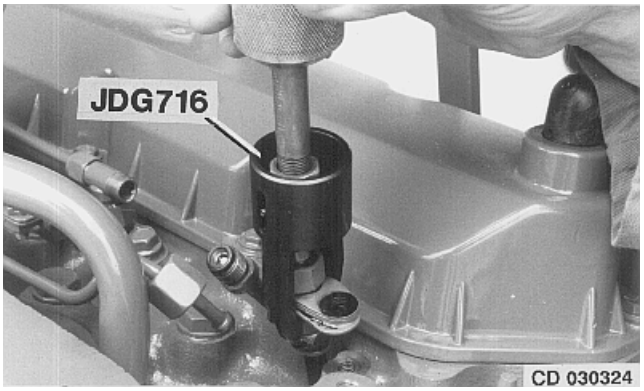
3. Remove cap screw (C).

4. Pull injection nozzles out of cylinder head, using JDG716 injection nozzle puller.

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



-UN-17FEB95
CD30323



-UN-17FEB95
CD30324

CD,3274,G40,38 -19-12NOV92

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59

CLEAN FUEL INJECTION NOZZLE

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.

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.

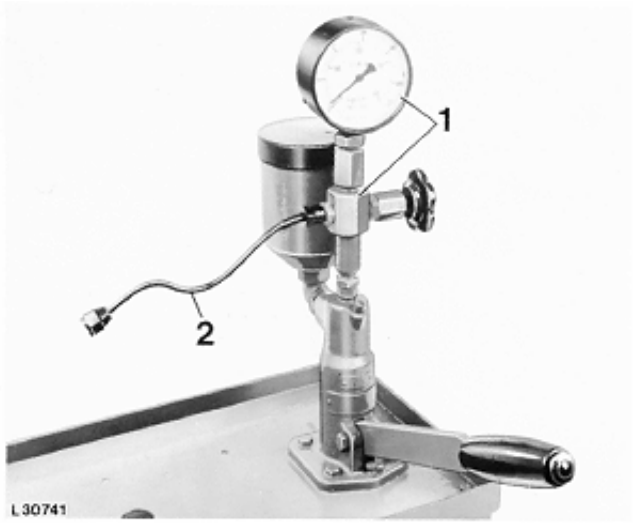
CD,CTM125,198 -19-01DEC97

FUEL INJECTION NOZZLE TEST

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.

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.



L30741 -UN-08AUG89

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.

CD,3274,G40,40 -19-27APR92

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.

CD,3274,G40,41 -19-01FEB94

Chatter test

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. 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.

CD,3274,G40,42 -19-01FEB94

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; there should be 3 to 10 drops.

CD,3274,G40,43 -19-01FEB94

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61

Opening pressure test

NOTE: Absolute opening pressure is less important than equal opening pressure of all nozzles. Max. permissible variation see Specifications.

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 (minimum pressure see “Specifications”).

If spray pattern, leakage test, and valve wear test (see below) are good but the opening pressure test is unsatisfactory, adjust opening pressure as described under “Adjustment”.

CD,3274,G40,44 -19-01FEB94

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 Specifications for opening pressure). Keep watching the nozzle. Under these conditions the nozzle tip has to stay dry (visual check) after a period of 5 seconds. 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.

CD,3274,G40,45 -19-01FEB94

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 (see under "Installation"). 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

ADJUST FUEL INJECTION NOZZLE

1. Loosen and remove lock nut (A) of lift adjusting screw (D).

2. Loosen lock nut (B) of pressure adjusting screw (C).

3. Connect nozzle to tester, then using JDG949 Special Wrench, adjust opening pressure by turning the pressure adjusting screw (C).

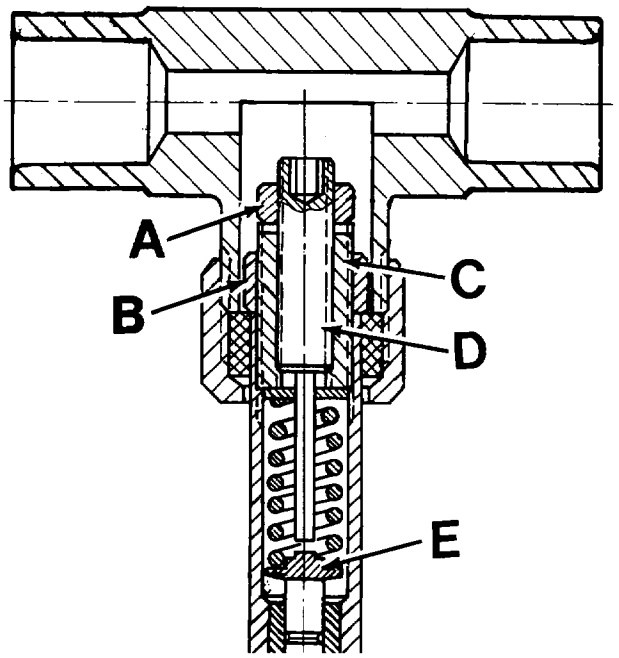
4. Tighten lock nut (B) to 10 N·m (7 lb-ft), then recheck opening pressure.

5. Carefully screw lift adjusting screw (D) until it bottoms on spring seat (E).

6. Unscrew lift adjusting screw with the number of turns as specified.

7. Tighten lock nut of lift adjusting screw to 5 N·m (3.5 lb-ft).

8. Recheck opening pressure.



CD30674 -UN-16JUN98

CD,CTM125,199 -19-01DEC97

INSTALL FUEL INJECTION 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.

IMPORTANT: Before installation, make sure nozzle is clean and free from oil or grease.

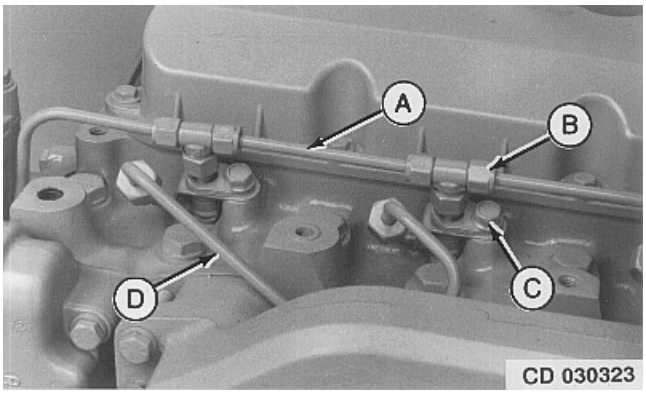
2. Install nozzle in cylinder head. Screw cap screw (C). Do not tighten at this stage.

3. Connect fuel injection line (D) to nozzle. Tighten pressure line to 30 N·m (23 lb-ft) using two wrenches as shown.

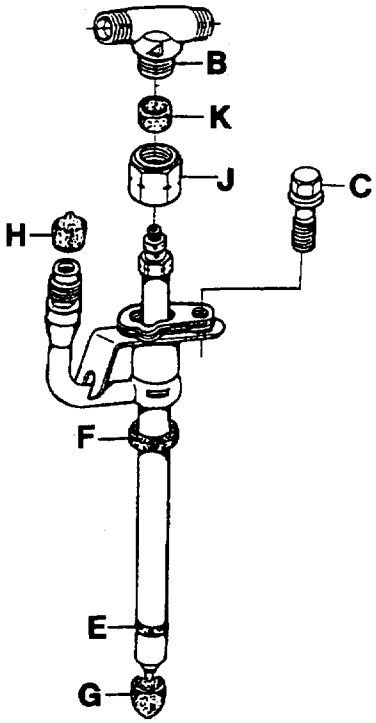
4. Tighten cap screws (C) to 37 N·m (27 lb-ft).

5. Install leak-off lines (A) and T-fittings (B). Tighten nut to 5 N·m (3.5 lb-ft).

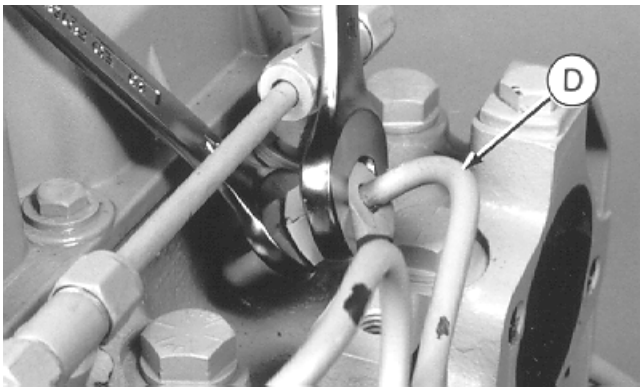
A—Leak-off line
B—T-fitting
C—Cap screw
D—Fuel injection line
E—Carbon stop seal
F—Seal washer
G—Protection cap
H—Protection cap
J—Tube nut
K—Rubber sleeve



-UN-17FEB95
CD30323



-UN-16JUN98
CD30675



-UN-20MAY98
CD30676

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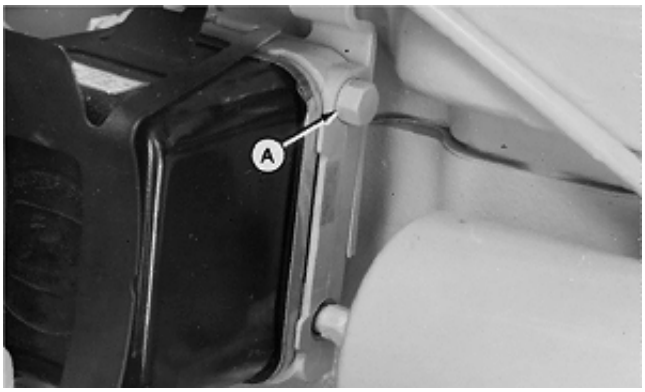
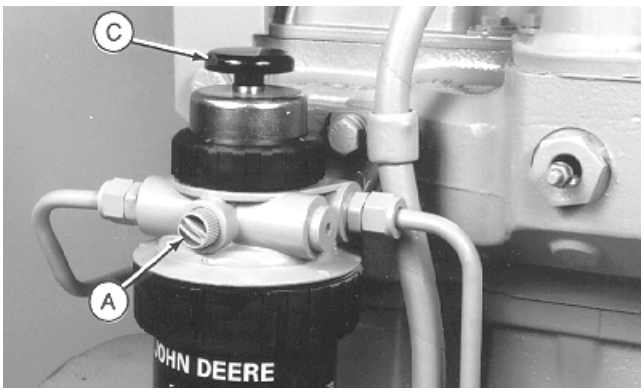
63

CD,CTM125,200 -19-01DEC97

BLEED THE FUEL SYSTEM AT FUEL FILTER



Rectangular Fuel filter



Round Fuel filter

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury.

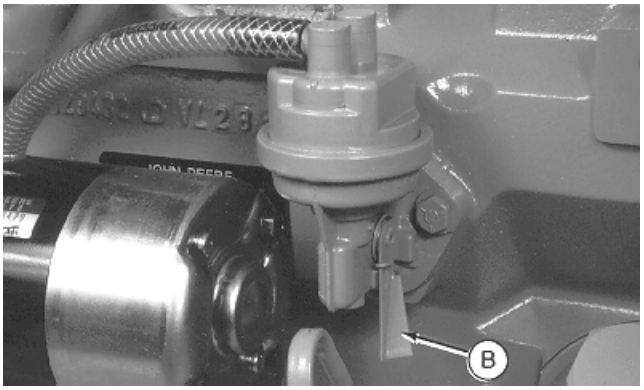
If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

1. Loosen air bleed screw (A).

2. Operate primer lever of fuel supply pump (B) or switch the ignition on (if the vehicle has an electic supply pump) until fuel flow is free from air bubbles.

NOTE: Round fuel filter may have the hand primer on filter mounting base (C).

3. Tighten bleed screw (A) by hand or using a coin.



CD,3274,G40,52 -19-04JAN99

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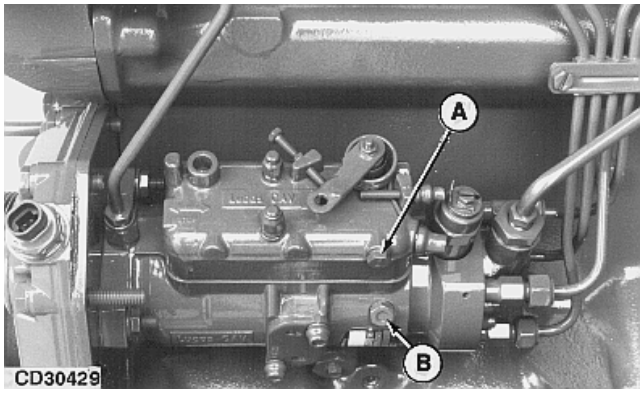
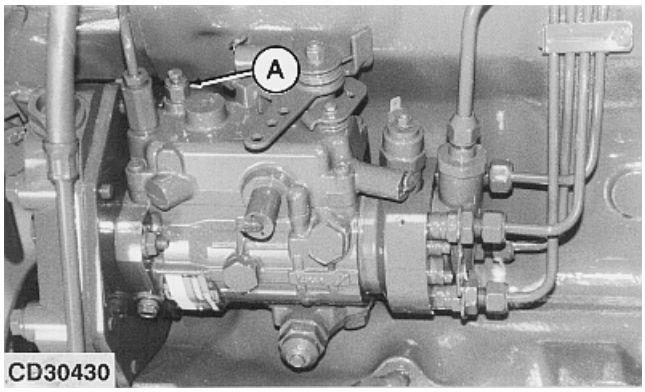
64

BLEED FUEL SYSTEM (LUCAS-CAV)



Lucas CAV - DPA Models



Lucas CAV - DP200 Models

1. Loosen bleed screw (A) on pump cover.

IMPORTANT: Never loosen screw (B) securing hydraulic head, otherwise pump damage may occur.

2. Operate primer lever of fuel supply pump or switch on the ignition for vehicle with electric supply pump.

3. As soon as fuel flow is free from air bubbles tighten bleed screw.

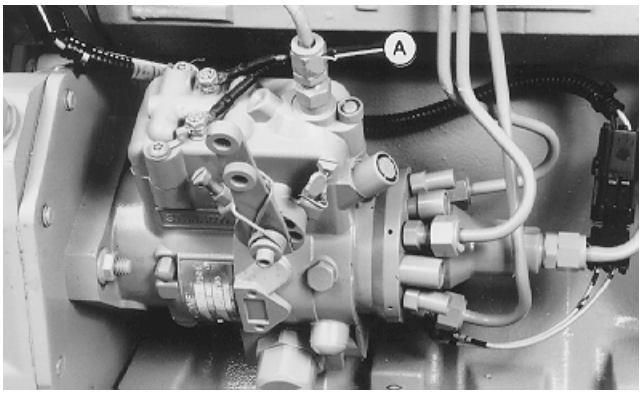
CD,3274,G40,53 -19-04JAN99

BLEED FUEL SYSTEM (STANADYNE)

1. Loosen fuel return line (A) at fuel injection pump.

2. Operate primer lever of fuel supply pump or switch on the ignition for vehicle with electric supply pump.

3. As soon as fuel flow is free from air bubbles tighten bleed screw.



CD,3274,G40,64 -19-04JAN99

BLEED FUEL SYSTEM (MICO IN-LINE INJECTION PUMP)

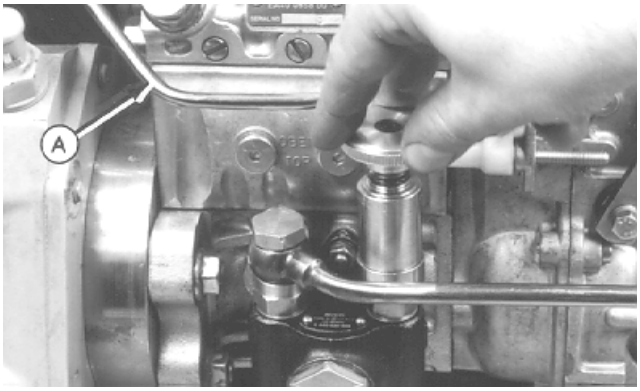
1. Loosen fuel return line (A).

2. Unscrew hand primer on fuel supply pump until it can be pulled by hand.

3. Operate the hand primer until fuel flow is free from air bubbles.

4. Simultaneously stroke the hand primer down and close the fuel return port. This prevents air from entering the system. Tighten securely.

5. Lock hand primer in position.



-UN-23FEB99
CD30737

CD,3274,G40,94 -19-04JAN99

BLEED FUEL SYSTEM AT FUEL INJECTION NOZZLES

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.

-UN-04MAY98
CD30680

CD,3274,G40,54 -19-04JAN99

ADJUST ENGINE SPEED ON DISTRIBUTOR INJECTION PUMP

NOTE: Before adjusting engine speed, make sure engine has reached its normal operating temperature.

All speeds indicated apply to an engine not under load. The maximum permissible speed variation is ± 50 rpm for slow idle speed and + 50 rpm for fast idle speed.

Fast idle checking:

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.

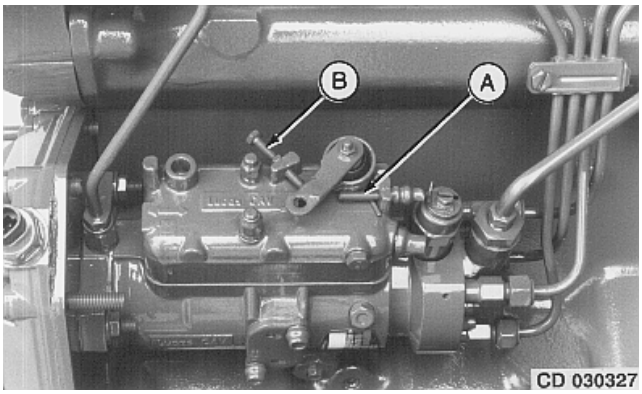
Slow idle checking:

1. Disconnect speed control rod at fuel injection pump.

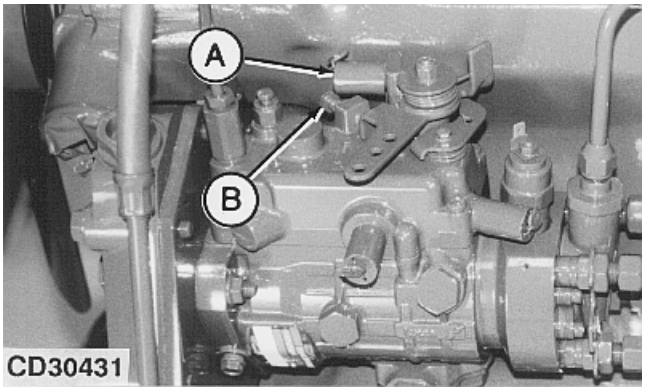
2. Move pump throttle lever in slow idle position against slow idle adjusting screw (B). Check engine speed and compare with specifications.

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.

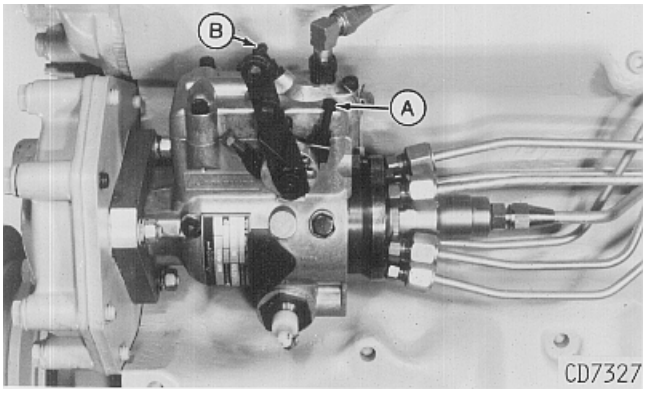
3. In case of incorrect engine speed, turn screw (B) clockwise to increase and counter-clockwise to decrease engine speed.



Lucas CAV - DPA Models



Lucas CAV - DP200 Models



STANADYNE injection pump

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CD,3274,G40,55 -19-04JAN99

ADJUST ENGINE SPEED ON MICO IN-LINE INJECTION PUMP

NOTE: Before adjusting engine speed, make sure engine has reached its normal operating temperature.

All speeds indicated apply to an engine not under load. The maximum permissible speed variation is ± 50 rpm for slow idle speed and + 50 rpm for fast idle speed.

Fast idle checking:

Move pump throttle lever against pump fast idle adjusting screw (A). Check engine speed and compare with specifications.

NOTE: Fast idle is settled by the factory then the fast idle adjusting screw (A) is sealed to prevent from tampering. Fast idle adjustment can only be done by an authorized fuel system agent.

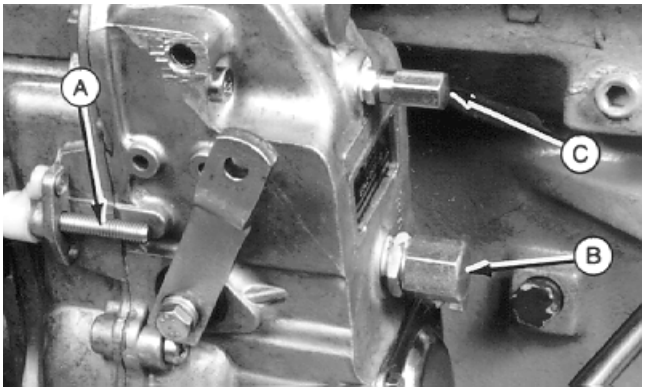
Slow idle checking:

NOTE: Both the slow idle spring screw (B) and the slow idle speed screw (C) are used to adjust the slow idle speed. Remove the threaded caps to access these adjusting screws.

1. Loosen slow idle spring screw (B) as much as possible.

2. Adjust slow idle speed screw (C) to the specifications minus 20 rpm.

3. Retighten slow idle spring screw (B) until engine slow idle speed specification is obtained.



MICO in-line pump

CD,3274,G40,95 -19-04JAN99

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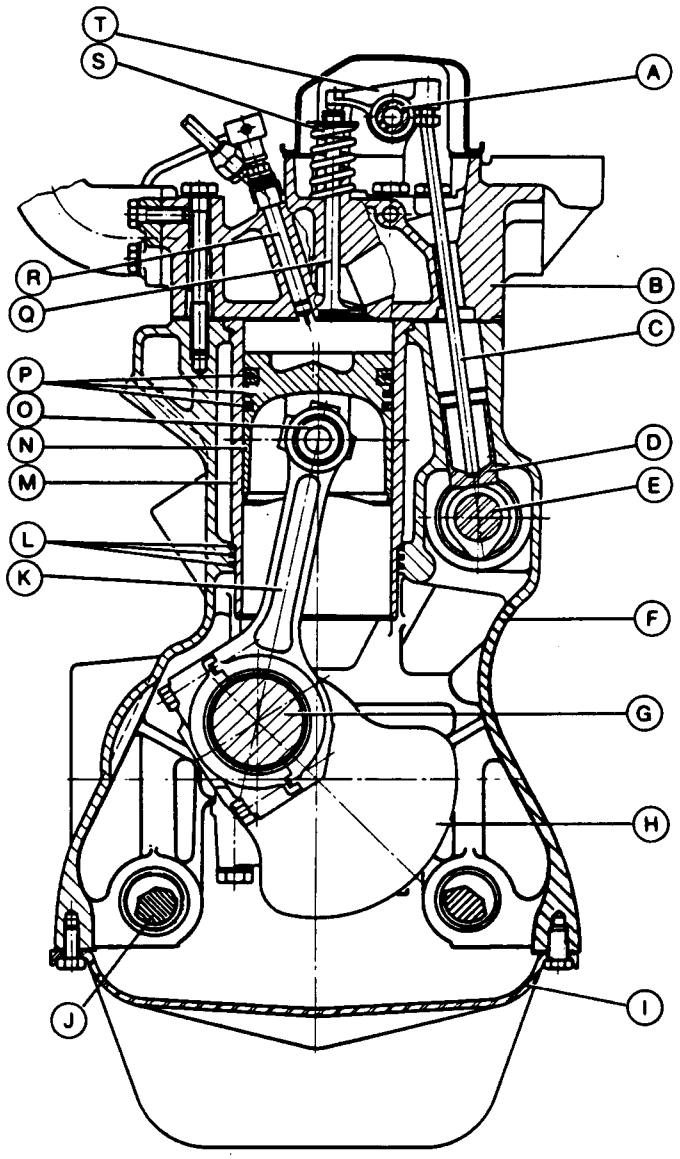
68

ENGINE—SECTIONAL VIEW



RG7248 -UN-11JUL95

A—Rocker Arm Shaft
B—Cylinder Head
C—Push Rod
D—Cam Follower
E—Camshaft
F—Cylinder Block
G—Crankshaft
H—Crankshaft Counterweight
I—Oil Pan
J—Balancer Shafts
K—Connecting Rod
L—Liner Packing Rings
M—Cylinder Liner
N—Piston
O—Piston Pin
P—Piston Rings
Q—Valve
R—Fuel Injection Nozzle
S—Valve Spring
T—Rocker Arm

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2

S11,2000,EH -19-11JUL95

GENERAL INFORMATION

Model 3029, 4039, 4045, 6059 and 6068 engines are vertical, in-line, valve in head, 4-stroke diesel engines.

The direct fuel injection is effected by means of a distributor-type fuel injection pump, which is driven by an intermediate gear in the timing gear train via the crankshaft gear.

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

The pistons are forged aluminium alloy. The outer surface of the pistons is cam ground. The piston crown has a cut-out swirl cup with a truncated cone in the center. Each piston has two compression rings which form a seal between combustion chamber and crankshaft housing and an oil control ring which controls lubrication between piston and wall of liner. All piston rings are located above the piston pin.

The hardened piston pins are fully-floating and held in position by means of snap rings.

The crankshaft is a one-piece, heat treated, steel forging or cast 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 are provided with a replaceable bronze bushing as bearing surface for the piston pins. Whereas the replaceable steel-backed bearing insert halves are aluminium lined and tin plated.

The camshaft, supported integrally in cylinder block, is driven by an intermediate gear of the timing gear train via the crankshaft gear. The camshaft cams determine time and rate of opening of each valve and actuate the fuel transfer 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.

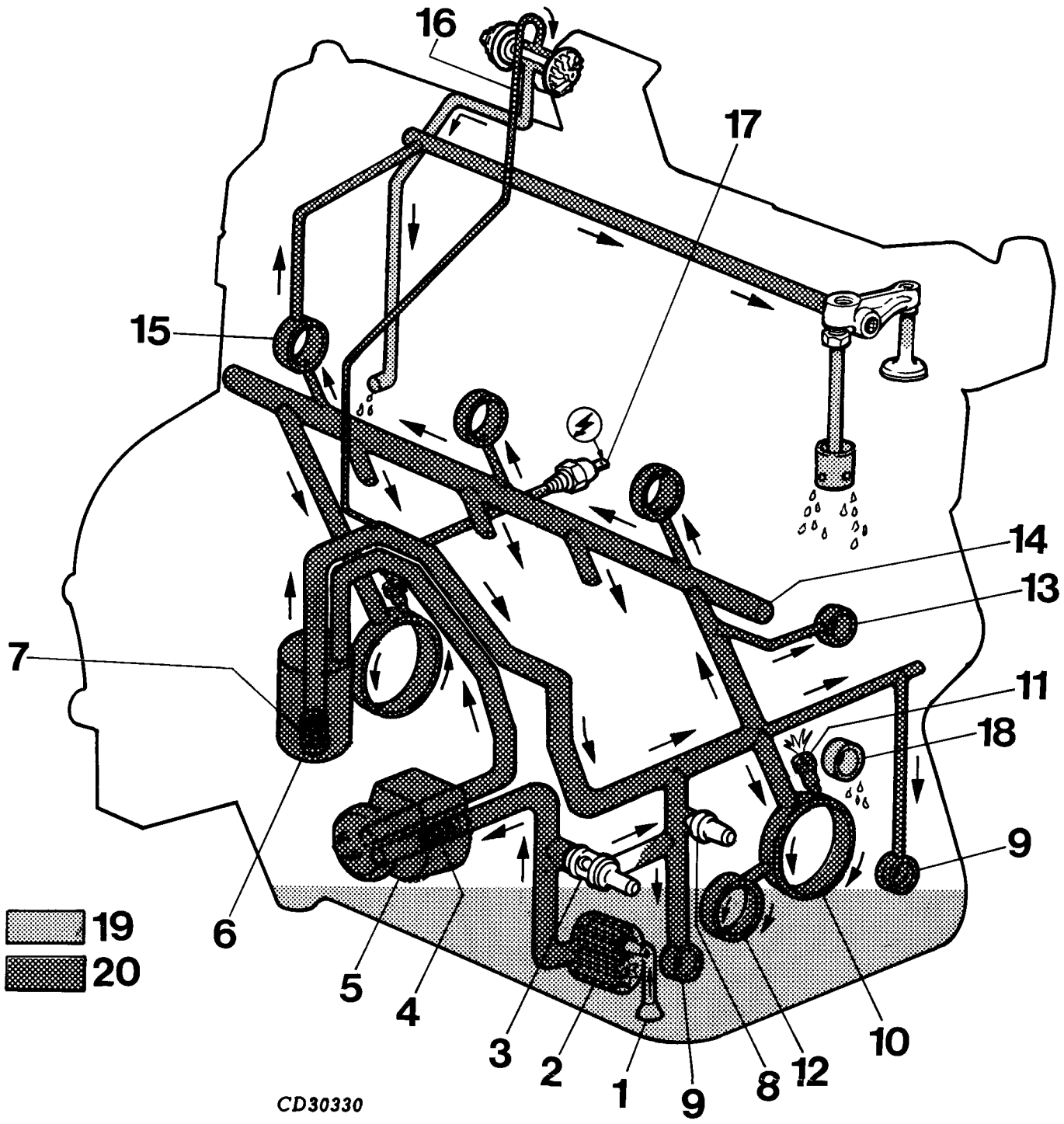
The engine is supplied with lubricating oil by a gear pump. The lubricating oil passes through a full-flow oil filter in the main oil circuit. To ensure engine lubrication, the oil filter is provided with a by-pass valve which opens when the filter element is restricted. On most engines, engine oil is 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 one or two thermostats.

Some engines are equipped with a turbocharger. Operated by exhaust gases, the turbocharger draws in filtered air to the combustion chambers.

Some other engines are designed and built with a turbocharger and an air-to-air aftercooler. Air-to-air aftercooler cools the turbocharger compressor discharge air by routing it through a heat exchanger (usually mounted in front of radiator) before it enters the intake manifold. The heat exchanger uses no liquid coolant, but relies on air flow to cool the charge air.

CD,3274,G205,1 -19-15MAY92



CD30330 -UN-08MAR95

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4

1—Suction line strainer
2—Oil pump
3—Oil by-pass valve
4—Oil cooler by-pass valve
5—Oil cooler
6—Oil filter
7—Oil filter by-pass valve
8—Oil pressure regulating valve
9—Balancer shaft bushings (4-cylinder)
10—Main bearings
11—Spray jet (1 per cylinder)
12—Connecting rod bearings
13—Upper idler gear
14—Main oil gallery
15—Camshaft bearings
16—Lubricating oil line to turbocharger (when equipped)
17—Oil pressure warning switch
18—Lower idler gear
19—Pressure-free oil
20—Engine lubricating oil

CD,3274,G205,2 -19-12NOV92

LUBRICATION SYSTEM

The engine has a pressure lubrication system. In the main it consists of the gear pump (2), filter strainer in the suction pipe, full flow oil filter (6), oil cooler (5), adjustable oil pressure regulating valve (8), oil by-pass valve (3) and an electrical pressure warning switch (17).

The pump draws lubricating oil from the crankcase through a strainer (1) and suction line and pumps it through an oil line via the oil cooler (5) to the oil filter (6) and to the main oil gallery (14) of the cylinder block.

From here oil is forwarded under pressure to the main bearings (10) and spray jets (11) to cool the pistons. Drilled cross passages in the crankshaft distribute oil from the main bearings to connecting rod bearings (12).

Lube oil holes in Nos. 1, 3, 5 main bearing oil grooves are provided to direct oil to the camshaft bearings (15). 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.

Direct oil passages from the main oil gallery provide lubricating oil to balancer shaft bushings (9) and the shaft of the turbocharger. The front right-hand balancer shaft bushing is lubricated directly from the oil pump.

CD,3274,G205,10-19-12NOV92

LUBRICATION SYSTEM - CONTINUED

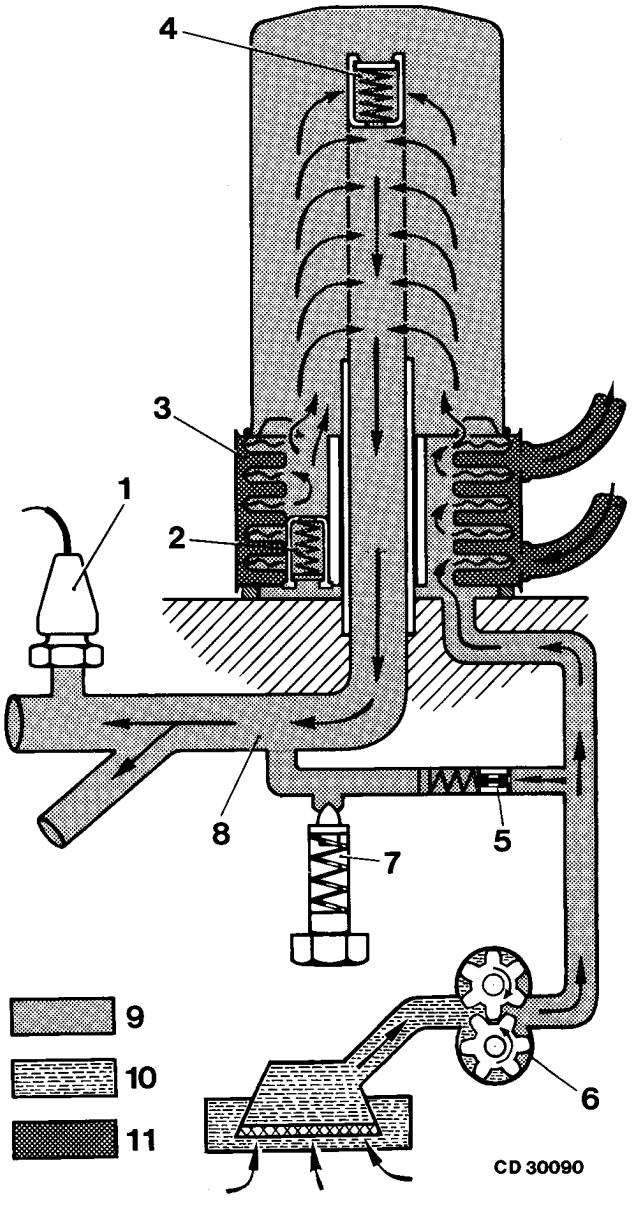
An externally adjustable pressure regulating valve is located at the front of the cylinder block in the oil gallery. It controls the oil pressure and provides constant pressure in the main gallery and in the complete lubrication system.

The valve consists of a valve cone held against a seat by means of a spring and plug. Pressure may be adjusted by changing the number of shims behind the valve plug. If oil pressure exceeds spring pressure, the valve cone is raised from the seat, permitting oil to bypass to the crankcase and maintain constant pressure.

An oil by-pass valve is located in the cylinder block behind the front plate and near the oil pressure regulating valve. Should the difference between the pressures in the main oil gallery and oil pump become excessive, this valve would open and let oil by-pass the filter and oil cooler to reach the main gallery faster. This valve has a permanent setting which cannot be changed.

The oil filter is mounted on the right-hand side of the engine. It is a full-flow type with a spin-on type replaceable element. If the filter clogs, a by-pass valve in the element opens to keep a full flow of oil to vital engine parts.

NOTE: Some high output engines are equipped with high flow oil coolers.



1—Oil pressure warning switch
2—Oil cooler by-pass valve
3—Oil cooler
4—Oil filter by-pass valve
5—By-pass valve
6—Oil pump
7—Oil pressure regulating valve
8—Main oil gallery
9—Lubricating oil
10—Pressure-free oil
11—Coolant from cooling system

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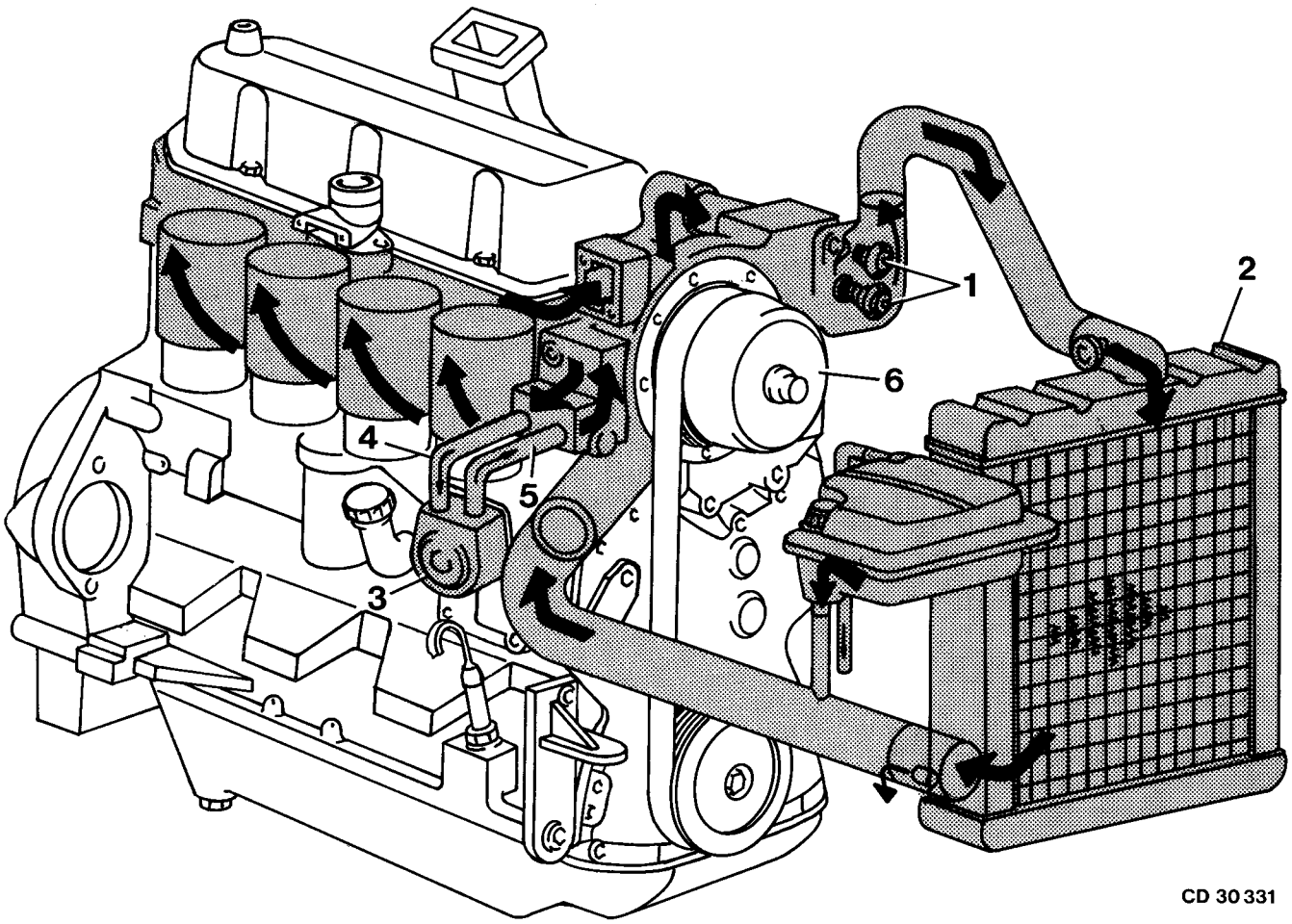
CD,3274,G205,3 -19-03NOV92

COOLING SYSTEM (4-CYLINDER ENGINE)



CD30331 -UN-08MAR95

1—Thermostats
2—Radiator
3—Oil cooler
4—Coolant flow to oil cooler
5—Return flow to water pump
6—Water pump

The principal components of the pressure cooling system are the radiator, water pump, multi-blade fan and thermostats.

During the warm-up period, thermostats (1) remain closed and coolant is directed through a by-pass to suction side of water pump (6). 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 thermostats open, coolant passes through the housing and upper radiator hose into top of radiator (2) where it is circulated to dissipate heat.

On some engines the water pump has two further hose connectors (4) and (5) which lead to the engine oil cooler (3).

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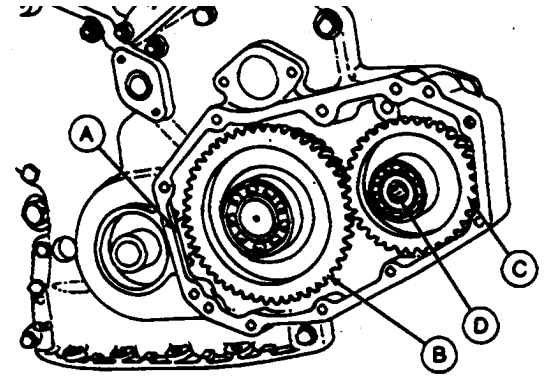
7

CD,3274,G205,4 -19-03NOV92

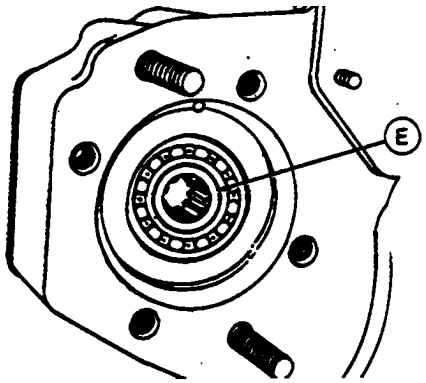
HOW THE 37 KW AUXILIARY DRIVE WORKS

A drive gear (A) on the engine crankshaft transmits power through an idler gear (B) to the auxiliary (output) drive gear (C) for driving engine accessories. The output shaft at the front (D) is equipped with an SAE 5/8-9 tooth "A"-spline and 2-bolt mounting. The output shaft at the rear (E) is equipped with an SAE 7/8-13 tooth "B" spline which can have either a 2-bolt or a 4-bolt mounting.

A—Drive gear
B—Idler gear
C—Auxiliary (Output) drive gear
D—Output shaft (at front)
E—Output shaft (at rear)



RG5173 -UN-30NOV88



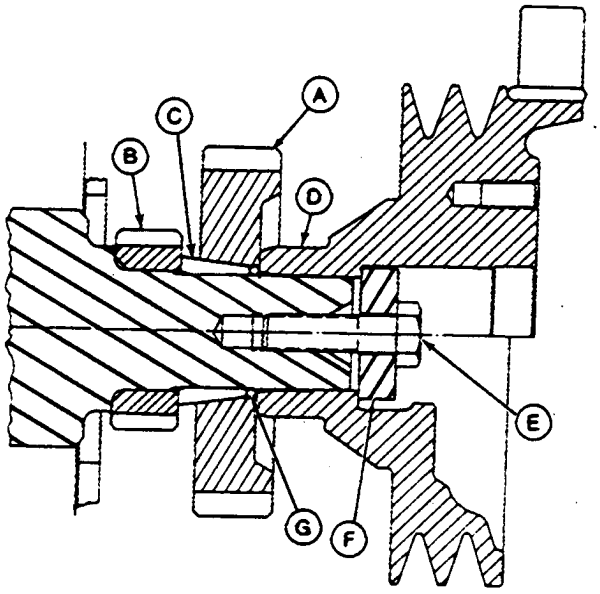
RG5174 -UN-30NOV88

CD,3274,G205,6 -19-15MAY92

Auxiliary crankshaft gear (A) is located in front of the regular crankshaft gear (B) and mounts on a tapered collet (C) which provides the press fit necessary for transmitting power. The amount of press is determined by the loading of pulley (D) or damper pulley against the gear on the collet when cap screw (E) is tightened to the specified torque. A thick washer (F) is used to help prevent loss of cap screw torque. An O-ring (G) is used to prevent external seepage of engine lube oil.

NOTE: Engines equipped with the auxiliary gear drive option have a "long-nose" crankshaft.

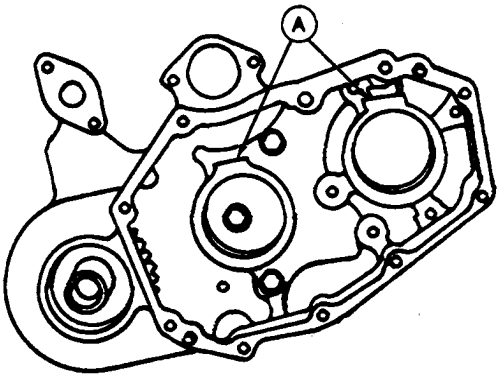
A—Auxiliary crankshaft gear
B—Regular crankshaft gear
C—Tapered collet
D—Pulley
E—Cap screw
F—Washer
G—O-ring



RG5175 -UN-30NOV88

CD,3274,G205,7 -19-15MAY92

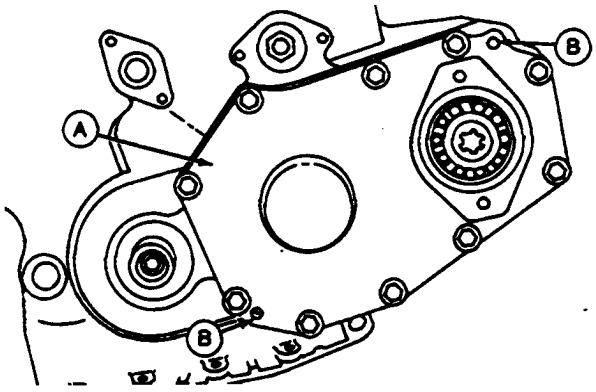
Both idler gear and output gear are supported by ball bearings. Gears and bearings are splash-lubricated. Splash oil collected on top of bearing bosses (A) is directed down through a hole in each boss to lubricate the bearings.



RG5176 -UN-30NOV88

CD,3274,G205,8 -19-15MAY92

Auxiliary gear cover (A) supports the outer bearing race for both the idler and output gear assemblies. Two dowel pins (B) are used to properly align the auxiliary gear cover and timing gear cover.



RG5177 -UN-30NOV88

CD,3274,G205,9 -19-15MAY92

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SPECIAL OR ESSENTIAL TOOLS

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

DX,TOOLS -19-20JUL95

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

To measure engine oil pressure.

-UN-28JUL94
FKM10002

CD,FKM10002 -19-01FEB94

Compression test set FKM10021

To check engine cylinder compression

-UN-07MAR95
L30722A

CD,FKM10021 -19-15MAY92

210
1

SPECIFICATIONS

Engine compression pressure:
— Minimum . . . . . 2100 kPa (21 bar; 300 psi)
— Maximum difference between cylinders . . . . . 350 kPa (3.5 bar; 50 psi)

Minimum engine oil pressure:
— at 800 rpm . . . . . 100 kPa (1 bar; 14 psi)
— at rated speed (1500 or 1800 rpm) . . . . . 275 kPa (2.75 bar; 40 psi)
— at rated speed (more than 1800 rpm) . . . . . 350 kPa (3.5 bar; 50 psi)

Engine blow-by at crankcase vent tube,
maximum at full load rated speed:
— all engines . . . . . 80 liter/kWh (2.8 cu.ft./kWh)

Engine oil consumption (all engines):
— Normal . . . . . Up to 0.5 % of fuel consumption rate
— Overhaul point . . . . . Above 0.625 % of fuel consumption rate

NOTE: Oil consumption should be measured over a 100 hour period.

CD,3274,G210,1 -19-04JAN99

ENGINE BREAK-IN INSTRUCTIONS

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 -19-01FEB94

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 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.

DX,ENOIL4 -19-10OCT97

DIAGNOSING 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

CD,3274,G210,3 -19-15MAY92

DIAGNOSING ENGINE MALFUNCTIONS - CONTINUED

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(s)
Cooling system limed up
Engine overloaded
Fuel injection pump delivers too much fuel
Damaged cylinder head gasket
Fuel injection pump incorrectly timed
Defective water pump
Too low crankcase oil level
Defective radiator cap

High oil consumption

Oil control rings worn or broken
Scored cylinder liners or pistons
Excessive resistance in air intake system
Oil flow through oil passages restricted
Worn valve guides or stems
Too low viscosity crankcase oil
Excessive oil pressure
Piston ring grooves excessively worn
Piston rings sticking in ring grooves
Insufficient piston ring tension
Piston ring gaps not staggered
Excessive 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)

CD,3274,G210,4 -19-15MAY92

DIAGNOSING ENGINE MALFUNCTIONS - CONTINUED

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 (wanders)
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(s) (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

CD,3274,G210,5 -19-15MAY92

DIAGNOSING ENGINE MALFUNCTIONS - CONTINUED

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(s)
Coolant temperature gauge defective

Engine vibrating

Fan blades bent
Pump shaft worn

CD,3274,G210,6 -19-15MAY92

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.

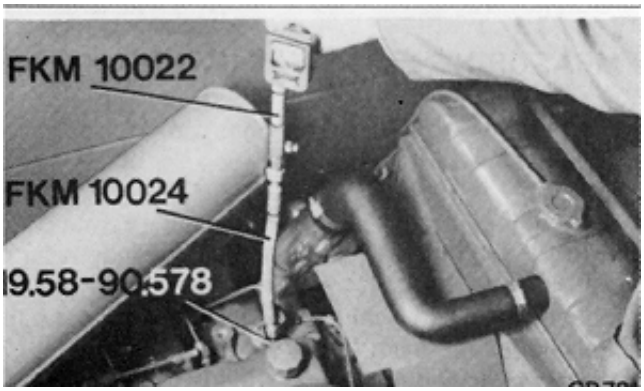
Remove fuel injection nozzles (see Group 40).

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

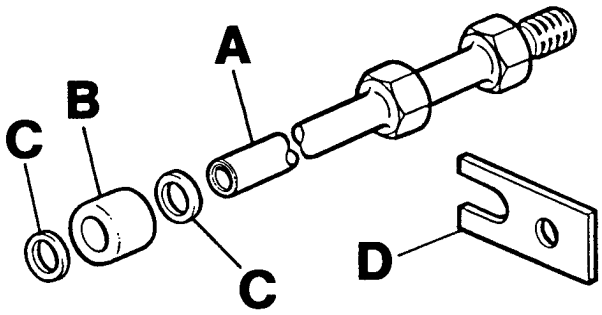
Push throttle lever to “STOP” position. Turn crankshaft for a few seconds with starting motor.

Compression pressure must be 2100 kPa (21 bar; 300 psi) minimum. The difference between the highest and lowest cylinder must be less than 350 kPa (3.5 bar; 50 psi). This test must be performed at a minimum cranking speed of 150 rpm.

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



CD7215 -UN-10FEB89



CD30432

CD30432 -UN-10MAY95

** Part of FKM10021 compression test kit*

CD,3274,G210,7 -19-01FEB94

CHECKING ENGINE OIL PRESSURE

1. Before checking oil pressure, warm up engine to allow the lubricating oil to reach operating temperature.

2. Attach pressure gauge.

NOTE: Use gauge from FKM10002 or JT05470 Universal pressure test kit if available. Otherwise, use gauge with a reading range of 0—600 kPa (0—6 bar ; 0—87 psi) minimum.

3. At 93˚C (200˚F) operating temperature, gauge should show a minimum pressure of:

—at 800 rpm . . . . . 100 kPa (1 bar; 14 psi)
—at rated speed (1500 or 1800 rpm) . . . . . 275 kPa (2.75 bar; 40 psi)
—at rated speed (more than 1800 rpm) . . . . . 350 kPa (3.5 bar; 50 psi)

CD,3274,G210,8 -19-04JAN99

MEASURING 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. Multiply figure obtained by 12 (hourly rate) and check against specified figure shown in Specifications.

If blow-by is lower, there is no undue 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,3274,G210,9 -19-15MAY92

USING STANADYNE “TIME-TRAC” AS TACHOMETER

The STANADYNE “TIME-TRAC” meter can be used as a tachometer by using clamp-on transducer FKM10429-5 (A) on any high-pressure line.

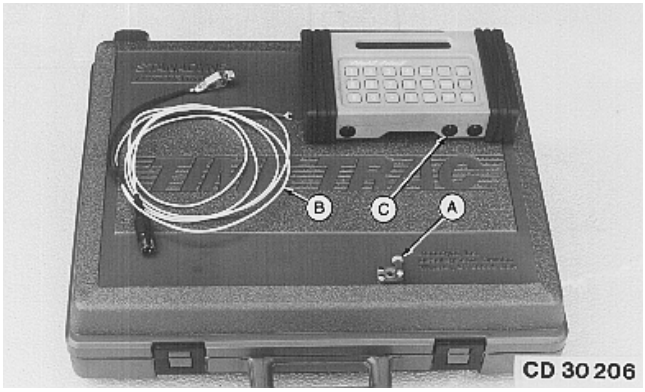
Operating instructions

1. Remove paint and thoroughly clean the area of the high-pressure line to which the clamp-on transducer is to be attached.

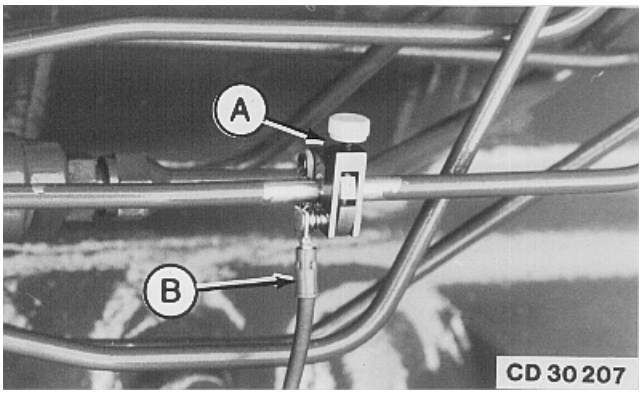
2. Install transducer (A) and connect cable FKM10429-3 (B) between transducer and socket meter (C). Also connect ground wire.

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

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



-UN-07MAR95
CD30206



-UN-07MAR95
CD30207

CD,3274,G210,10-19-15MAY92

INSPECT THERMOSTAT AND TEST OPENING TEMPERATURE

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

• Test thermostat as follows:

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

1. Remove thermostat.

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.

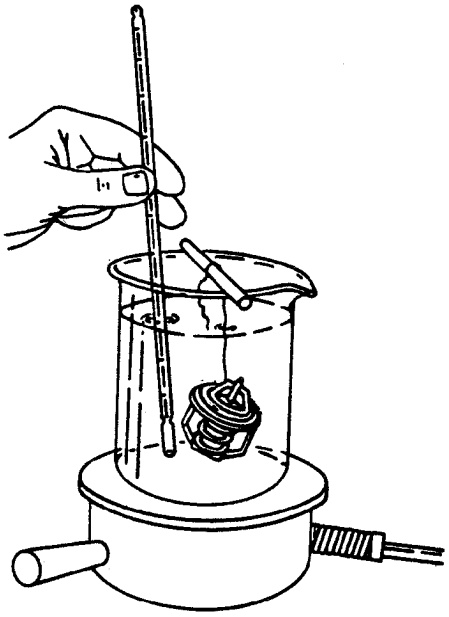
NOTE: Due to varying tolerances of different suppliers, initial opening and full open temperatures may vary slightly from specified temperatures.

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.



RG5971 -UN-23NOV97

210
11

CD,CTM125,229 -19-01DEC97

SPECIAL OR ESSENTIAL TOOLS

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

DX,TOOLS -19-20JUL95

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

To test engine intake manifold pressure.

-UN-28JUL94
FKM10002

CD,FKM10002A -19-01FEB94

SPECIFICATIONS

Turbocharger minimum boost pressure
at engine rated speed and rated power . . . . . 60 kPa (0.6 bar ; 9 psi)

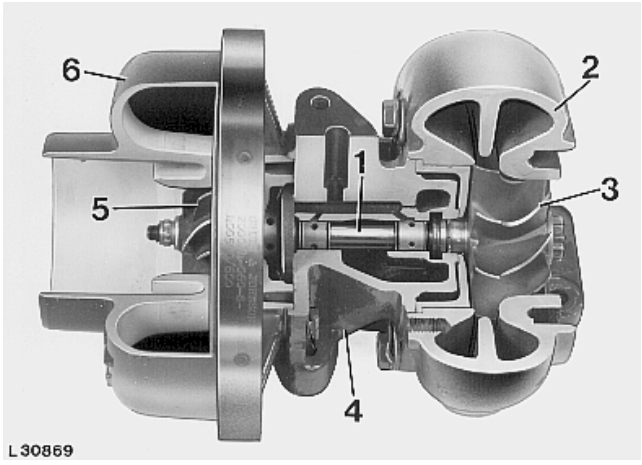
CD,3274,G215,1 -19-15MAY92

TURBOCHARGER OPERATION

The turbine wheel (3) is driven by the hot engine exhaust gases. These gases flowing through the turbine housing (2) act on the turbine wheel causing shaft (1) to turn.

Compressor wheel (5) sucks in filtered air and discharges the compressed air into the intake manifold where it is then delivered to engine cylinders.

Engine oil under pressure from the engine lubrication system is forced through passages in center housing (4) to the bearings.



-UN-23MAY95
L30869

1—Shaft
2—Turbine housing
3—Turbine wheel
4—Center housing
5—Compressor wheel
6—Compressor housing

215
1

CD,3274,G215,2 -19-16MAY92

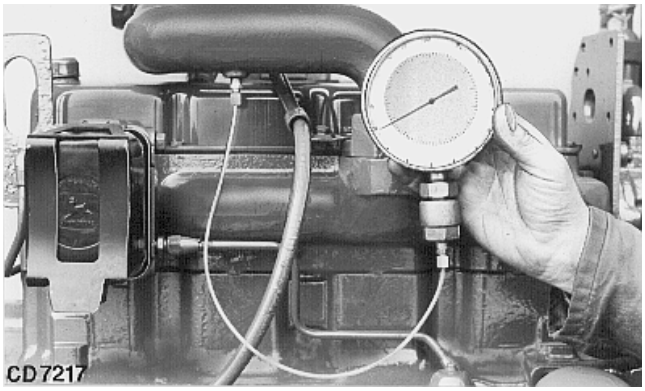
TURBOCHARGER BOOST PRESSURE CHECK

Attach pressure gauge.

Before checking boost pressure, warm up engine to allow the lubricating oil to reach operating temperature.

Observe pressure reading on gauge. Reading should be at least 60 kPa (0.6 bar ; 9 psi) when engine is developing rated horse power at full load speed. 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,3274,G215,3 -19-15MAY92

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).

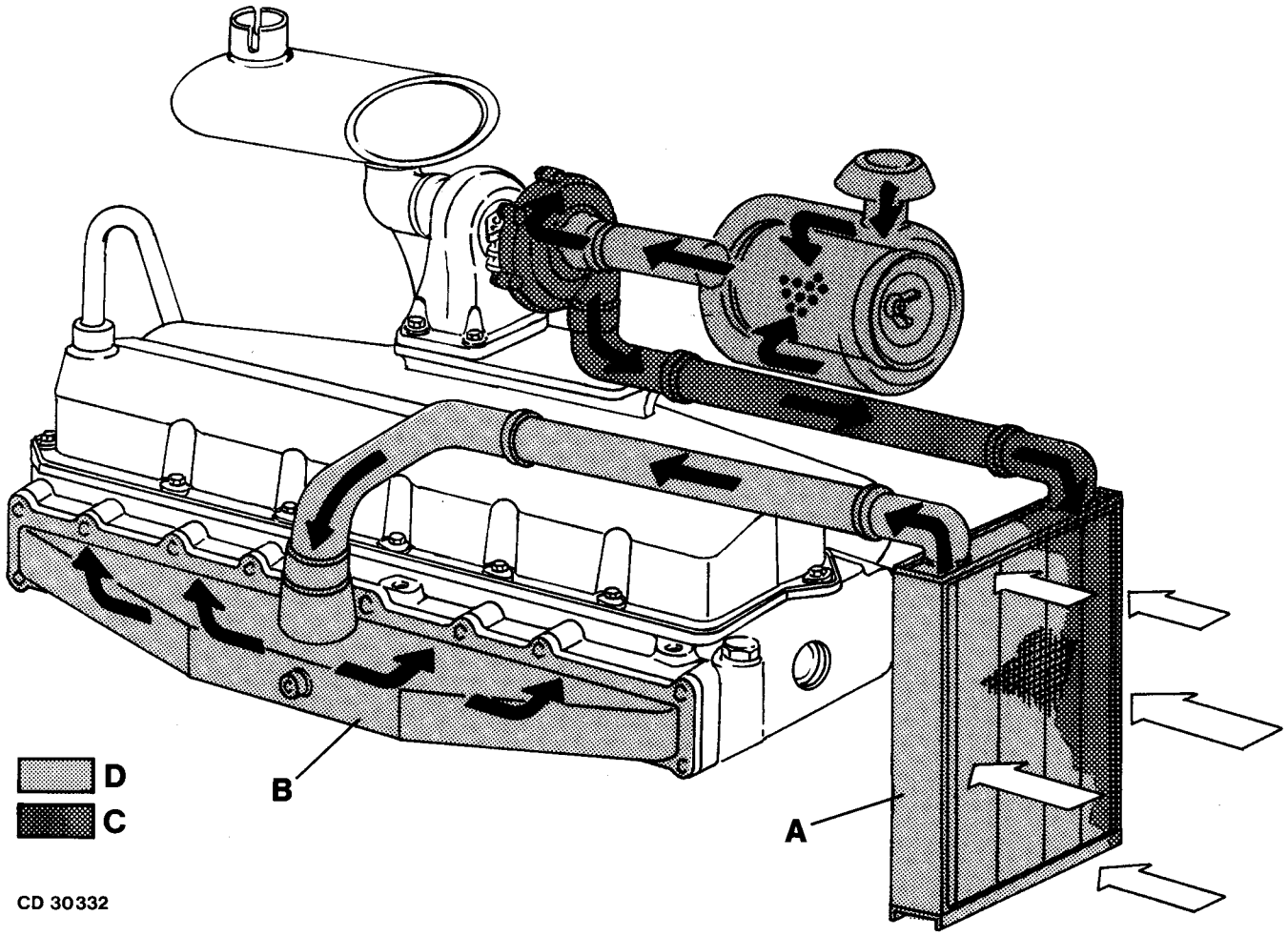
Bearings not lubricated (insufficient oil pressure)
Air leak in engine intake or exhaust manifold
Improper clearance between turbine wheel and turbine housing
Broken blades (or other wheel failures)

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

AIR-TO-AIR AFTERCOOLER OPERATION



A—Heat exchanger **B—Intake manifold** **C—Hot air flow** **D—Cooled air flow**

Intake air, which has been compressed (and heated) by the turbocharger is routed, before entering the intake manifold (B), toward a heat exchanger (A) (usually mounted in front of radiator) to lower the air temperature.

Lowering the air temperature makes the air more dense and permits an even greater volume of air to be delivered to engine cylinders for combustion.

This increased volume of air, when combined with a predetermined quantity of additional fuel, enables more power to be produced.

The heat exchanger uses no liquid coolant but relies on air flow to cool the charge air.

CD,3274,G215,5 -19-15MAY92

FUEL FILTER OPERATION

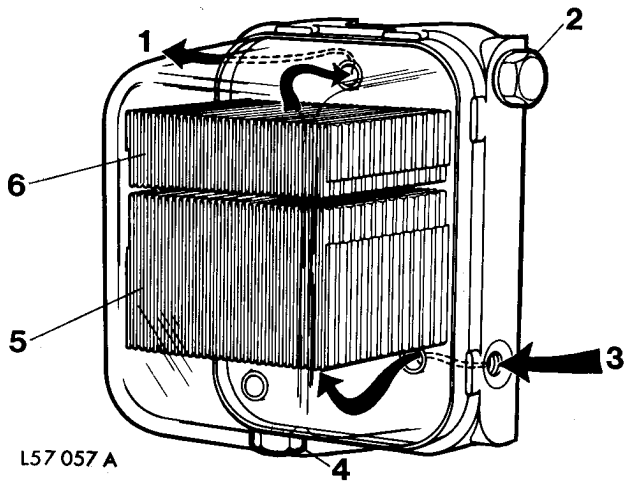
Fuel enters the filter at (3) and flows through a first stage filter medium (5) and a second stage filter medium (6) before flowing through outlet (1) to the fuel injection pump. The filter media are housed in a metal sediment bowl and are glued to the bowl as one assembly.

Since water and other contaminants may settle at the bottom of the sediment bowl, a drain plug (4) is provided to permit their removal.

An air vent (2) enables air in the system to be expelled to the outside through the filters when the bleed plug is removed.

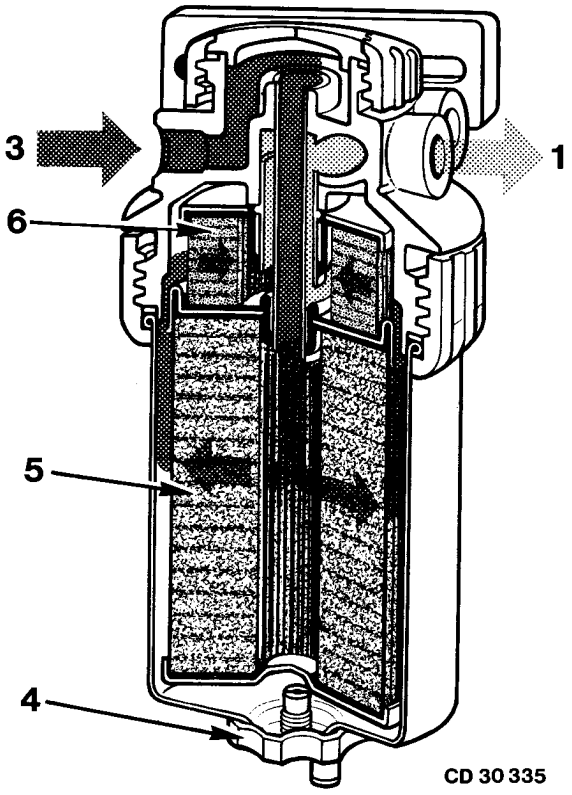
NOTE: On recent engines the round fuel filter may have an one-stage element.

1—Fuel outlet
2—Air vent plug
3—Fuel inlet
4—Drain plug
5—First stage filter
6—Second stage filter



L57057A -UN-23MAY95

Rectangular filter



CD30335 -UN-08MAR95

Round filter

CD,3274,G220,4 -19-04JAN99

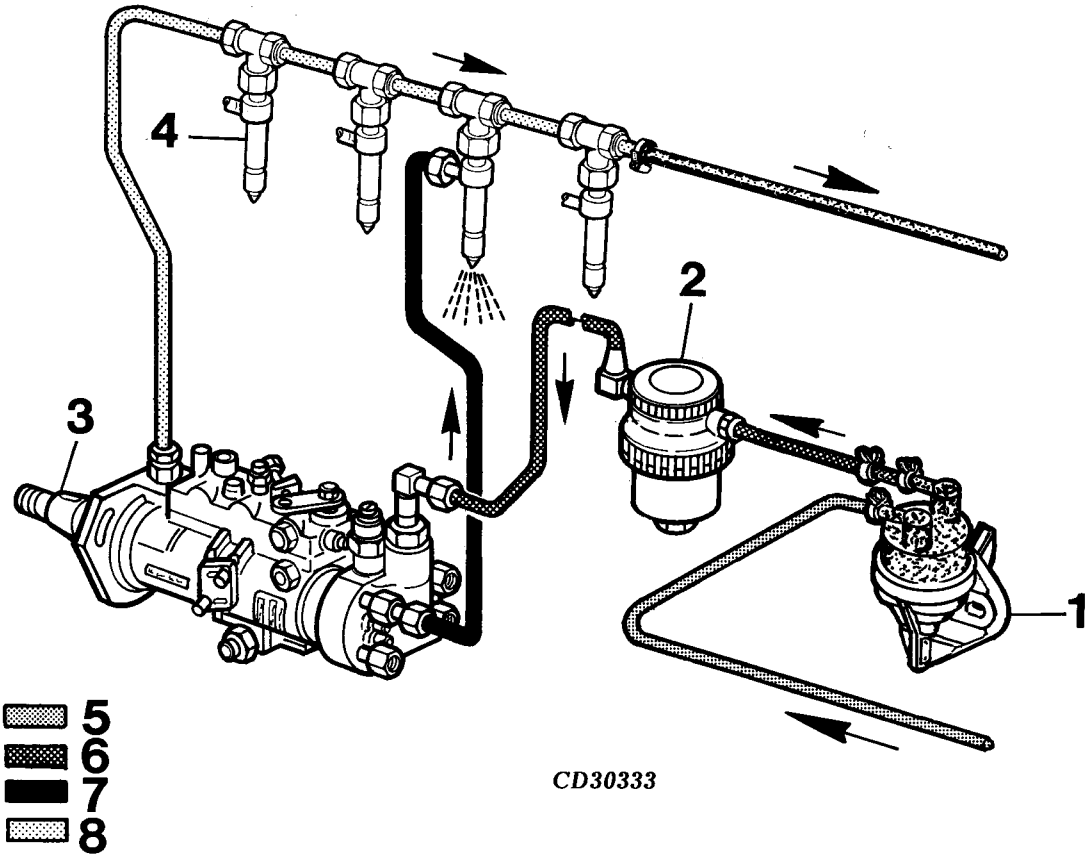
SPECIFICATIONS

Engine speeds . . . . . See specifications in Group 40

Fuel transfer pump pressure at engine slow idle . . . . 20—30 kPa (0.20—0.30 bar; 2.9—4.35 psi)

CD,3274,G220,1 -19-01FEB94

FUEL SYSTEM OPERATION - DISTRIBUTOR INJECTION PUMP



CD30333

1—Fuel transfer pump
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) 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.

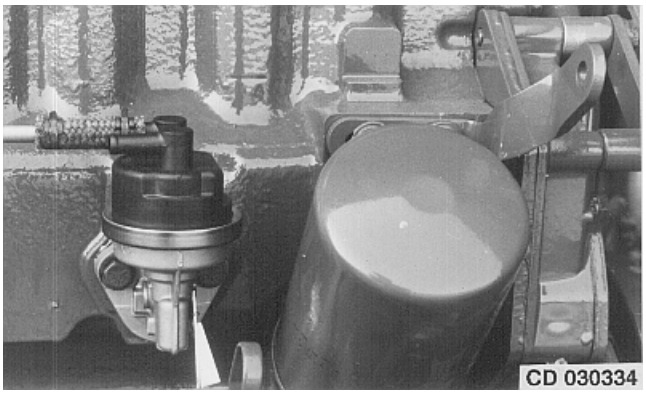
2. Fuel injection nozzles: A small amount of fuel seeps past the nozzle valve for lubrication purposes.

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.

FUEL TRANSFER PUMP OPERATION (DISTRIBUTOR INJECTION PUMP)

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 20 to 30 kPa (0.20 to 0.3 bar ; 2.9 to 4.35 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.



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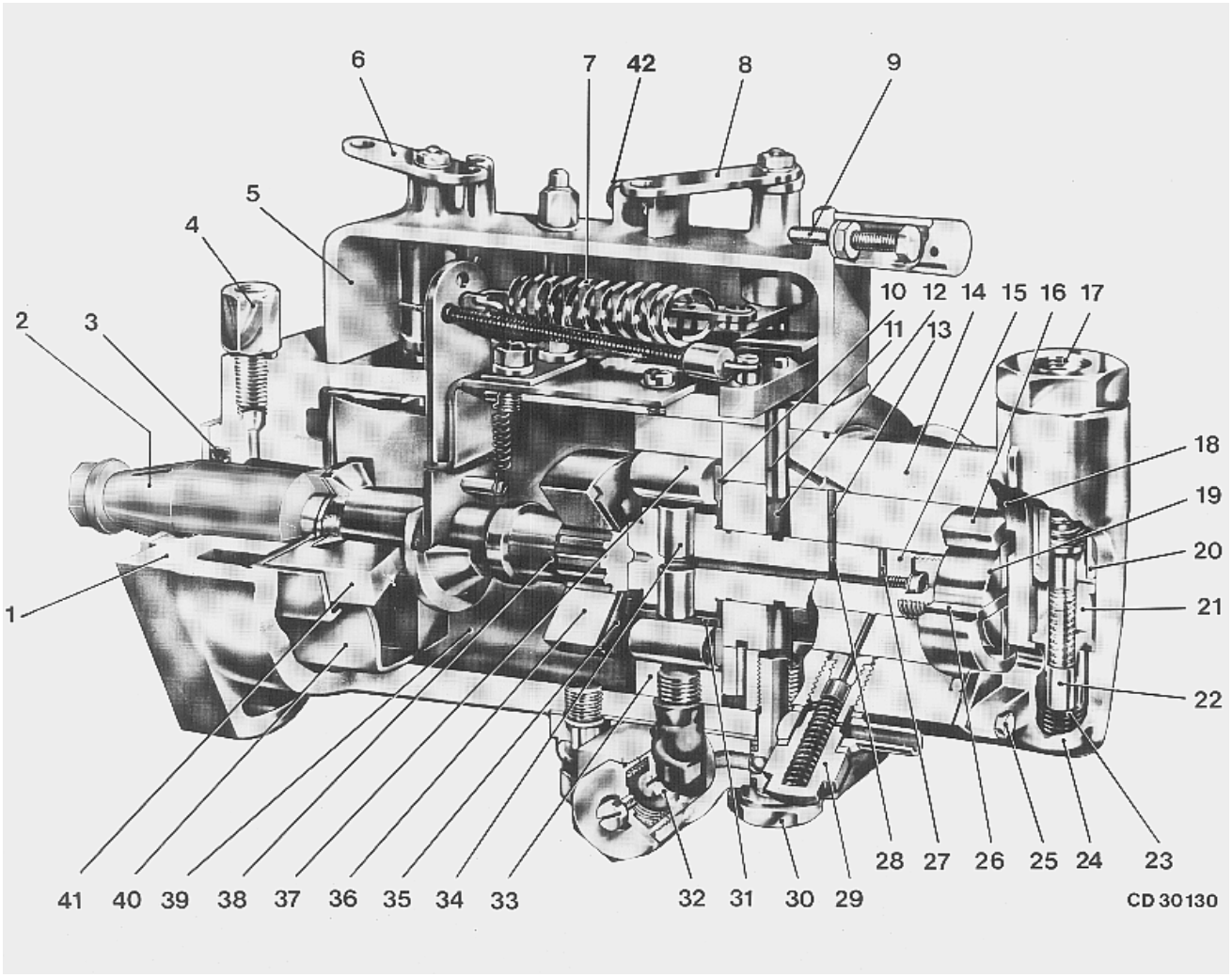
CD30334

CD,3274,G220,3 -19-04JAN99

LUCAS CAV FUEL INJECTION PUMP - SECTIONAL VIEW



1—Pump housing
2—Drive shaft
3—Seal ring
4—Leak-off adapter
5—Governor housing
6—Shut-off lever
7—Governor spring
8—Speed control lever
9—Fast idle adjusting screw
10—Rear adjusting plate
11—Metering valve
12—Metering valve chamber
13—Inlet passage
14—Pump head
15—Pump and distributor rotor
16—Eccentric sleeve of transfer pump
17—Fuel inlet
18—Seal
19—Rotor of transfer pump
20—Filter
21—Pressure regulating valve sleeve
22—Pressure regulating valve piston
23—Bleed spring
24—End plate
25—Cap screw
26—Rotor blades of transfer pump
27—Discharge port
28—Inlet passage (one bore for each cylinder)
29—Pressurizing valve (one for each cylinder)
30—Hollow screw
31—Race
32—Automatic advance
33—Cam ring
34—Plunger
35—Front adjusting plate
36—Drive plate
37—Cam roller
38—Pump shaft
39—Internal chamber of pump housing
40—Governor cage
41—Flyweights
42—Slow idle adjusting screw

CD,3274,G220,5 -19-04NOV92

LUCAS CAV FUEL INJECTION PUMP - OPERATION

General information
The Lucas CAV fuel injection pump is a horizontally installed 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 lubricant is required. Four pump models are used:
• DPA2 - 2 plungers
• DPA4 - 4 plungers
These pumps are progressively replaced by the following pumps which are designed to meet future emission requirements:
• DP200 - 2 plungers
• DP201 - 4 plungers

Transfer pump and metering
The diesel fuel for injection is fed to the cylinders - regardless of their number - by a single unit. Its pump and distributor rotor is fitted with two opposed plungers controlled by a cam ring. On the other end of the rotor, opposite the two pump plungers, there is a transfer pump which delivers the fuel, drawn from the fuel filter, through the metering valve into the inlet passage (13) in the pump head, at a pressure which varies with engine speed.

Filling process:
As rotor (15) rotates, inlet passage (13) in pump head aligns with inlet passage (28) in the rotor. Fuel coming from the transfer pump reaches the pump plunger chamber through inlet passage (28), regulated by the metering valve and forces the two plungers (34) apart.

Pumping and delivery process:
During further rotation of rotor (15), inlet passage (13) in the pump head is closed and discharge port (27) in the rotor eventually aligns with one of the outlet bores in the pump head. Meanwhile the pump plungers (34) have reached the cam so that they move towards each other. The trapped, metered fuel is forced, under high pressure, through discharge port (27) in the rotor and outlet opening in the pump head, through pressurizing valve and connected pressure line, to the fuel injection nozzle and into the appropriate cylinder.

A pressurizing valve is located at each outlet in the pump head (as on in-line type fuel injection pumps) where the pressure line leading to the fuel injection nozzle is connected. After injection the pressure regulating valve closes again and with its small relief piston sucks a quantity of fuel from the pressure line. The resulting relief in pressure in the pressure line causes a quick and firm shutting of the nozzle valve, thus preventing 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 which is controlled via speed control rod and control lever (8), by the governor inside housing (5).

In the engine “shut-off” position, the metering valve completely cuts off the supply of fuel from transfer pump to the rotor.

At idling speed or under 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.

Automatic advance (speed responsive)

To obtain the best possible performance over the entire speed range, the fuel injection pump is fitted with an automatic advance system, hydraulically actuacted (32). It is pre-set at the factory.

The speed advance adjusts timing of the fuel injection pump in relation to engine speed and load.

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,3274,G220,6 -19-01FEB94

TEST SHUT-OFF SOLENOID ON LUCAS-CAV INJECTION PUMP

220
8

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.

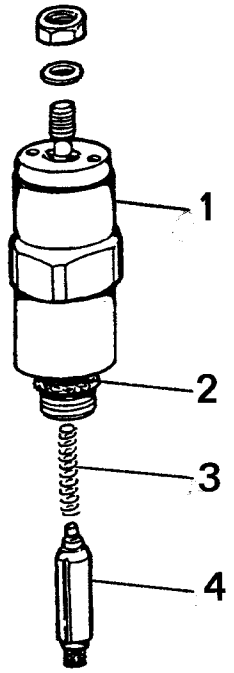
5. Check that the plunger moves freely in the solenoid body.

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 15 N·m (11 lb-ft).

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

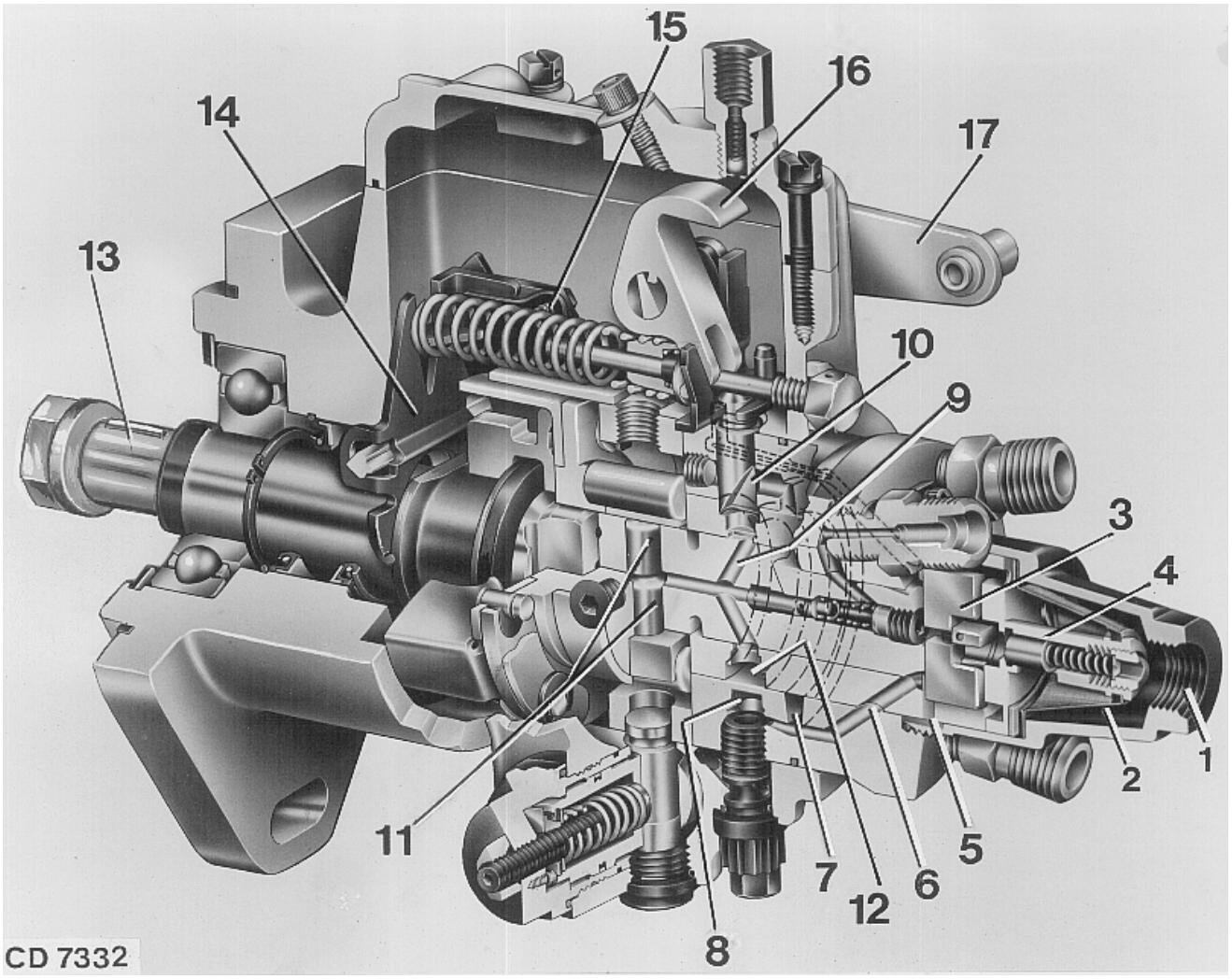


CD30739 -UN-22FEB99

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

CD,3274,G220,17-19-04JAN99

STANADYNE FUEL INJECTION PUMP (TYPE DM4) - SECTIONAL VIEW



1—Transfer pump inlet
2—Screen
3—Pump
4—Regulator assembly
5—Rotor retainer
6—Passage
7—Charging circuit
8—Advance circuit
9—Inlet passages
10—Metering valve
11—Pumping plungers
12—Charging ring
13—Drive shaft
14—Governor arm
15—Governor spring and link
16—Governor spring lever
17—Throttle lever

CD,3274,G220,7 -19-15MAY92

STANADYNE FUEL INJECTION PUMP (DM4) - OPERATION

Fuel is delivered to the transfer pump inlet (1) where it passes through inlet screen (2) and enters the vane-type pump (3). Since the transfer pump displacement greatly exceeds the injection requirements, a large percentage of fuel is by-passed through the regulator assembly (4) to the suction side. This positive displacement pump causes fuel flow to increase with speed and, because of the regulating piston, pump pressure also increases with speed.

Fuel under transfer pump pressure flows past rotor retainers (5) into an annulus on the rotor. It then flows through a connecting passage (6) in the head to the advance (8) and charging circuit (7). The fuel flows around the annulus through a connecting passage to the metering valve (10). The radial position of metering valve (controlled by the governor) regulates flow of fuel into charging ring (12) which incorporates the inlet passages.

As rotor revolves, the two inlet passages (9) register with inlet passages in hydraulic head, allowing fuel to flow into the pumping cylinders. With further rotation, inlet passages move out of registry and discharge port of rotor registers with one of the head outlets. While discharge port is opened, rollers contact cam lobes, forcing plungers together. Fuel trapped between plungers is then delivered to the fuel injection nozzle.

To obtain the best possible performance over the entire speed range, the fuel injection pump is fitted with an automatic advance system, hydraulically actuated. It is pre-set at the factory.

The speed advance adjusts timing of the fuel injection pump in relation to engine speed and load.

With the exception of the drive shaft bearing on DM4 models, lubrication of pump working parts is achieved by means of fuel by-passed from the transfer pump before it is returned to the fuel tank. The drive shaft bearing on DM4 models is lubricated by engine oil from the timing gear housing.

As fuel leaves the transfer pump, it is directed through a passageway leading to an annulus in the hydraulic head. Connected to this passageway is a vent passage located behind the metering valve bore. This vent passage contains a vent wire to prevent excessive return fuel flow and high pressure loss. A short passage connects vent passage with governor linkage compartment. Should air enter the transfer pump, it immediately passes to the vent passage. Air and a small quantity of fuel then flow from the housing to the fuel tank by way of the return pipe.

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.

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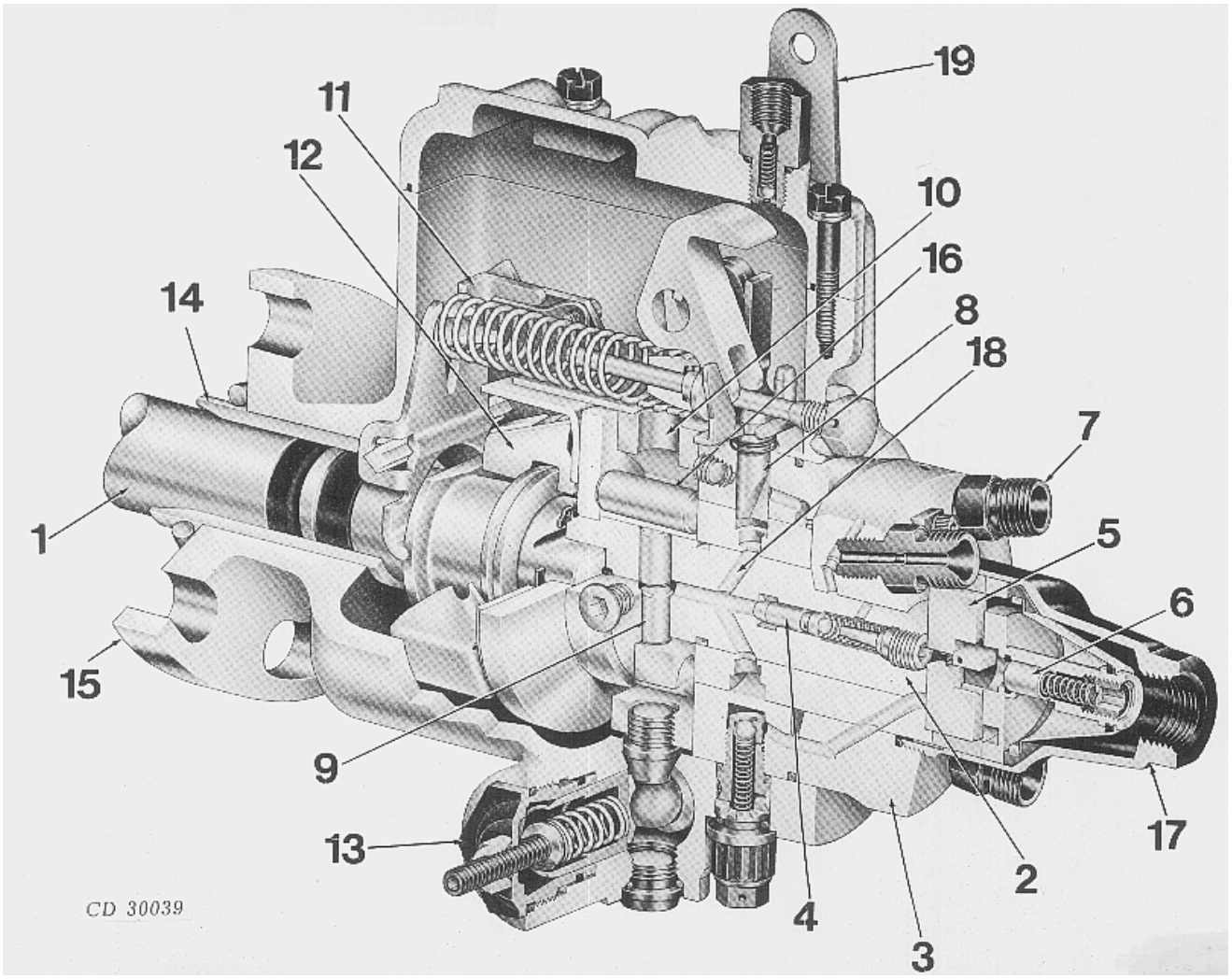
STANADYNE FUEL INJECTION PUMP (TYPE DB2/DB4) - SECTIONAL VIEW



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

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STANADYNE FUEL INJECTION PUMP (DB2/DB4) - OPERATION

The main rotating components are the drive shaft (1), distributor rotor (2), transfer pump (5) and governor (11).

The drive shaft engages the distributor rotor in the hydraulic head (3). The drive end of the rotor incorporates the transfer pump.

The plungers (9) are actuated towards each other simultaneously by an internal cam ring (10) via rollers (16) and shoes which are carried in slots at the drive end of rotor. The number of cam lobes normally equals the number of engine cylinders.

The transfer pump at the rear of the rotor is of a positive displacement vane type and is enclosed in the end caps. These end caps also house transfer pump inlet (17), fuel strainer and pressure regulator (6). Transfer pump pressure is automatically compensated for changes in viscosity due to temperature and variations in fuel grade.

The distributor rotor incorporates two inlet passages (18) and a single axial bore with one delivery valve (4) to serve all discharge fittings (7) to the injection lines. The hydraulic head contains the bore in which the rotor revolves, the metering valve (8) bore, the charging ports and head discharge fittings.

This pump contains its own all-speed mechanical governor (11). The centrifugal force of weights (12) in their retainer is transmitted through a sleeve to a governor arm and through a positive linkage hook to the metering valve. The metering valve can be closed to shut off fuel through a solid linkage by an independently operated shut-off lever.

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.

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,3274,G220,10-19-01FEB94

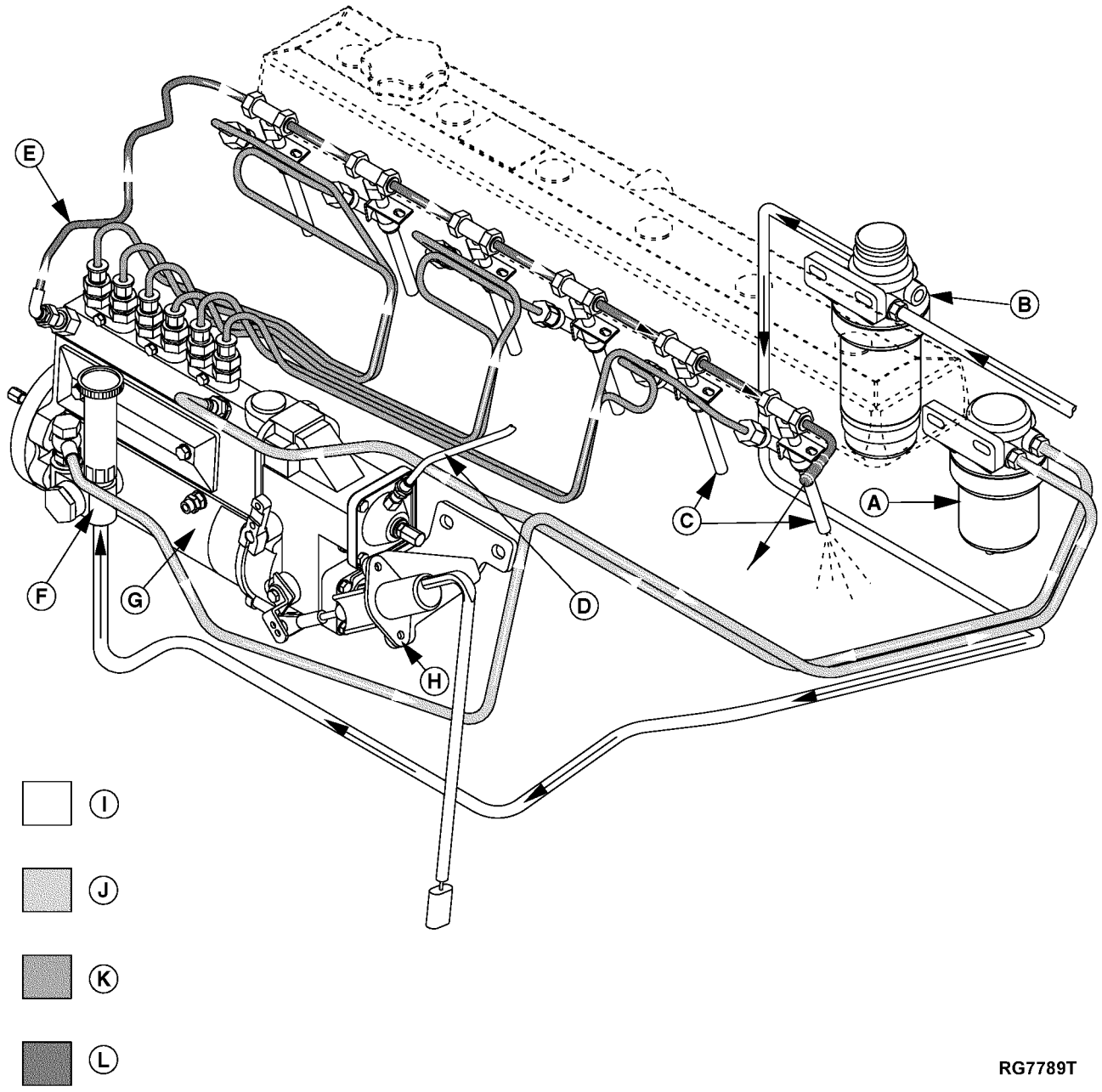
SPECIFICATIONS (IN-LINE PUMP)

Engine speeds . . . . . See specifications in Group 40

Fuel transfer pump pressure . . . . . 350 kPa (3.5 bar; 50 psi)

CD,3274,G220,18-19-04JAN99

FUEL SYSTEM OPERATION - IN-LINE INJECTION PUMP (6 CYL. SHOWN)



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RG7789T

RG7789T

A—Final fuel filter
B—Primary fuel filter/Water separator (optional)
C—Injection nozzles
D—Aneroid inlet line (optional)
E—Fuel return (leak-off) line
F—Fuel supply pump
G—Fuel injection pump
H—Fuel shut-off solenoid (optional)
I—Suction fuel from tank
J—Supply pump pressure fuel
K—Injection pressure fuel
L—Return (leak-off) line

CD,3274,G220,19-19-04JAN99

FUEL SYSTEM OPERATION—IN-LINE INJECTION PUMP

The supply pump (F) draws fuel from the vented fuel tank through the primary filter (B) when equipped.

The supply pump pressurizes the fuel so that it flows through the filter (A) to the injection pump galley. Supply pump output pressure will vary depending on load and application.

The galley is kept full by the supply pump. Injection pump plungers further pressurize the fuel. Injection pressure lines route the fuel to the nozzles (C).

The high pressure fuel (K) opens the nozzle valve and forces fuel out the small orifices in the nozzle tip. This atomizes the fuel as it enters the combustion chamber.

There are two sources of excess fuel incorporated into the system. The supply pump supplies more fuel to the pump than is required by the engine, and the nozzle requires excess fuel to lubricate the nozzle valve. A leak-off line (L) returns this excess fuel to the tank from both the pump and nozzles.

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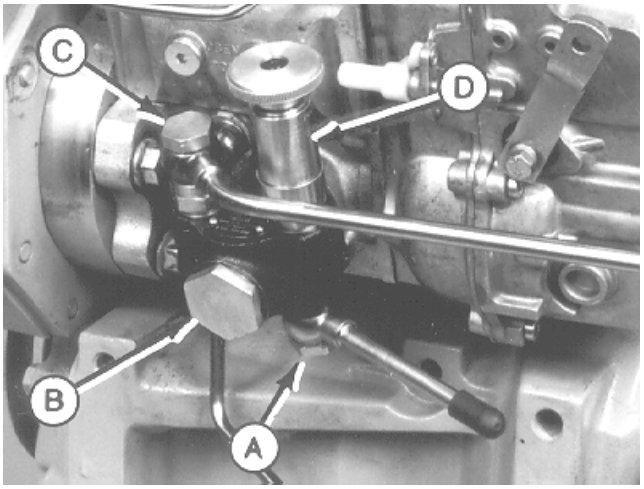
FUEL TRANSFER PUMP OPERATION (IN-LINE INJECTION PUMP)

The plunger-type MICO fuel supply pump is mounted on the side of the injection pump housing and is driven by the injection pump camshaft. Fuel enters the supply pump at (A), is pressurized by the plunger (B) to 350 kPa (3.5 bar; 50 psi), and discharged through outlet (C). The hand primer (D) provides manual pump operation for bleeding the fuel system.

A—Fuel inlet
B—Plunger
C—Fuel outlet
D—Hand primer



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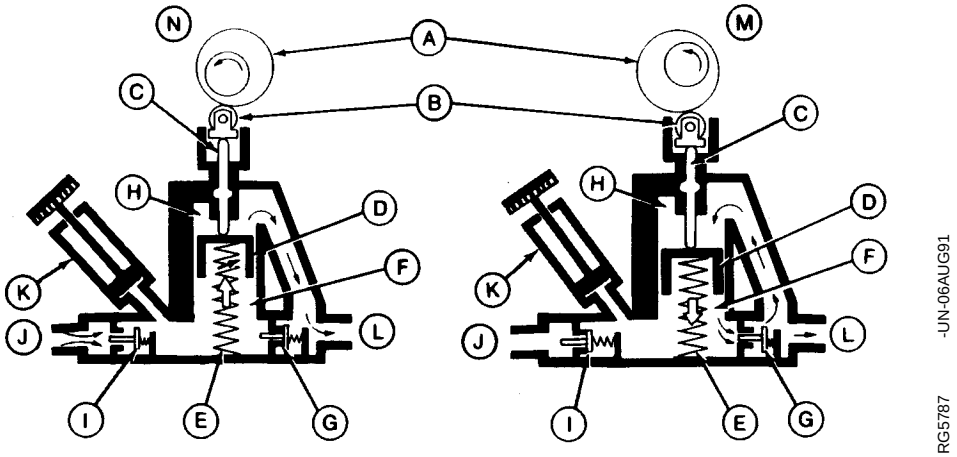
FUEL TRANSFER PUMP OPERATION (IN-LINE INJECTION PUMP) - CONT'D



A—Camshaft
B—Roller Tappet
C—Pressure Spindle
D—Plunger
E—Plunger Spring
F—Suction Chamber
G—Pressure Valve
H—Pressure Chamber
I—Suction Valve
J—Fuel Inlet
K—Hand Primer Pump
L—Fuel Outlet
M—Intermediate Stroke Position
N—Suction and Discharge Stroke Position

As the pump camshaft (A) rotates toward the "high cam" intermediate stroke position (M), the roller tappet (B) and pressure spindle (C) cause the plunger (D) to compress the plunger spring (E).

Plunger movement forces the fuel out of the suction chamber (F), through the pressure valve (G) and into the pressure chamber (H). The amount of fuel discharged from the suction chamber is equal to the amount of fuel delivered for each stroke of the plunger. Towards the end of the intermediate stroke, the spring-loaded pressure valve closes again.

As the camshaft rotates toward the "low cam" or suction and discharge position (N), plunger spring pressure causes the plunger, pressure spindle and roller tappet to follow the camshaft.

Movement of the plunger pushes the fuel from the pressure chamber and delivers it to the fuel filters and injection pump. At the same time, plunger suction pressure is permitting fuel to enter the suction chamber through the suction valve (I). With the suction chamber charged with fuel, the pumping cycle begins again.

Fuel is allowed to flow in around the pressure spindle to lubricate the spindle as it moves back and forth in housing. To prevent the fuel from entering the pump camshaft case, a rubber seal is positioned in the spindle bore of housing at the roller tappet end.

Unscrewing the knurled knob on the hand primer pump (K) and pulling upward causes the suction valve to open and fuel to flow into the suction chamber. When the hand plunger is pushed downward, the suction valve closes and fuel is forced out of the pressure valve.

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DIAGNOSE FUEL SUPPLY PUMP MALFUNCTIONS—IN-LINE INJECTION PUMP

IMPORTANT: Visually inspect the fuel inlet fitting and pump filter for possible plugging before disassembling to determine cause of malfunction.

Symptom	Problem	Solution
Low Supply Pump Output Pressure or Pump Not Functioning Correctly	Restriction at fuel inlet fitting.	Thoroughly clean fuel tank, lines, filters, and inlet fitting.
	Hand primer not screwed down tight, allowing dirt to enter hand primer plunger chamber.	Advise customer to tighten hand primer after use.
	Worn or pitted valves caused by foreign material lodging in valve.	Replace valves or complete pump depending on service part availability.
	Missing or broken spring(s).	Replace spring(s) or complete pump depending on service part availability.
	Broken spindle.	Replace pump.
	Out of fuel.	Add fuel to fuel tank.
	Fuel shut off at tank.	Open fuel shut off valve.
	Restricted fuel line.	Clean as required.
	Air leak in fuel line between pump and tank.	Repair as required.
	Loose or damaged fuel line connetions.	Repair.
	Hand primer left in upward position.	Bleed fuel system, gently push hand primer down and tighten securely.
	Worn or damaged valve assemblies.	Repair or replace.
	Broken valve spring(s)	Repair or replace.
Diesel Fuel Leaking Into Injection Pump Camshaft Case	Worn spindle and/or pump housing.	Replace pump.
	Defective seal.	Replace seal.

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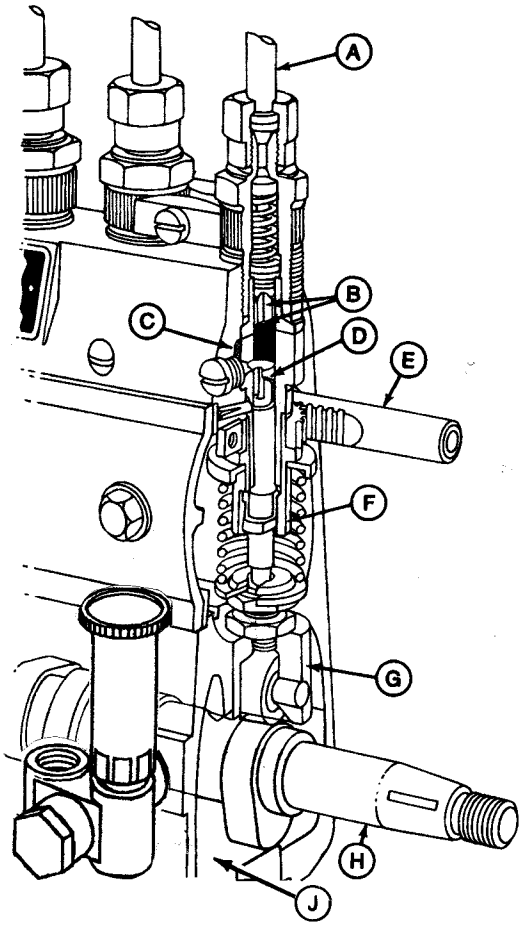
IN-LINE FUEL INJECTION PUMP OPERATION

Filtered fuel under pressure by the supply pump fills the injection pump fuel gallery (C). As the camshaft rotates, roller tappets (G) riding on the camshaft (H) lobes operate the plungers (D) to supply high pressure fuel through the delivery valves (B) to the injection nozzles.

A governor-operated control rack (E) is connected to the control sleeves (F) and plungers to regulate the quantity of fuel delivered to the engine.

Engine lubricating oil is piped to the injection pump camshaft case (J) to provide splash lubrication of the working parts. Drain hole at the front end of the pump determines the level of oil maintained in the camshaft case. Excess oil drains out of this hole and returns back to the engine through the timing gear cover.

A—Fuel delivery pipe
B—Delivery valve
C—Fuel gallery
D—Barrel and plunger
E—Control rack
F—Control sleeve
G—Roller tappet
H—Camshaft
J—Camshaft case



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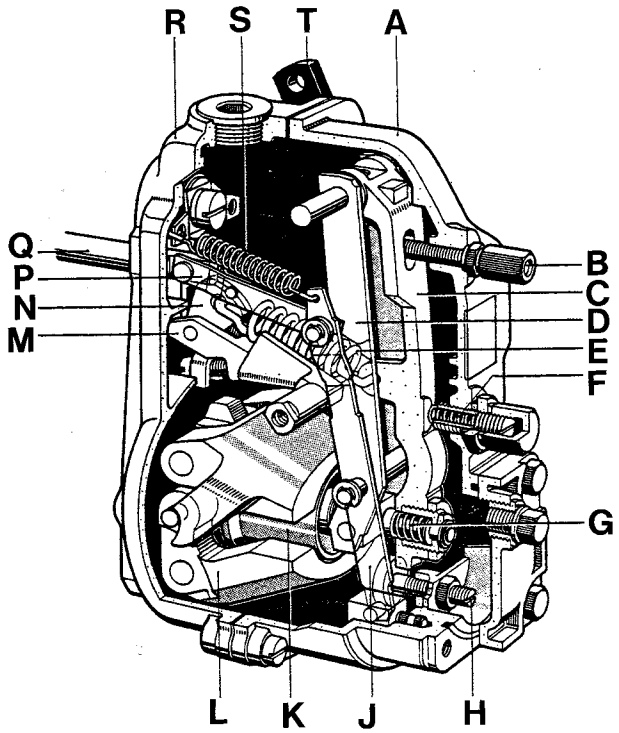
GOVERNOR OPERATION (IN-LINE PUMP)

Governor maintains a set engine speed under varying loads.

The injection pump governor is a mechanical centrifugal flyweight type contained in a housing assembled to the injection pump and serviced with the pump.

The flyweights (L) are mounted on the injection pump camshaft. The flyweights move the thrust sleeve (k) in and out with changes in engine rpm. The thrust sleeve works against the tensioning lever (C). The tensioning lever is connected to the injection pump control rack (Q) by the link (P). The governor spring (E) connects the tensioning lever assembly to the throttle lever (T).



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A—Governor cover
B—Slow idle speed screw
C—Tensioning lever
D—Guide lever
E—Main governor spring
F—Slow idle spring screw
G—Torque control spring
H—Full load adjusting screw
J—Fulcrum lever
K—Thrust sleeve
L—Flyweight
M—Swivel lever
N—Rocker
P—Link
Q—Control rack
R—Governor housing
S—Starting spring
T—Throttle lever

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DIAGNOSE IN-LINE FUEL INJECTION PUMP MALFUNCTIONS

Symptom	Problem	Solution
Engine Starts Hard or Won't Start	Incorrect fuel shut-off lever position (pump control rack not moving all the way forward)	Adjust shut-off cable as required.
	Defective injection pump	Remove pump from engine and repair (see Group 40)
	Injection pump not correctly timed	Check pump timing
Slow Idle Speed Irregular	Slow idle stop screw improperly adjusted	Recheck stop screw adjustment
	Supplementary idling spring improperly adjusted	Recheck adjustment
	Defective injection pump	Remove pump from engine and repair (See Group 40)
Engine Horsepower Low	Pump not properly timed	Check timing
	Defective injection pump	Remove pump from engine and repair (See Group 40)

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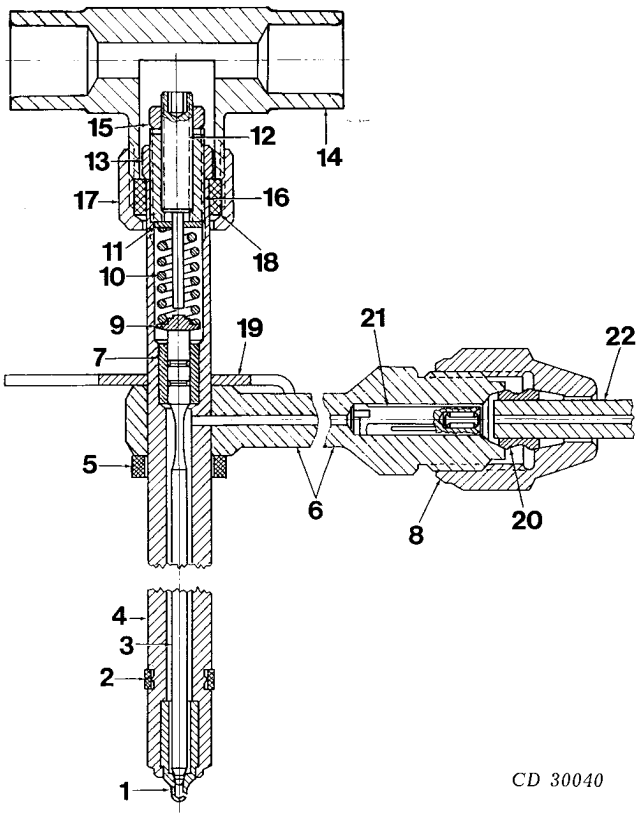
FUEL INJECTION NOZZLES - GENERAL INFORMATION

Fuel injection nozzles are of the multi-orifice type.

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-piece (14), which is fitted on the nozzle body and secured with grommet (18) and hex. nut (17).

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 valve lift of nozzle valve (3) is adjusted by screw (12) located in pressure adjusting screw (16).

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



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
12—Lift adjusting screw
13—Lock nut
14—T-piece
15—Lock nut
16—Pressure adjusting screw
17—Hex. nut
18—Grommet
19—Location clamp
20—Nipple
21—Filter screen
22—Fuel pressure line

CD,3274,G220,11-19-15MAY92

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

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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

TIMING OF FUEL INJECTION PUMPS ON DIESEL ENGINES USING STROBOSCOPIC LAMP

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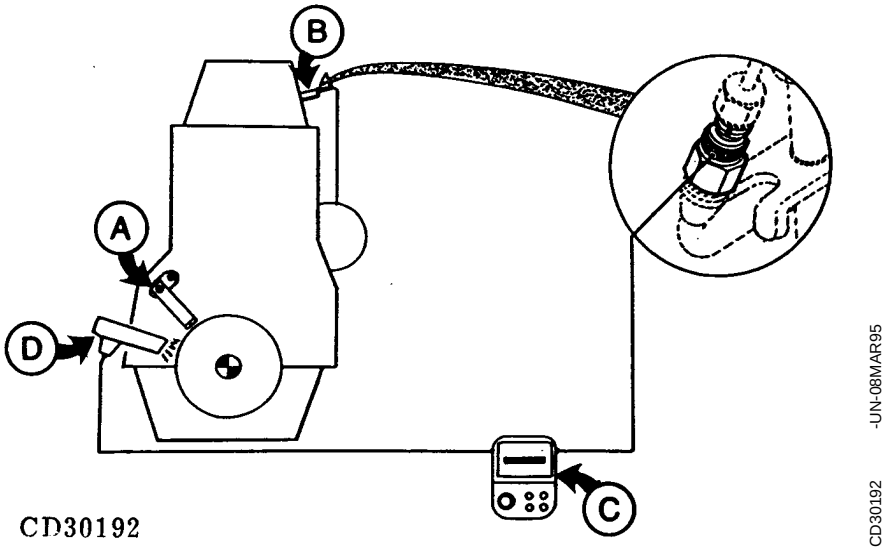

A—Stationary pointer **B—Timing sensor** **C—Timing meter** **D—Stroboscopic lamp**

The ever-increasing tightening of the specifications relating to engine exhaust emissions (e.g. smoke level) call for greater accuracy in the timing of the fuel injection pump.

In order to guarantee the specified engine performance, however, it is necessary to measure the start of fuel injection.

Static timing

The static timing of a stationary diesel engine is a slow process which provides only an approximate reading and usually requires a certain amount of disassembly work.

Dynamic timing

The alternative, dynamic timing of a running diesel engine, involves measuring the angular difference between the start of fuel injection and the top dead center (TDC) position of the reference piston (usually piston No.1).

This approach allows more precise timing and can be carried out quickly and simply.

Dynamic timing operation

A timing sensor (B) mounted on the nozzle inlet measures the pressure variation, and thus the start of fuel injection.

Coupled to a timing meter (C), the timing sensor pulse signal actuates a stroboscopic lamp (D) which indicates the position of the reference piston on the pulley, when injection occurs.

The timing meter instantly displays engine speed (in rpm) and fuel injection timing (in degrees).

To obtain the proper timing value, stop engine and rotate the fuel injection pump accordingly within the slots in its flange.

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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.

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INDX

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INDX 1

Page


SAFETY
live with it


VEILIGHEID
om mee te leven


SAFETY
live with it


TURVALLISUUS
ennen kaikkea


SÉCURITÉ
avant tout


SICHERHEIT
hat Vorfahrt


SICUREZZA
innanzi tutto


SEGURANÇA
Acima de tudo


SEGURIDAD
viva con ella


SÄKERHET
din trygghet


SIKKERHED
frem for alt


SIKKERHET
foran alt