

# **6076 Engines**

**Serial Number ( —499999)**

**Deere Power Systems Group  
CTM6 (17MAR97)**

LITHO IN U.S.A.  
ENGLISH

# Introduction

## FOREWORD

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

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



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

Use this component technical manual in conjunction with the machine technical manual. An application listing 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 diagnostics. Repair sections contain necessary instructions to repair the component. Diagnostic 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 torques.

Binders, binder labels, and tab sets can be ordered by John Deere dealers direct from the John Deere Distribution Service Center.

This manual is part of a total product support program.

## FOS MANUALS—REFERENCE

## TECHNICAL MANUALS—MACHINE SERVICE

## COMPONENT MANUALS—COMPONENT SERVICE

Fundamentals of Service (FOS) Manuals cover basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes. FOS Manuals are for training new personnel and for reference by experienced technicians.

Technical Manuals are concise guides for specific machines. Technical manuals are on-the-job guides containing only the vital information needed for diagnosis, analysis, testing, and repair.

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

## MANUAL ORGANIZATION

Group 00—Introduction and Safety Information

Group 01—General Information

Group 02—Fuels, Lubricants and Coolant

Group 03—Engine Mounting

Group 04—Engine Rebuild Guide

Group 05—Cylinder Head and Valves

Group 10—Cylinder Block, Liners, Pistons and Rods

Group 15—Crankshaft, Main Bearings, and Flywheel

Group 16—Camshaft and Timing Gear Train

Group 20—Lubrication System

Group 25—Cooling System

Group 30—Air Intake and Exhaust System

Group 35—Fuel System

Group 100—Tune-Up

Group 105—Engine System Operation and Test

Group 110—Air Intake System Operation and Test

Group 115—Fuel System Operation and Tests

Group 199—Dealer Fabricated Tools

# Dealer Presentation Sheet

## JOHN DEERE DEALERS

**IMPORTANT: The important changes listed below make your current CTM obsolete. Discard CTM6, dated 15 Sep 89. Please remove this page and route through your service department.**

Engine application charts have been updated to include new product models. See ENGINE APPLICATION CHART in Group 01.

Revised the engine oil module. See DIESEL ENGINE OIL in Group 02.

Revised the engine coolant module. See ENGINE COOLANT RECOMMENDATIONS in Group 02.

Revised valve lift specifications in Groups 05 and 105.

Included torque-turn procedure for tightening flanged-head cylinder head cap screws. See TORQUE-TURN FLANGED-HEAD CAP SCREWS in Group 05.

Added information on the manufacturing date codes stamped on cylinder liners. See INSTALL CYLINDER LINERS in Group 10.

Revised removal and installation procedures for the auxiliary drive in Groups 15 and 16.

Provided crankcase oil fill quantities for all 6076 engine applications. See ENGINE CRANKCASE OIL FILL QUANTITIES in Group 20.

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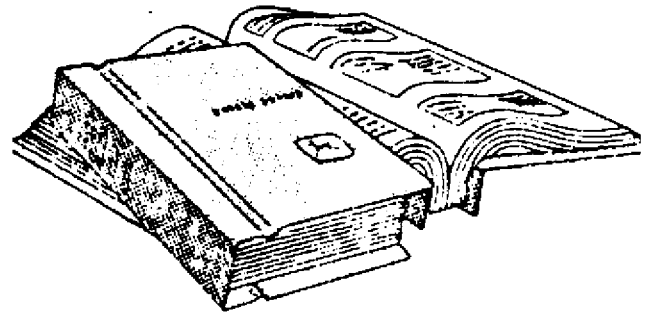
## ABOUT THIS MANUAL

This Component Technical Manual (CTM6) covers the recommended repair procedure for all 6076, 7.6 L (466 cu. in.) diesel engines, serial no. ( —499999), and produced in Waterloo, Iowa. For repair information on 6076 engines produced after serial no. (499999— ) refer to CTM42.

Before beginning repair of an engine, clean engine and mount on a repair stand. (See ENGINE MOUNTING in Group 03.)

Some components of this engine may be serviced without removing the engine from the machine. Refer to the specific machine technical manuals for information or components that can be serviced without removing the engine from the machine and for engine removal and installation procedures.

Follow only the procedures that apply to the engine model number you are working on. If only one procedure is given, that procedure applies to all 6076 diesel engines in this manual.



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-JUN-15DEC88  
RG4624

S55,2000,DA -19-24SEP91

## 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.



-JUN-23AUG88  
TS227

DX,FLAME -19-04JUN90

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## 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).



DX,SPARKS -19-04JUN90

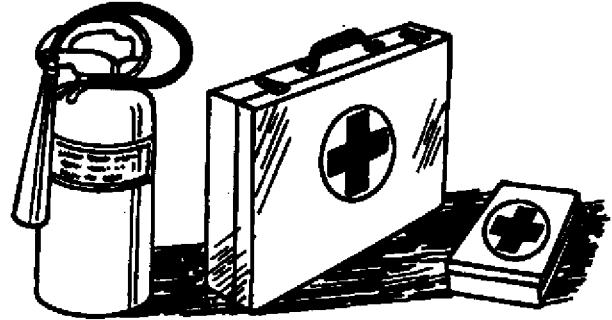
TS204 -JUN-23AUG88

## 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.



DX,FIRE2 -19-04JUN90

TS291 -JUN-23AUG88

## 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:

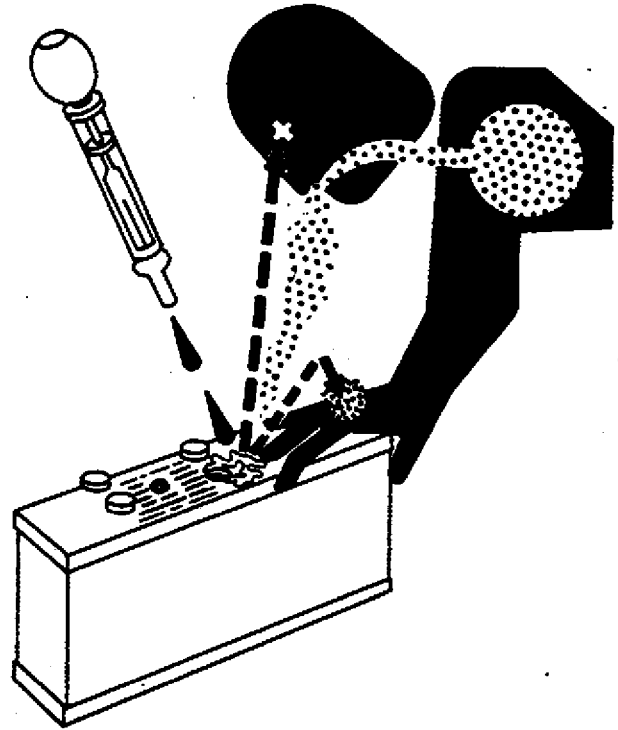
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

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 10—15 minutes. Get medical attention immediately.

If acid is swallowed:

1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.



DX,POISON -19-04JUN90

TS203 -UN-23AUG88

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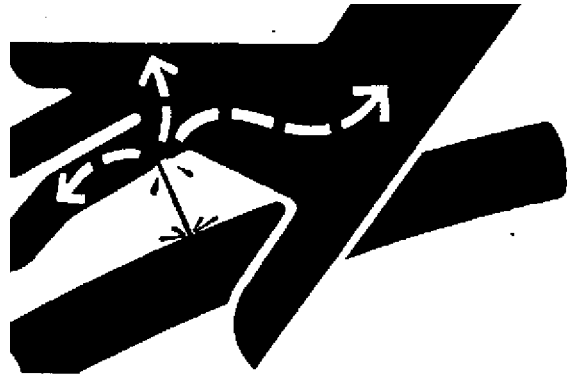
## AVOID HIGH-PRESSURE FLUIDS

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.



-JUN-23AUG88

X9811

DX,FLUID -19-09AUG91

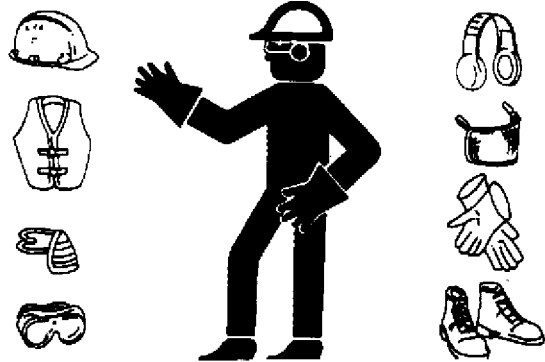
## WEAR PROTECTIVE CLOTHING

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.



-JUN-23AUG88

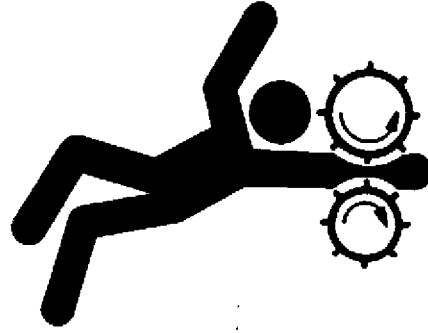
TS206

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.



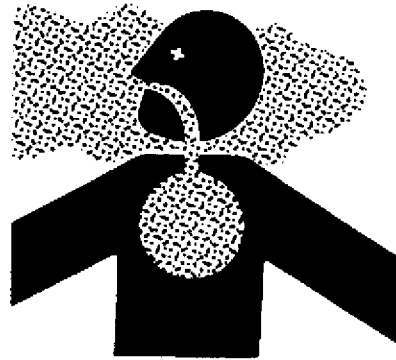
DX, LOOSE -19-04JUN90

TS228 -UN-23AUG88

## 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.



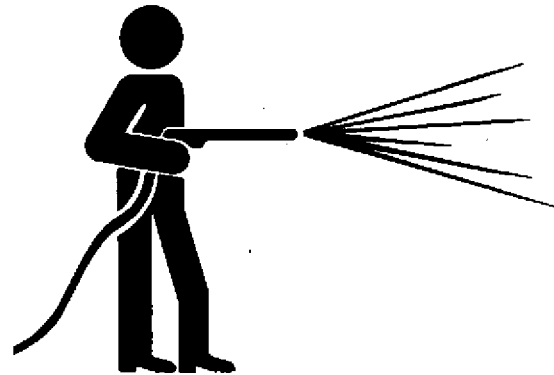
DX, AIR -19-04JUN90

TS220 -UN-23AUG88

## 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.



DX, CLEAN -19-04JUN90

T6642EJ -UN-18OCT88

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## REMOVE PAINT BEFORE WELDING OR HEATING

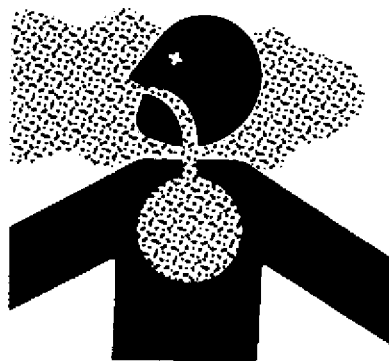
Avoid potentially toxic fumes and dust.

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 -JUN-23AUG88

DX,PAINT -19-04JUN90

## 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 -JUN-15MAY90

DX,TORCH -19-05OCT90

## 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.



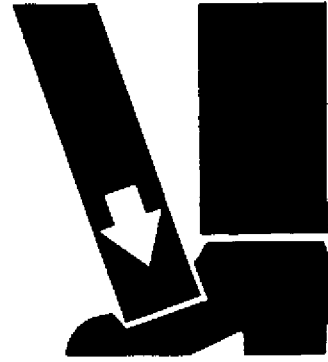
TS223 -JUN-23AUG88

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.



DX,LIFT -19-04JUN90

TS226 -UN-23AUG88

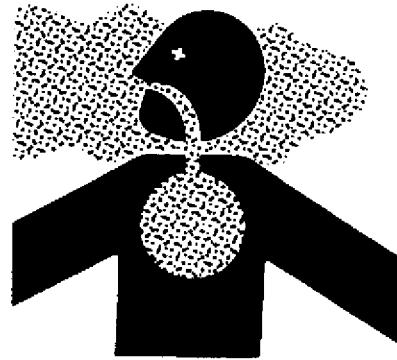
## AVOID HARMFUL ASBESTOS DUST

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.

Keep bystanders away from the area.



DX,DUST -19-15MAR91

TS220 -UN-23AUG88



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## PRACTICE SAFE MAINTENANCE

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

Never lubricate or service 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.

Disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.



DX,SERV -19-04JUN90

TS218 -JUN-23AUG88

## USE PROPER TOOLS

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.



DX,REPAIR -19-04JUN90

TS779 -JUN-08NOV89

## DISPOSE OF WASTE PROPERLY

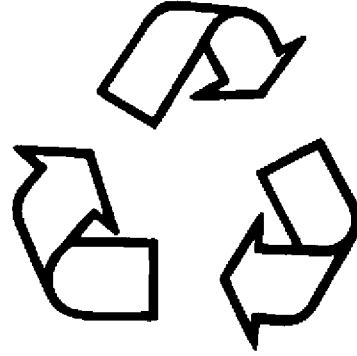
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

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

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

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



DX,DRAIN -19-09AUG91

TS1133 -JUN-26NOV90

## LIVE WITH SAFETY

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



DX,LIVE -19-04JUN90

TS231 -19-07OCT88

## ENGINE MODEL DESIGNATION

### 1. John Deere Engine Model—6076 Engine

John Deere Engine model designation includes number of cylinders, displacement in liters, aspiration, user code, and application code. For example:

#### 6076AF-00 Engine

6	.....	Number of cylinders
07.6	.....	Liter displacement
A	.....	Aspiration code
F	.....	User code
01	.....	Application code

#### Aspiration Code

T	.....	Turbocharged
A	.....	Turbocharged and aftercooled
H	.....	Turbocharged and air-to-air aftercooled

#### User Code

DW	.....	Davenport
N	.....	Des Moines
T	.....	Dubuque
H	.....	Harvester
L	.....	Mannheim
E	.....	Ottumwa
RW	.....	Tractor
F	.....	OEM
CZ	.....	Venezuela

#### Application Code

00, 01, 02, etc .

2. Detroit Diesel Corporation (DDC) Engine  
Model—G063E600

DDC engine model designation cross-reference with the John Deere engine model. It includes the series, number of cylinders, application type, direction of rotation, aspiration, and application code. Thus, the model 6076AF-00 engine previously discussed, becomes DDC model G063E600. For example:

**G063E600**

G ..... Engine series  
06 ..... Number of cylinders  
3 ..... Application type  
E ..... Electronic fuel injection  
6 ..... Aspiration  
00 ..... Application code

**Application Type**

2 ..... Marine  
3 ..... Industrial  
4 ..... Power Base  
5 ..... Generator Set  
8 ..... Special

**Aspiration**

3 ..... Turbocharged  
6 ..... Turbocharged and aftercooled  
7 ..... Turbocharged and air-to-air aftercooled

**Application Code**

00, 01, 02, etc ..... code for each specific application

01  
5

### ENGINE SERIAL NUMBER PLATE

#### 1. Engine Serial Number (A)

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

**RG6076T000000**

RG . . . . . Factory producing engine  
6076T . . . . . Engine Model Designation  
000000 . . . . . Sequential Number

#### Factory Code Producing Engine

RG . . . . . Waterloo Engine Works

#### Engine Model Designation

6076T . . . . . Definition explained previously. (See "Engine Model Designation".)

#### Sequential Number

000000 . . . . . 6-digit sequential number.

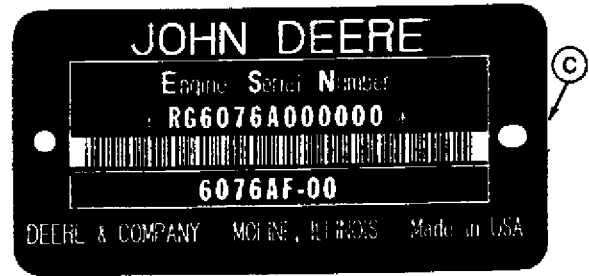
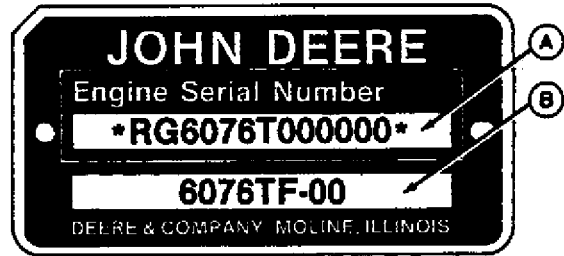
The engine serial number plate is either located on the right-hand side of engine between the oil filter base and fuel injection pump, or on the left-hand side of block directly above the starting motor (viewed from flywheel end).

#### 2. Engine Application Data (B)

The second line of information on the nameplate identifies the engine/Deere machine or OEM relationship. See "Engine Application Chart" in this group.

*NOTE: Current production engine are equipped with a laser-generated serial number plate (C) which contains the same information as the previous plate with the addition of bar coding.*

**IMPORTANT: The engine serial number plate can easily be destroyed. Remove the plate before hot tank cleaning of the block.**



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-JUN-15DEC88

RG5343

-JUN-23JAN91

RG5701

3. Unit Number (A)

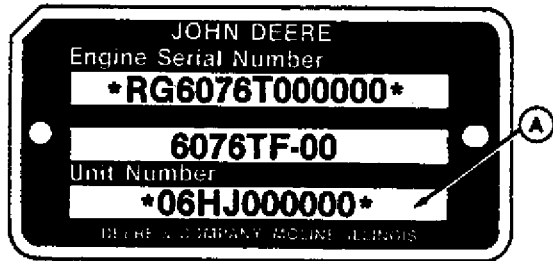
Engines marketed by Detroit Diesel Corporation (DDC) have a third line of information on the nameplate. The unit number is the DDC applied serial number and must be utilized for DDC service and customer reference purposes.

A typical unit number converts the 13-digit engine serial number into one that is 10-digit. It includes the number of cylinders, manufacturing factory location, and the DDC model designation. Example:

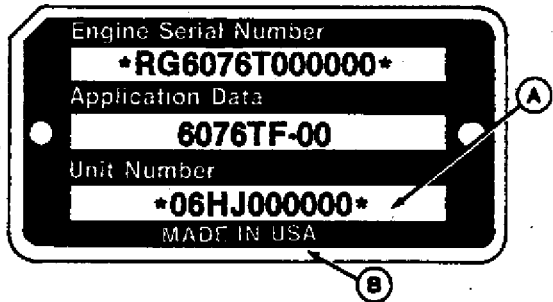
JD Engine Serial No.                      DDC Unit No.  
**RG6076T000000**                      **06HJ000000**

6 ..... 06  
 RG ..... H  
 076 ..... \*\*J  
 000000 ..... 000000

JD/DDC Factory Code	Model Codes Deere Engine Model	DDC Model Code** (4th position of Unit No.)
RG/H	6076T	J
RG/H	6076A	K
RG/H	6076H	L



DDC Unit Number Nameplate



Generic Engine Nameplate

**NOTE:** Some nameplates (B) are used which do not have the John Deere name printed.

RG5344 -UN-15DEC88  
 RG5345 -UN-15DEC88

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7

**OPTION CODE LABEL**

1101 1303 1403 1505 1640 1705 1908  
 2001 2101 2399 2499 2803 3005 3199  
 3801 4199 4602 4807 5299 5505 5601  
 5798 6201 6401 6501 6903 7203



Deere & Company  
 U.S.A.

Base Code 1235F  
 Unit 06HK000000

SN RG6076AF000000  
 !!!!SAMPLE ONLY!!!!

Model 6076AF-00

RG6348 -JUN-15DEC88

An option code label is affixed to the rocker arm cover on all OEM engines. (Label is not installed on engines for John Deere machines.) The option code label can be easily destroyed, so keep a copy of options on your engine in a safe place.

A four-digit number is used to identify a particular option. For example, Code 1403 indicates that the engine is equipped with an SAE No. 3 flywheel housing.

The label identifies only the factory-installed options on each engine. Distributor/Dealer installed kits would not be shown.

Always provide option code information when ordering repair parts. A listing of option codes is given in the Operator's Manual.

S55,2000,DF -19-20MAR91

**JOHN DEERE INDUSTRIAL EQUIPMENT APPLICATIONS**

Machine Model No.	Engine Model
<b>LOADERS</b>	
644E . . . . .	6076TDW01, 02
644EH . . . . .	6076ADW01
<b>FORKLIFTS, 4-WHEEL DRIVE</b>	
644ER . . . . .	6076ADW02
<b>SKIDDERS</b>	
740E, 740EH . . . . .	6076TDW02
SP740E	6076ADW03

S55,2000,DG -19-22AUG91

**OEM APPLICATIONS**

Machine Model No.	Engine Model
Repower .....	6076TF, AF, HF
Kohler Air Compressor .....	6076AF010, 011, 012, 013, 014, and 6076TF010, 011
Marine .....	6076AFM

S55,2000,DH -19-22AUG91

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**JOHN DEERE AGRICULTURAL EQUIPMENT APPLICATIONS**

Machine Model No.	Engine Model
<b>COMBINES</b>	
9500 .....	6076TH001, 6076HH03, 6076HH004
9600 .....	6076HH001, 6076HH03, 6076TH001
9600 Export .....	6076HH002

<b>COTTON PICKERS</b>	
9960 .....	6076AN001

<b>TRACTORS — WATERLOO</b>	
4055 .....	6076TRW06, 6076TRW08
4055 Export .....	6076TRW08
4255 .....	6076TRW01
4255 Export .....	6076TRW03
4255 Hi-Crop .....	6076TRW02
4455 .....	6076TRW04
4455 Export .....	6076TRW05
4555 .....	6076TRW07
4560 .....	6076TRW09
4755 .....	6076ARW01, 6076ARW06
4755 Export .....	6076ARW02
4760 .....	6076ARW07
4955 .....	6076ARW03, 6076ARW05
4955 Export .....	6076ARW02, 6076ARW04
4960 .....	6076ARW08, 6076ARW11
8560 4-Wheel Drive .....	6076HRW01, 6076HRW02

<b>TRACTORS — VENEZUELA</b>	
4255 .....	6076TCZ01
4455 .....	6076TCZ02
4555 .....	6076TCZ03

S55,2000,MV -19-22AUG91



**BASIC 6076 ENGINE SPECIFICATIONS**

Item	Unit of Measure	6076T	6076A	6076H
Number of Cylinders	- - -	6	6	6
Fuel	- - -	Diesel	Diesel	Diesel
Bore	mm (in.)	116 (4.56)	116 (4.56)	116 (4.56)
Stroke	mm (in.)	121 (4.75)	121 (4.75)	121 (4.75)
Displacement	L (in. <sup>3</sup> )	7.64 (466)	7.64 (466)	7.64 (466)
Piston Speed at Rated Speed	m/min.(ft/min.)	531 (1742)	531 (1742)	531 (1742)
Compression Ratio	- - -	16.0:1	16.0:1	16.0:1
Cylinder Firing Order	- - -	1,5,3,6,2,4	1,5,3,6,2,4	1,5,3,6,2,4
<b>Rated Speeds</b>				
—Std. Mechanical Gov.	rpm	2200	2200	2200
—3-5% Mechanical Gov.	rpm	1800	- - -	- - -
—Electric Gov.	rpm	- - -	1800	- - -
Slow Idle Speed	rpm	850	850	850
<b>Crankshaft Bearings</b>				
—Number of Mains	- - -	7	7	7
—Main ID	mm (in.)	85.73 (3.375)	85.73 (3.375)	85.73 (3.375)
—Main Width	mm (in.)	36.53 (1.438)	36.53 (1.438)	36.53 (1.438)
—Thrust Width	mm (in.)	37.49 (1.476)	37.49 (1.476)	37.49 (1.476)
<b>Connecting Rods</b>				
—Rod Journal OD	mm (in.)	76.165 (2.998)	76.165 (2.998)	76.165 (2.998)
<b>Camshaft</b>				
—Journal OD	mm (in.)	67.008 (2.6378)	67.008 (2.6378)	67.008 (2.6378)
—Bushing ID	mm (in.)	67.089 (2.6413)	67.089 (2.6413)	67.089 (2.6413)
<b>Lubrication System</b>				
—Pump Type	- - -	Crankshaft-driven	Crankshaft-driven	Crankshaft-driven
—Pump Capacity	L/min. (gpm)	109.8 (29)	109.8 (29)	109.8 (29)
<b>Physical Dimensions</b>				
—Width	mm (in.)	572 (22.5)	572 (22.5)	572 (22.5)
—Height	mm (in.)	1173 (46.2)	1173 (46.2)	1173 (46.2)
—Length	mm (in.)	1229 (48.4)	1229 (48.4)	1229 (48.4)

S55,2000,DI -19-22AUG91

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## GENERAL ENGINE DESCRIPTION

All 6076 Engines are vertical stroke, in-line, valve-in-head, 6-cylinder diesel engines.

On 6076 Engines, direct fuel injection is provided by an in-line injection pump and 21 mm injection nozzles mounted in cylinder head. The pump is driven by an intermediate gear in the timing gear train meshing with the camshaft gear.

The pump has an engine-driven camshaft which rotates at one-half engine speed. Roller cam followers, riding on the camshaft lobes, operate the plungers to supply high-pressure fuel through the delivery valves to the injection nozzles. A governor-operated (mechanical or electronic) control rack is connected to the control sleeves and plungers to regulate the quantity of fuel delivered to the engine.

All engines are turbocharged. Operated by exhaust gases, the turbocharger compresses intake air from air cleaner and routes it to each cylinder's combustion chamber.

6076A Engines are turbocharged, and in addition, have a heat exchanger (called an aftercooler) located in the intake manifold. The aftercooler cools the compressed (and heated) intake air from the turbocharger before entering the combustion chamber. Engine coolant flowing through the aftercooler is the media used for heat exchange.

On 6076H Engines, an 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.

The camshaft is made of special alloy iron. The cam lobes are individually flame hardened to provide excellent wear characteristics. Spherically ground followers riding on tapered cam lobes help insure positive follower rotation.

Intake and exhaust valves are operated by cam followers, push rods, and rocker arm assembly. Cylinder heads have replaceable inserts and valves, and have positive rotators for both intake and exhaust valves.

The crankshaft is a one-piece, heat treated, dynamically balanced steel forging which rotates in replaceable two-piece main bearings. The rear thrust bearing has a flange on each side to reduce crankshaft deflection and to limit end play during high load operation.

Cylinder liners are of a wet sleeve, flanged, and centrifugally cast design. O-rings are used to seal the connection between cylinder block and liners. Liners are induction hardened and are individually replaceable.

Pistons are constructed of high-grade cast aluminum alloy and are cam ground. A double Ni-Resist ring carrier is cast integrally in the piston to greatly improve the life of the two ring grooves. A deep combustion chamber design provides maximum combustion efficiency. Pistons have a three ring combination. The top two rings are compression rings and the lower ring is an oil control ring.

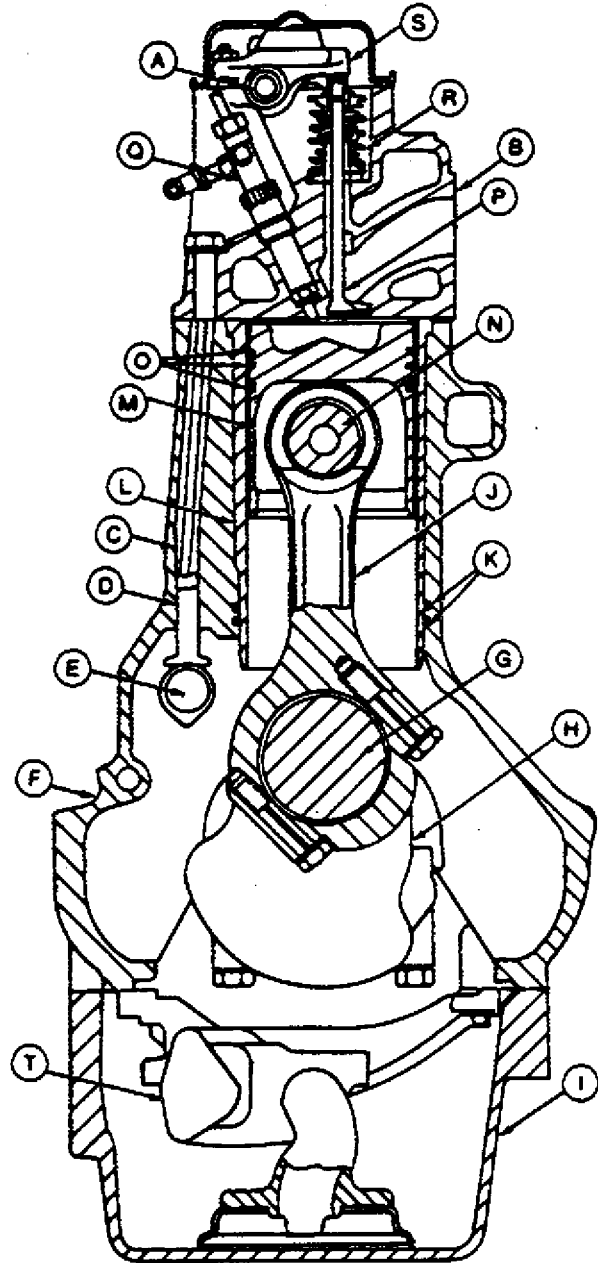
The highly polished, hardened piston pins are fully-floating and held in position by means of snap rings. Spray jets (piston cooling orifices) in cylinder block direct pressure oil to lubricate piston pins and cool pistons.

Connecting rods are of forged steel and have replaceable bushing and bearing inserts. They are weight controlled (by machining) on both ends to minimize engine vibration.

The engine is supplied with lubricating oil by a gear pump driven by the crankshaft. The lubricating oil passes through a full-flow oil filter in the main oil gallery of cylinder block. 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.

**ENGINE—SECTIONAL VIEW**

- 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—Connecting Rod
- K—Liner Packing Rings
- L—Cylinder Liner
- M—Piston
- N—Piston Pin
- O—Piston Rings
- P—Valve
- Q—Fuel Injection Nozzle
- R—Valve spring
- S—Rocker Arm
- T—Oil Pump



S11,2000,FA -19-16FEB87

RG4967 -UN-15DEC88

01  
12

## **DIESEL FUEL**

Use either Grade No. 1-D or Grade No. 2-D fuel as defined by ASTM Designation D975 for diesel fuels. In European countries, use ISO 1585 commercial diesel fuel.

*NOTE: At altitudes above 1500 m (5000 ft) use Grade 1-D for all temperatures. If engine is operated under "stand-by" conditions, use grade 1-D for all temperatures.*

If engine is operated at temperatures of -40° to -57°C (-40° to -70°F), Grade DF-A arctic fuel is recommended.

Fuel sulphur content of less than 0.5 percent is preferred, to prevent higher wear from corrosive combustion products.

**IMPORTANT: If fuel sulphur content exceeds 0.7 per cent, the engine oil drain interval must be reduced by 50 percent.**

Cetane number should be no less than 40 to assure satisfactory starting and overall performance. At low temperatures and/or high altitude, a cetane number of more than 45 is recommended.

*NOTE: Excessive white smoke at start-up could be the result of low cetane fuel.*

Cloud point should be at least 6°C (10°F) below lowest expected air temperature at time of starting. Wax can separate from fuel when temperature decreases to cloud point and may plug filter.

RG,CTM42,G2,1 -19-24SEP91

## DIESEL ENGINE OIL

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

**IMPORTANT:** John Deere TORQ-GARD SUPREME PLUS-50™ engine oil is not recommended during engine break-in (first 100 hours on a new or overhauled engine). The superior lubricating properties of this oil will not allow the engine to properly wear during break-in period.

John Deere TORQ-GARD SUPREME PLUS-50 engine oil is recommended at all other times. This oil is specially formulated to provide superior protection against high temperature thickening and wear as well as exceptional cold weather starting performance; these properties may result in longer engine life.

*NOTE: When John Deere TORQ-GARD SUPREME PLUS-50 engine oil and a John Deere oil filter are used, the change interval may be extended by 50 hours. ALWAYS follow recommendations in the operator's manual.*

John Deere TORQ-GARD SUPREME® engine oil is also recommended but standard operator's manual oil change intervals must be maintained. Other oils may be used if they meet one or more of the following specifications:

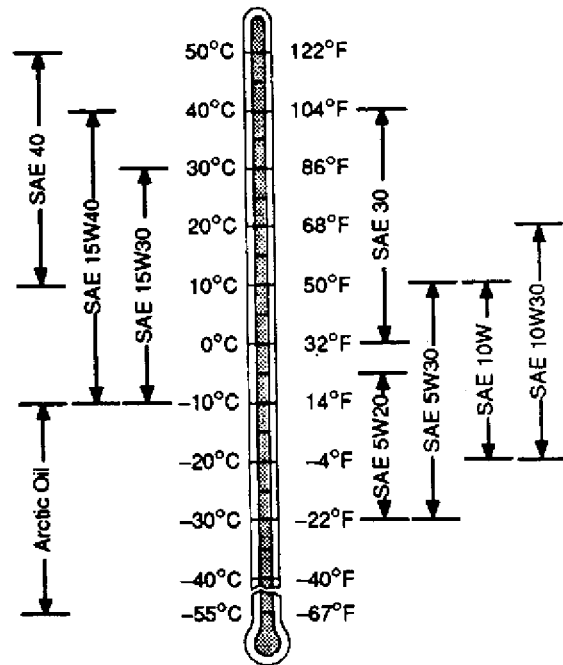
- API Service Classification CE or CD
- Military Specification MIL-L-2104E or MIL-L-2104D or MIL-L-2104C

In European countries, oils meeting CCMC Specification D4 or D5 may be used.

SAE 5W20, SAE 5W30, and arctic oil viscosity grades meeting API Service Classification CC may be used, but oil and filter must be changed at one-half the normal interval.

Oils meeting Military Specification MIL-L-46167B may be used as arctic oils.

*NOTE: Some increase in oil consumption may be expected when low viscosity oils are used. Check oil levels more frequently.*



TS238 -19-17MAY91

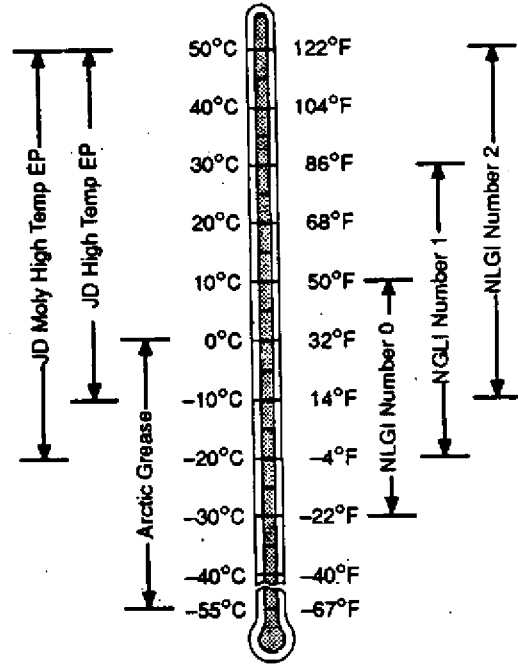
## EXTREME PRESSURE OR MULTIPURPOSE GREASE

Use grease based on the expected air temperature range during the service interval.

John Deere Moly High Temperature EP Grease and John Deere High Temperature EP Grease are recommended.

Other greases that may be used are:

- SAE Multipurpose EP Grease with 3 to 5 percent molybdenum disulfide.
- SAE Multipurpose EP Grease.
- Greases meeting Military Specification MIL-G-10924C may be used as arctic grease.



DX.GREA1 -19-15MAR91

TS248 -19-28NOV90

02  
3

## ENGINE COOLANT RECOMMENDATIONS

**⚠ CAUTION:** Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Remove the radiator filler cap only when the cap is cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



- Always maintain engine coolant at correct level.
- Coolant make-up should be mixed at same concentrations as original coolant, including inhibitors.
- In tropical areas where antifreeze or John Deere Cooling Fluid is not available, use water meeting quality specifications outlined in this group and John Deere RE23182 Liquid Coolant Conditioner. The liquid coolant conditioner should be added in the amount recommended on the label for your cooling system capacity.

**IMPORTANT: John Deere Liquid Coolant Conditioner does not protect against freezing.**

In certain geographical areas where water quality is unacceptable, John Deere Engine Cooling Fluid is marketed for use in the engine cooling system. It protects the engine from corrosion and freezing down to  $-37^{\circ}\text{C}$  ( $-35^{\circ}\text{F}$ ).

John Deere Engine Cooling Fluid or John Deere Low Silicate Antifreeze are recommended for all John Deere Diesel Engines. John Deere Cooling Fluid is ready to use as is without dilution or mixing. John Deere Low Silicate Antifreeze is concentrated and should be mixed minimum 40%—maximum 60% antifreeze and distilled or deionized water. Consult your John Deere Parts Network for local availability.



TS281 -JUN-23AUG88

RG5214 -JUN-14DEC88

RG,OMFL,3 -19-25APR91

## ENGINE COOLANT REQUIREMENTS

To meet critical cooling system protection requirements, the coolant has to consist of high quality water, the correct type antifreeze, and the correct supplemental coolant additive concentration. Refer to charts, water quality specifications (A) and water quality evaluations (B) when determining coolant requirements.

### 1. Water Quality:

Preferred—Distilled or deionized

Acceptable—Softened to 170 parts per million (10 grains per gallon)

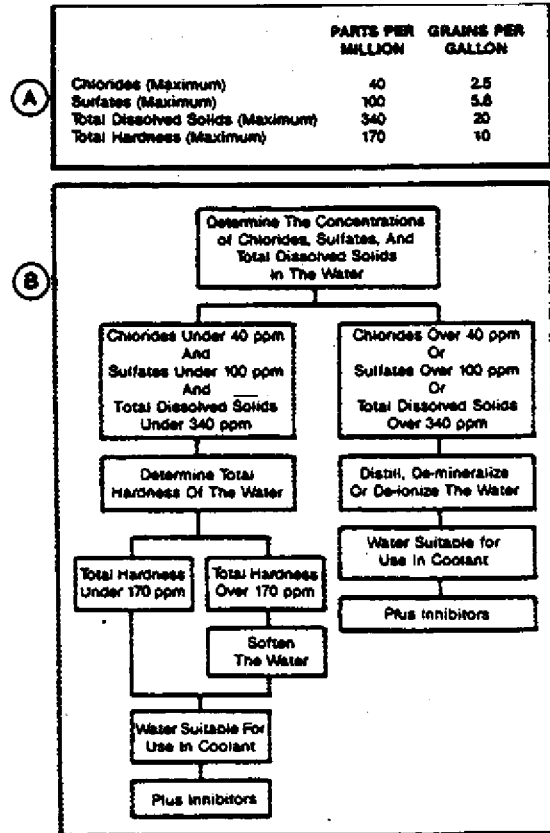
### 2. Antifreeze:

—Must be ethylene-glycol type, contain not more than 0.1 percent anhydrous metasilicate, and meet General Motors Performance Specification GM1899M, or be formulated to GM6038M (or equivalent).

**IMPORTANT:** Some types of ethylene-glycol antifreeze commonly available on the open market are intended for automotive use. These products are often labeled for use in aluminum engines and usually contain more than 0.1 percent anhydrous metasilicate. Use of this type antifreeze can cause a gel-like deposit to form that reduces heat transfer and coolant flow. When wet, the gel becomes the same color as the coolant. When dry, it is a white, powdery deposit. Check container label or consult with antifreeze supplier before using.

—Solutions containing 60 percent (maximum) to 40 percent (minimum) antifreeze mixed with clean soft water or deionized water are recommended.

—Antifreeze solutions should be used year-round for freeze protection, boil-over protection, and to provide a stable environment for seals and hoses. It is acceptable to use a properly inhibited coolant mix of clean soft water and John Deere Liquid Coolant Conditioner during warm weather operation on some applications in place of antifreeze solutions. Contact your authorized servicing dealer or engine distributor, if there are further questions.



A—Water Quality Specifications  
B—Water Quality Evaluation



## ENGINE COOLANT REQUIREMENTS—CONTINUED

### 2. Antifreeze: (continued)

—DO NOT use methyl alcohol base antifreeze.

—DO NOT use methoxy propanol antifreeze. Damage can occur to rubber seals on cylinder liners which are in contact with coolant.

—DO NOT use antifreeze-coolant mix containing sealer or stop-leak additives.

*NOTE: John Deere Liquid Coolant Conditioner does not protect against freezing.*

### 3. Inhibitors:

—ALWAYS inhibit the antifreeze-coolant mix with a non-chromate inhibitor such as RE23182 John Deere Liquid Coolant Conditioner.

—DO NOT use soluble oil.

—ALWAYS follow the supplier's recommendations printed on the container. Over-inhibiting antifreeze solutions can cause silicate-dropout. When this happens, a gel-type deposit is created which retards heat transfer and coolant flow.

*Contact your authorized servicing dealer or engine distributor, if there are further questions.*



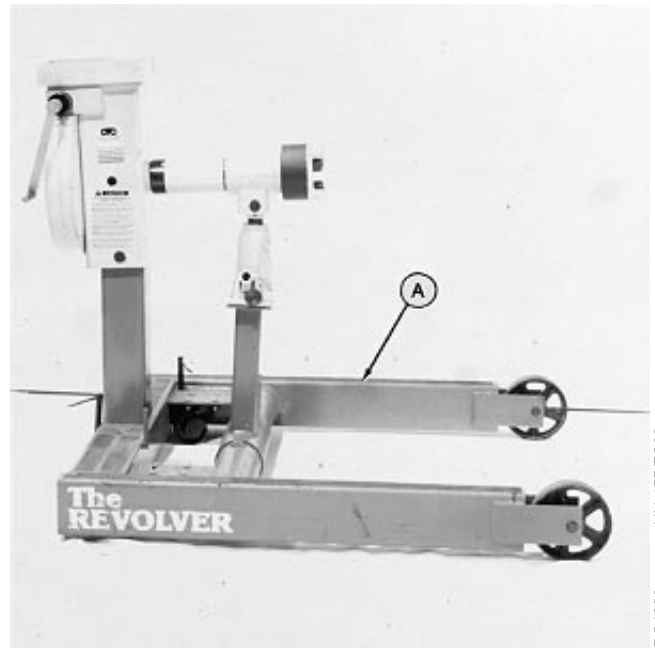
RC4690 -JUN-14DEC88

02  
6

S11,2000,FS -19-24APR91

## ENGINE REPAIR STAND

*NOTE: Only the 2722 kg (6000 lb) heavy duty engine repair stand (A) No. D05223ST manufactured by Owatonna Tool Co., Owatonna, Minnesota is referenced in this manual. When any other repair stand is used, consult the manufacturer's instructions for mounting the engine.*



RG4929 -UN-15DEC88

03

S11,2000,EM -19-05APR90

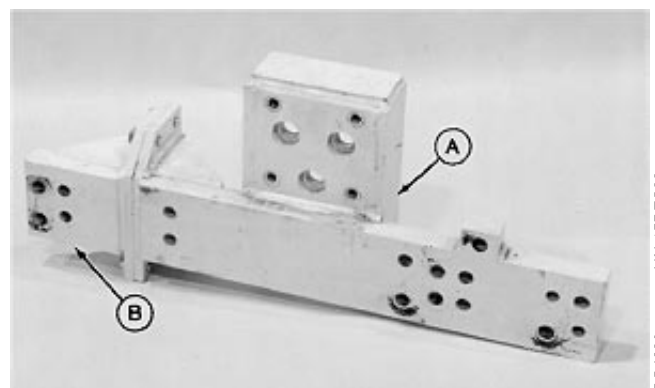
## SAFETY PRECAUTIONS

- The engine 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 socket head 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 or personal injury, do not exceed the maximum capacity rating of 2722 kg (6000 lb). Maximum capacity is determined with the center of the engine located not more than 330 mm (13 in.) from the mounting hub surface of the engine stand.
- To avoid an unsafe off-balance load condition, the center of balance of an engine must be located within 51 mm (2 in.) of the engine stand rotating shaft. Engine center of balance is generally located a few millimeters above the crankshaft.
- 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.
- The lifting jack is to be used when it is necessary to lift the engine for rotation. When working on the engine, the jack should be at its lowest position to keep the center of gravity low and the possibility of tipping low.
- To prevent possible personal injury due to sudden engine movement, lower engine by operating jack release valve slowly. Do not unscrew release valve knob more than two turns from its closed position.

S11,2000,DZ -19-05APR90

## INSTALL 400 SERIES ADAPTERS ON REPAIR STAND

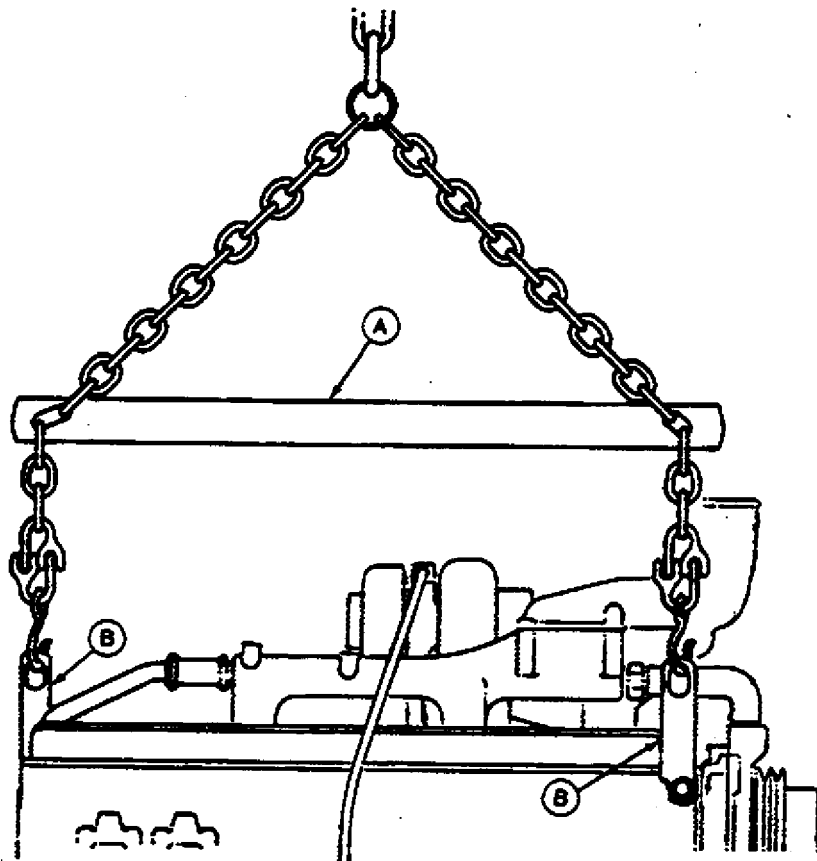
1. Attach the No. 60581 Engine Adapter (A) to mounting hub of the engine repair stand using SAE Grade 8 socket head screws. Tighten screws to 135 N·m (100 lb-ft).
2. Attach the No. 51400 end adapter (B) to the engine adapter, using four 5/8-11 x 2 in. SAE Grade 8 cap screws. Tighten screws to 135 N·m (100 lb-ft).



S11,2000,FB -19-07AUG91

RG-4930  
-JUN-15DEC88

## ENGINE LIFTING PROCEDURE



RG4971 -JUN-15DEC88

**CAUTION:** Use extreme caution when lifting and NEVER permit any part of the body to be positioned under a load being lifted or suspended.

1. Attach the JDG23 Engine Lifting Sling (A, or other suitable sling) to engine lifting straps (B) and overhead hoist on floor crane.

*NOTE: If engine does not have lifting straps, they can be procured through service parts or made-up locally. Use of an engine lifting sling (as shown) is the preferred method for lifting engine. However, if a sling is not on hand, engine can be lifted by chain(s) attached to lifting straps and overhead hoist.*

2. Carefully lift engine to desired location.

S11,2000,FC -19-16FEB87

## CLEAN ENGINE

1. Cap or plug all openings on engine. If electrical components (starter, 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.**

03  
4

S11,2000,EC -19-05APR90

## DISCONNECT TURBOCHARGER OIL INLET LINE

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

**IMPORTANT: When servicing 6076 Engines on a rollover stand, disconnect turbocharger oil inlet line (A) from oil filter housing or turbocharger before rolling engine over. Failure to do so may cause a hydraulic lock upon starting engine. Hydraulic lock may cause possible engine failure.**



RG5323 -JUN-06DEC88

**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 cylinder(s) filling them with oil causing hydraulic lock and possible engine failure.**

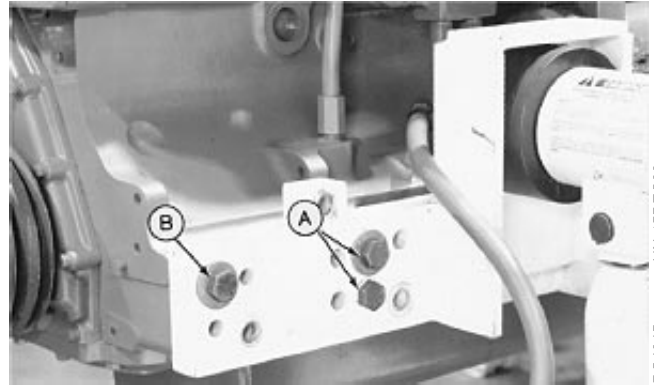
2. Disconnect turbocharger oil inlet line at oil filter housing or turbocharger.

RG,CTM6,G03,1 -19-22AUG91

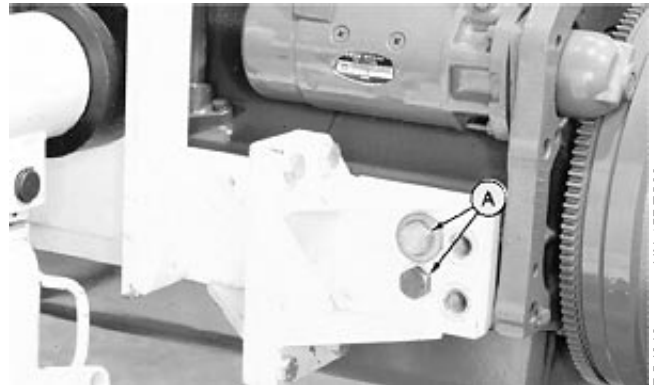
## MOUNT ENGINE ON REPAIR STAND

*NOTE: If starting motor is to be removed from engine, remove before mounting engine into repair stand.*

1. Mount the starter side of the engine to the engine adapter with five 3/4-10 UNC x 2-3/4 in. cap screws (A and B).
2. Tighten cap screws to 203 N·m (150 lb-ft).
3. Slowly relieve tension on lift sling and carefully remove sling from engine.



RG4945 -JUN-15DEC88



RG4946 -JUN-15DEC88

S55,2000,DK -19-22AUG91

## 6076 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.

*NOTE: Remove starting motor before mounting engine into repair stand.*

1. Drain all coolant and engine oil. Check engine oil for metal contaminates.
  2. Remove turbocharger oil inlet line.
  3. Remove breather hose.
  4. Remove fan pulley and water manifold assembly.
  5. Remove turbocharger exhaust elbow and connector. Remove turbocharger.
- NOTE: DO NOT damage option code label (if equipped), when removing rocker arm cover.*
6. Remove rocker arm cover.
  7. Remove rocker arm assembly and push rods. Identify parts for re-assembly.
  8. Remove alternator and mounting brackets.
  9. Remove front crankshaft pulley and damper assembly.
  10. Remove fuel injection lines and injection nozzles.
  11. Remove water pump.
  12. Remove engine oil filter and oil filter housing.
  13. Remove injection pump gear cover and remove injection pump. Remove fuel filter and mounting base.
  14. On 6076A Engines, remove aftercooler cover and aftercooler assembly.
  15. Remove exhaust manifold and air intake manifold.

16. Remove turbocharger oil return line.
  17. Remove engine oil cooler assembly.
  18. Remove cylinder head with valve assembly. Remove head gasket.
  19. On SAE No. 3 flywheel housings, remove flywheel then remove flywheel housing.
  20. On SAE No. 1 and 2 flywheel housings, remove flywheel housing then remove flywheel.
  21. Roll engine over and remove oil pan and engine oil pump assembly.
  22. On engines equipped with front auxiliary drive assembly, remove auxiliary drive idler gear.
  23. Remove front timing gear cover.
  24. Rotate engine to vertical position. Remove pistons and connecting rods. Identify for re-assembly. Perform wear checks with PLASTIGAGE™.
- NOTE: Perform wear check on main bearing surfaces with PLASTIGAGE, when removing main bearing caps.*
25. Remove main bearing caps. Remove crankshaft and main bearings. Identify for re-assembly.
  26. Remove camshaft and cam followers. Identify for re-assembly.
  27. Rotate engine and remove liners and their O-ring seals. Mark liners for reassembly in same bore from which removed.
  28. Remove piston cooling orifices.
  29. Remove cylinder block plugs and engine serial number plate, if block is to be put in a "hot tank".
  30. Refer to appropriate group for inspection and repair of engine components.

PLASTIGAGE™ is a trademark of the Perfect Circle Division of Dana Corp.

S55,2000,DL -19-22AUG91

## 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. ALWAYS use the following recommended sealants when assembling your John Deere Diesel Engine to assure quality performance.

LOCTITE® products are designed to perform to sealing standards with machine oil residue present. If excessive machine oil or poor cleanliness quality exist, clean with solvent. Refer to John Deere Merchandise and Parts Sales Manual for ordering information.

### • LOCTITE 242 Thread Lock & Sealer (Medium Strength) (blue):

—Plugs and fittings: fuel filter base, intake manifold, cylinder block (oil galley).

—Capscrews: injection pump access cover, electronic tachometer cover, oil filler inlet, flywheel.

—Oil pressure sending unit

### • LOCTITE 271 Thread Lock & Sealer (High Strength) (clear):

—Studs: Injection pump-to-block and exhaust manifold-to-turbocharger.

### • LOCTITE 277 Plastic Gasket (High Strength) (red):

—Steel cap plugs: cylinder block, cylinder head, and water pump

—O-ring adapter for oil pump outlet tube

### • LOCTITE 592 Pipe Sealant with TEFLON® (white):

—Pipe plugs: cylinder block (water manifold), thermostat housing, air intake manifold, and water pump.

—Injection pump governor cover fitting (fuel return)

—Threaded nipples and elbows in water pump housing

—Temperature sending unit

—Oil pan (drain hose and drain valve)

—Connectors: turbo line and turbo drain.

—Adapter fitting for turbo oil inlet line

### • LOCTITE 609 Retaining Compound (green):

—Wear ring-to-crankshaft

### • PERMATEX® AVIATION (Form-A-Gasket No. 3):

—Timing gear cover-to oil pan

—Flywheel housing-to-oil pan

### • PT569 NEVER-SEEZ® COMPOUND:

—Cap Screws: exhaust manifold and turbine housing-to-center housing.

### • PERMATEX (Form-A-Gasket No. 2):

—Water pump and thermostat cover gaskets

### • AR31790 SCOTCH-GRIP® EC-1099 Plastic Adhesive:

—Rocker arm cover gasket

LOCTITE® and PERMATEX® are registered trademarks of Loctite Corporation.

NEVER-SEEZ® is a registered trademark of the Emhart Chemical Group.

SCOTCH-GRIP® is a registered trademark of 3M Company.

TEFLON® is a registered trademark of Dupont Company.

RG,CTM6,G04,1 -19-24SEP91



## 6076 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 in cylinder block that were removed to service block. Install engine serial number plate.

2. Install clean piston cooling orifices.

3. Install cylinder liners without O-rings and measure liner stand-out. Install liner O-rings in block and packings on liners. Install liners.

*NOTE: If new piston and liner kit assemblies are being installed, install the crankshaft first.*

4. Install main bearings and crankshaft. Rotate crankshaft to assure correct assembly. Check crankshaft end play.

5. If installing new piston/liner kits, assemble the respective connecting rods.

6. Install engine oil pump assembly.

7. Install crankshaft rear oil seal and wear sleeve.

8. Install cam followers in hole from which originally removed.

9. Install camshaft. Align timing marks (camshaft to crankshaft gears) with No. 1 piston at TDC compression stroke.

10. Align camshaft thrust plate holes and secure plate-to-block. Check camshaft end play.

11. Install fuel injection pump and drive gear.

12. Install engine oil filter base and oil filter as an assembly, if removed.

13. Install flywheels:

SAE 1 or SAE 2: Flywheel goes on before housing.

SAE 3: Housing goes on before flywheel.

14. Install head gasket.

15. Install cylinder head.

16. Install timing gear gasket, cover, and front oil seal.

17. On engines equipped with front auxiliary drive assembly, install auxiliary drive idler gear. Install cover.

18. Install push rods.

19. Install rocker arm assembly.

20. Install oil cooler assembly.

21. Install air intake manifold

*NOTE: On 6076A Engines, 2-5/16 x 4 in. cap screws located above the oil cooler must be installed with the aftercooler manifold base.*

22. Install aftercooler assembly on 6076A Engines.

23. Install turbo oil return line.

24. Install exhaust manifold.

25. Install water pump.

26. Adjust all valves.

27. Install turbocharger with elbow and connector.

28. Install injection nozzles.

## 6076 ENGINE ASSEMBLY SEQUENCE—CONTINUED

29. Install high-pressure fuel lines and spill-back lines.
30. Install front pulley and damper as an assembly.
31. Install alternator.
32. Install fuel filter base, inlet and pump supply lines, and filter.
33. Install water manifold and thermostat housing as an assembly. Install fan pulley assembly.
34. Install breather hose.
35. Install turbocharger oil line.
36. Fill engine with clean oil and the proper coolant. Install dipstick.
37. Perform engine break-in and normal standard performance checks.

04  
4

S55,2000,DN -19-22AUG91

**SPECIAL OR ESSENTIAL TOOLS**

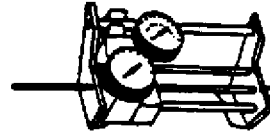
*NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).*

DX,TOOLS -19-05JUN91

Spring Compression Tester . . . . . D01168AA

RG5061 -UN-23AUG88

Test valve spring compression

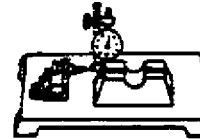


S53,D01168,AA -19-13FEB87

Valve Inspection Center . . . . . D05058ST

RG5062 -UN-23AUG88

Check valves for out-of round.

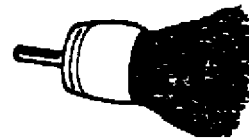


S53,D05058,ST -19-02APR87

End Brush . . . . . D17024BR

RG5063 -UN-23AUG88

Clean valve seat and bores.

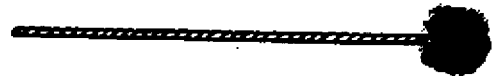


S53,D17024,BR -19-26JAN87

Nozzle Thread Cleaning Brush . . . . . D17030BR

RG5099 -UN-23AUG88

Used to clean nozzle threads in cylinder head.



S53,D17030,BR -19-16FEB87

Valve Guide Knurling Tool Set . . . . . D0002WI

RG5064 -UN-23AUG88

Knurl valve guides.



S53,D20002,WI -19-26JAN87

Valve Seat Pilot Driver . . . . . JDE7

RG5065 -UN-23AUG88

Install replacement valve seat inserts. Use with JDG05.



S53,JDE7A -19-23AUG91

Torque Wrench Adapter . . . . . JDE37A


RG5072 -UN-23AUG88

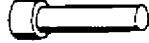
Retighten cylinder head cap screws when rocker arm assembly is installed.

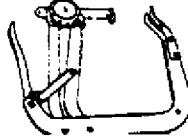


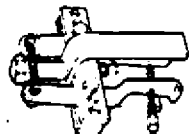
S53,JDE37A -19-07AUG91


*Cylinder Head and Valves/Essential Tools*


Flywheel Turning Tool . . . . . JDE81-1 Rotate engine flywheel. Use with JDE81-4.	RG4950	-UN-23AUG88	
			S53,JDE811 -19-07JUL89

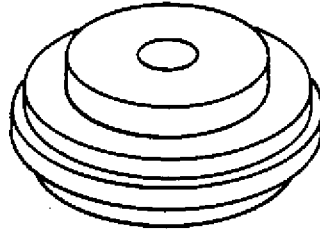
Timing Pin . . . . . JDE81-4 Lock engine at TDC when timing valve train. Use with JDE81-1 or JDE83.	RG5068	-UN-23AUG88	
			S53,JDE814 -19-06APR90

Valve Spring Compressor . . . . . JDE138 Used to compress valve spring when removing and installing valves.	RG5070	-UN-23AUG88	
			S53,JDE138 -19-04MAR87

Valve Seat Puller . . . . . JDE41296 Remove valve seats.	RG5071	-UN-23AUG88	
			S53,JDE,41296 -19-26JAN87

Tap . . . . . JDF5 Used to restore nozzle threads in cylinder head.	RG5100	-UN-23AUG88	
			S53,JDF5 -19-16FEB87

Tap . . . . . JDG681 Used to restore threaded holes in cylinder block for cylinder head cap screws.	RG5100	-UN-23AUG88	
			RG,JDG681 -19-25MAR91

Valve Seat Installer . . . . . JDG605 Install intake and exhaust valve seat inserts. Use with JDE7.		
		S53,JDG605 -19-25MAR91

RG5240 -UN-23AUG88

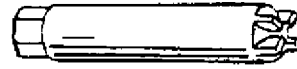
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*Cylinder Head and Valves/Other Materials*

Nozzle Seat Reamer . . . . . JDG609

RG5289 -UN-23AUG88

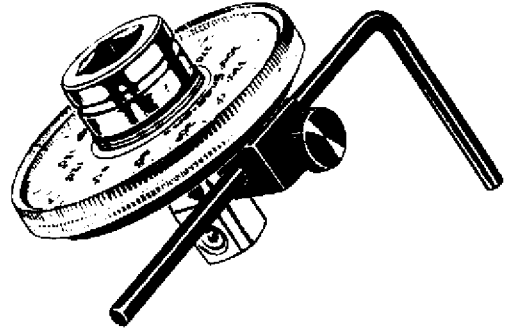
Used to clean carbon from nozzle seats in cylinder head.



S53,JDG609 -19-02DEC87

Torque Angle Gauge . . . . . JT05993

Used to TORQUE-TURN flanged-head cylinder head and connecting rod cap screws.



RG,JT05993 -19-22AUG91

RG5698 -UN-27AUG90

**SERVICE EQUIPMENT AND TOOLS**

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

Name	Use
D05012ST Precision "Bevelled Edge" Straightedge	Check cylinder head flatness
Plastic Brush	Clean valve guides

RG,CTM8,G05,1 -19-22AUG91

**OTHER MATERIAL**

Name	Use
AR44402 Valve Stem Lubricant	Lubricate valve stems.
PT569 NEVER-SEEZ® Compound	Exhaust manifold cap screws.
AR31790 SCOTCH-GRIP® Plastic Adhesive	Rocker arm cover gasket.

S11,2505,BW -19-24SEP91

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**CYLINDER HEAD AND VALVES SPECIFICATIONS**

ITEM	NEW PART SPECIFICATION	WEAR TOLERANCE
Valve Lift at 0.00 mm (in.) Clearance		
Engine Serial No. ( —121169)		
Intake . . . . .	14.05—14.48 mm (0.553—0.570 in.)	13.16 mm (0.518 in.)
Exhaust . . . . .	15.88—16.31 mm (0.625—0.642 in.)	14.99 mm (0.590 in.)
Engine Serial No. (121170— ) and converted 644E Loaders		
Intake . . . . .	13.39—13.84 mm (0.527—0.545 in.)	12.50 mm (0.492 in.)
Exhaust . . . . .	14.38—14.84 mm (0.566—0.584 in.)	13.49 mm (0.531 in.)
Valve Clearance (Rocker Arm-to-Valve Tip):		
Intake . . . . .	0.38 mm (0.015 in.)	—
Exhaust . . . . .	0.51 mm (0.020 in.)	—
Valve Spring Compressed Height:		
Engine Serial No. ( —129678)		
Valve Closed-Intake . . . . .	52.5 mm @ 353—407 N (2.07 in. @ 79—91 lb-force)	—
Exhaust . . . . .	54.5 mm @ 301—355 N (2.15 in. @ 68—80 lb-ft)	—
Valve Open-Intake . . . . .	38.1 mm @ 719—789 N (1.50 in. @ 162—177 lb-force)	—
Exhaust . . . . .	38.5 mm @ 709—779 N (1.52 in. @ 159—175 lb-force)	—
Engine Serial No. (129679— )		
Valve Closed-Intake . . . . .	52.5 mm @ 345—399 N (2.07 in. @ 78—90 lb-force)	—
Exhaust . . . . .	54.5 mm @ 284—338 N (2.15 in. @ 64—76 lb-force)	—
Valve Open-Intake . . . . .	38.1 mm @ 810—880 N (1.50 in. @ 182—198 lb-force)	—
Exhaust . . . . .	38.5 mm @ 797—867 N (1.52 in. @ 179—195 lb-force)	—
Valve Head OD:		
Intake . . . . .	50.87—51.13 mm (2.003—2.013 in.)	—
Exhaust . . . . .	46.87—47.13 mm (1.845—1.856 in.)	—
Valve Stem OD:		
Exhaust . . . . .	9.44—9.46 mm (0.3717—0.3724 in.)	—
Intake . . . . .	9.46—9.49 mm (0.3724—0.3736 in.)	—
Oversize Valve (Stem) Available . . .	0.08, 0.38, 0.76 mm (0.003, 0.015, 0.030 in.)	—
Valve Guide ID . . . . .	9.51—9.54 mm (0.3745—0.3755 in.)	—
Valve Stem-to-Guide Clearance:		
Exhaust . . . . .	0.051—0.102 mm (0.002—0.004 in.)	—
Intake . . . . .	0.025—0.076 mm (0.001—0.003 in.)	—
Valve Face Angle . . . . .	29.25° ± 0.25°	—
Valve Seat Angle . . . . .	30° ± 0.25°	—
Valve Seat Width:		
Exhaust . . . . .	2.0—3.8 mm (0.79—0.150 in.)	—
Intake . . . . .	1.4—3.8 mm (0.055—0.150 in.)	—

S11,2005,NA -19-23AUG91

**CYLINDER HEAD AND VALVES SPECIFICATIONS—CONTINUED**

ITEM	NEW PART SPECIFICATION	WEAR TOLERANCE
Valve Seat Concentricity with Guide . . . . .	0.051 mm (0.0020 in.)	—
Valve Recess in Cylinder Head:		
Intake . . . . .	3.35—3.86 mm (0.132—0.152 in.)	4.62 mm (0.182 in.)
Exhaust . . . . .	1.19—1.70 mm (0.047—0.067 in.)	2.46 mm (0.097 in.)
Maximum Valve Seat Runout . . . . .	0.051 mm (0.0020 in.)	—
Maximum Valve Face Runout . . . . .	0.051 mm (0.0020 in.)	—
Cylinder Firing Order . . . . .	1-5-3-6-2-4	—
Rocker Arm ID . . . . .	19.07—19.10 mm (0.7507—0.7520 in.)	—
Rocker Arm Shaft OD . . . . .	19.01—19.05 mm (0.7484—0.7500 in.)	—
Cylinder Head Reconditioning:		
Thickness of Head (Rocker Arm Cover Gasket Rail-to-Combustion Face) . . . . .	155.45—155.71 mm (6.120—6.130 in.)	—
Minimum Acceptable Thickness . . . . .	154.69 mm (6.09 in.)	—
Maximum Acceptable Out-of-Flat (Entire Length or Width) . . . . .	0.102 mm (0.0040 in.)	—
Combustion Face Surface Finish (surface grind only) . . . . .	60—110AA	—
Maximum Material Removal for Resurfacing Head . . . . .	0.762 mm (0.0300 in.)	—

S11,2005,NO -19-23AUG91

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**CYLINDER HEAD AND VALVES SPECIFICATIONS—CONTINUED**

**TORQUES**

Cylinder Head-to-Cylinder Block:

SAE Grade 180 or 12.9 (G-Grade) Cap Screws with Washers

- Step 1 . . . . . 224 N·m (165 lb-ft)
- Step 2 . . . . . 245 N·m (180 lb-ft)
- Step 3 . . . . . Wait 2 Hours; loosen and tighten to 245 N·m (180 lb-ft)

Flanged-Head Cap Screws (no Washers)

- Step 1 . . . . . 100 N·m (75 lb-ft)
- Step 2 . . . . . 125 N·m (95 lb-ft)
- Step 3 . . . . . Tighten an Additional 90—100 degrees

Rocker Arm Shaft Clamps . . . . . 75 N·m (55 lb-ft)

Rocker Arm Cover-to-Cylinder Head . . . . . 8 N·m (6 lb-ft) (72 lb-in.)

Intake Manifold-to-Cylinder Head . . . . . 47 N·m (35 lb-ft)

Exhaust Manifold-to-Cylinder Head . . . . . 47 N·m (35 lb-ft)

Valve Adjusting Screw Locknut . . . . . 27 N·m (20 lb-ft)

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RG,CTM6,G05,1 -19-25MAR91



## DIAGNOSING MALFUNCTIONS

### • Sticking Valves:

Carbon deposits on valve stem.  
Worn valve guides.  
Warped valve stems.  
Cocked or broken valve springs.  
Worn or distorted valve seats.  
Insufficient lubrication.

### • Warped, Worn, or Distorted Valve Guides:

Lack of lubrication.  
Cylinder head distortion.  
Excessive heat.  
Unevenly tightened cylinder head cap screws.

### • Distorted Cylinder Head and Gasket Leakage:

Loss of cylinder head cap screw torque.  
Broken cylinder head cap screw.  
Overheating from low coolant level operation.  
Insufficient liner stand-out.  
Coolant leakage into cylinder causing hydraulic failure of gasket.  
Leaking aftercooler.  
Cracked cylinder head.  
Cracked cylinder liner.  
Damaged or incorrect gasket.  
Overpowering or overfueling.  
Damaged cylinder head or block surfaces.  
Improper surface finish on cylinder head.  
Improperly tightened cylinder head cap screws.  
Faulty gasket installation (misaligned).

### • Worn or Broken Valve Seats:

Misaligned valves.  
Distorted cylinder head.  
Carbon deposits on seats due to incomplete combustion.  
Valve spring tension too weak.  
Excessive heat.  
Improper valve clearance.  
Improper valve timing.

### • Burned, Pitted, Worn, or Broken Valves:

Worn or distorted valve seats.  
Worn valve guides.  
Insufficient cooling.  
Cocked or broken valve springs.  
Improper engine operation.  
Improper valve train timing.  
Faulty valve rotators.  
Warped or distorted valve stems.  
"Stretched" valves due to excessive spring tension.  
Warped cylinder head.  
Bent push rods.  
Carbon build-up on valve seats.  
Rocker arm failure.

### • Improper Valve Clearance:

Inefficient use of fuel.  
Engine starts harder.  
Maximum engine power will not be achieved.  
Shorter service life of valve train.  
Greater chance for engine to overheat.

**CHECK AND ADJUST VALVE CLEARANCE**

Too little valve clearance throws valves out of time. Valves open too early and close too late. This causes the valves to overheat due to hot combustion gases rushing past valves when out of time. Overheating lengthens valve stems which prevents proper seating of valves. The valves seat so briefly or poorly that normal heat transfer into the cooling system does not have time to take place, causing burned valves and low power.

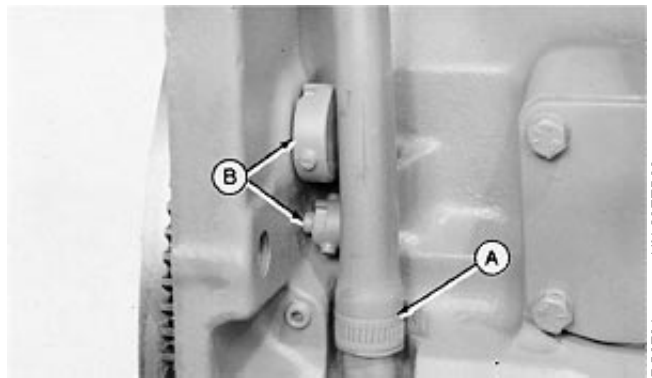
Too much valve clearance causes a lag in valve timing causing engine valve train imbalance. The fuel-air mixture enters the cylinders late during intake stroke. The exhaust valve closes early and prevents waste gases from being completely removed from cylinders. Also, the valves close with a great deal of impact, which may crack or break the valves and scuff the camshaft and followers.

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

*NOTE:* Valve clearance can be checked with engine cold or warm.

1. Remove rocker arm cover with ventilator tube (A).
2. Remove plastic plugs (B).

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

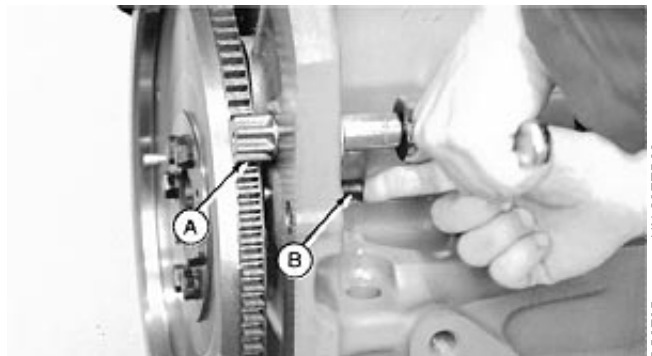


RG3794 -JUN-23FEB89

S11,2005,DO -19-23AUG91

3. Rotate engine with the JDE81-1 Flywheel Turning Tool (A) until JDE81-4 Timing Pin (B) engages timing hole in flywheel.

If the rocker arms for No. 1 cylinder are loose, the engine is at No. 1 "TDC-Compression." If the rocker arms for No. 6 cylinder are loose, the engine is at No. 6 "TDC-Compression." Rotate the engine one full revolution to No. 1 "TDC-Compression."



RG3795 -JUN-23FEB89

S11,2005,DP -19-07FEB85

4. With engine lock-pinned at "TDC" of No. 1 piston's compression stroke, check and adjust (as needed) valve clearance on Nos. 1, 3 and 5 exhaust valves and Nos. 1, 2 and 4 intake valves.

**VALVE CLEARANCE SPECIFICATIONS**

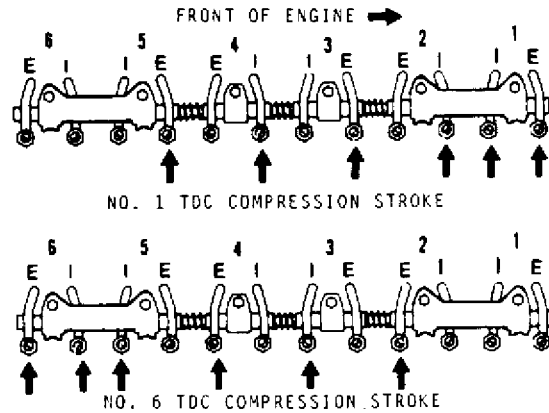
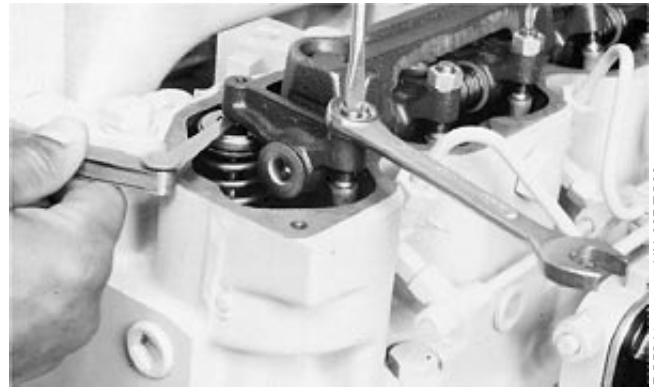
Intake Valves	0.38 mm (0.015 in.)
Exhaust Valves	0.51 mm (0.020 in.)

5. If valve clearance needs to be adjusted, loosen the locknut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten locknut to 27 N·m (20 lb-ft). Recheck clearance again after tightening locknut. Readjust clearance as necessary.

6. Rotate flywheel 360° until No. 6 piston is at "TDC" of its compression stroke. Rocker arms for No. 6 piston should be loose.

7. Check and adjust (as needed) valve clearance to the same specifications on Nos. 2, 4 and 6 exhaust and Nos. 3, 5, and 6 intake valves. Tighten valve adjusting screw locknut to 27 N·m (20 lb-ft).

8. Recheck clearance on all valves again after locknut is tightened.



S11,2005,NB -19-22AUG91

-JUN-06DEC88  
RG6241

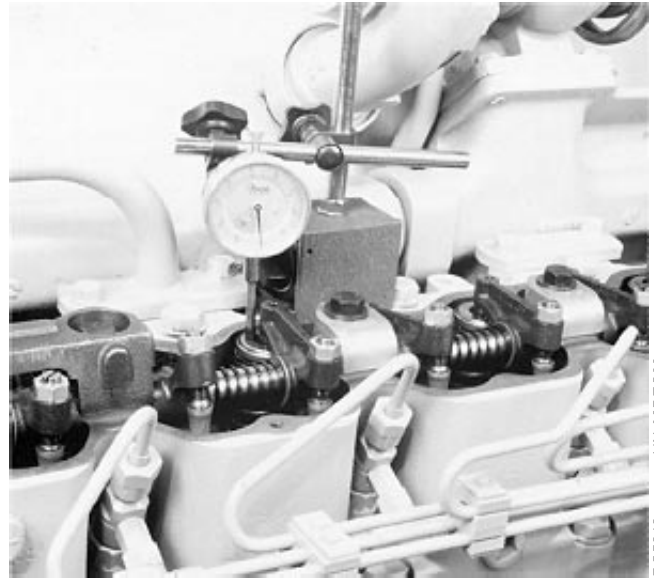
-19-21AUG91  
RG4295

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## CHECK VALVE LIFT

*NOTE: Measuring valve lift can give an indication of wear on camshaft lobes and cam followers or bent push rods.*

1. Remove rocker arm cover and loosen locknut on rocker arm. Set valve clearance at 0.00 mm (in.). Tighten locknut.
2. Put dial indicator tip on valve rotator. Be sure that valve is fully closed.
3. Check pre-set on dial indicator. Set dial indicator pointer at zero.
4. Manually turn engine in running direction, using the engine rotation tools previously mentioned for checking valve clearance.
5. After rocker arm contacts valve wear cap, observe dial indicator reading as valve is moved to fully open position.



-JUN-06DEC88  
RG5242

### VALVE LIFT SPECIFICATION AT 0.00 MM (IN.) CLEARANCE

Engine Ser. No. ( —121169)

Intake . . . . .	14.05—14.48 mm (0.553—0.570 in.)
Minimum Acceptable . . . . .	13.16 mm (0.518 in.)
Exhaust . . . . .	15.88—16.31 mm (0.625—0.642 in.)
Minimum Acceptable . . . . .	14.99 mm (0.590 in.)

Engine Ser. No. (121170— ) and converted 644E Loaders

Intake . . . . .	13.39—13.84 mm (0.527—0.545 in.)
Minimum Acceptable . . . . .	12.50 mm (0.492 in.)
Exhaust . . . . .	14.38—14.84 mm (0.566—0.584 in.)
Minimum Acceptable . . . . .	13.49 mm (0.531 in.)

6. Adjust valve clearance to specification as outlined earlier in this group after measuring lift. (See CHECK AND ADJUST VALVE CLEARANCE.)

S11,2005,MN -19-18SEP91

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