

# *POWERTECH*<sup>®</sup> 4.5L & 6.8L Diesel Engines

## Base Engine

### TECHNICAL MANUAL *POWERTECH*<sup>®</sup> 4.5 L & 6.8 L Diesel Engines— Base Engine

CTM104 22JAN02 (ENGLISH)

For complete service information also see:

<i>POWERTECH</i> <sup>®</sup> 4.5 L and 6.8 L Diesel Engines—Mechanical Fuel Systems . . . . .	CTM207
<i>POWERTECH</i> <sup>®</sup> 4.5 L and 6.8 L Diesel Engines—Level 4 Electronic Fuel Systems with Bosch VP44 Pump. . . . .	CTM170
<i>POWERTECH</i> <sup>®</sup> 4.5 L and 6.8 L Diesel Engines—Level 12 Electronic Fuel Systems with Stanadyne DE10 Pump . . . . .	CTM331
<i>POWERTECH</i> <sup>®</sup> 4.5 L and 6.8 L Diesel Engines—Level 1 Electronic Fuel Systems with Delphi/Lucas DP201 Pump . . . . .	CTM284
Alternators and Starter Motors. . . . .	CTM77
OEM Engine Accessories . . . . .	CTM67 (English Only)

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

# Introduction

## Forward

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.

This manual (CTM104) covers only the base engine. It is one of five volumes on 4.5 L and 6.8 L engines. The following four companion manuals cover fuel system repair, operation and diagnostics:

- CTM207—Mechanical Fuel Systems
- CTM170—Level 4 Electronic Fuel Systems with Bosch VP44 Pump
- CTM331—Level 12 Electronic Fuel Systems with Stanadyne DE10 Pump
- CTM284—Level 1 Electronic Fuel Systems with Delphi/Lucas DP201 Pump

Other manuals will be added in the future to provide additional information on electronic fuel systems as needed.

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 Section 01, Group 001 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.

Information is organized in sections and groups for the various components requiring service instruction. Section 05 summarizes all applicable essential tools, service equipment and tools, other materials needed to do the job, and service parts kits. Section 06 summarizes all specifications, wear tolerances, and torque values.

Before beginning repair on an engine, clean the engine and mount on a repair stand. (See Section 02, Group 010.)

This manual contains SI Metric units of measure followed immediately by the U.S. customary units of measure. Most hardware on these engines is metric sized.

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

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

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

DPSG,OUO1004,2767 -19-18MAY00-1/1

## John Deere Dealers

The changes listed below make your CTM obsolete. Repair, operation and diagnostics on 4.5L and 6.8 L diesel engines is now covered in five manuals.

**Discard CTM104 dated 19JUN00 and replace with the following new manuals:**

- CTM104—4.5 L and 6.8 L Diesel Engines—Base Engine
- CTM207—4.5 L and 6.8 L Diesel Engines—Mechanical Fuel Systems
- CTM170—4.5 L and 6.8 L Diesel Engines—Level 4 Electronic Fuel Systems with Bosch VP44 Pump
- CTM331—4.5 L and 6.8 L Diesel Engines—Level 12 Electronic Fuel Systems with Stanadyne DE10 Pump
- CTM284—4.5 L and 6.8 L Diesel Engines—Level 1 Electronic Fuel Systems with Delphi/Lucas DP201 Pump

Also, copy this page listing changes and route through your Service Department.

### SECTION 01—GROUP 001 (Engine Identification)

- Updated engine model designation chart.
- Updated engine application charts.

### SECTION 01—GROUP 002 (Fuels Lubricants and Coolants)

- Revised diesel/bio-diesel fuel guidelines and specifications.
- Revised diesel engine oil guidelines.

### SECTION 02—GROUP 010 (Engine Rebuild)

- Revised engine disassembly sequence.
- Revised engine assembly sequence.

### SECTION 02—GROUP 020 (Cylinder Head and Valves)

- Updated electronic fuel system references.
- Revised rocker arm seal replacement requirement.

- Revised procedure for assemble rocker arm assembly.
- Revised lubrication for install valves.
- Revised procedure for torque-turn method for proper torque.

### SECTION 02—GROUP 030 (Cylinder Block, Liners, Pistons and Rods)

- Revised piston ring end gap specifications.
- Revised procedure for complete disassembly of cylinder block.
- Revised procedure and specifications for checking piston ring groove wear.
- Updated specifications for inspect and clean cylinder block.
- Revised specification for inspect and measure connecting rod bearings.
- Revised procedure for remove, inspect and install piston cooling orifices.
- Revised procedure for assemble piston and connecting rod.
- Revised procedure for installation of piston and rod assembly.
- Revised procedure for completing final assembly.

### SECTION 02—GROUP 040 (Crankshaft, Main Bearings and Flywheel)

- Revised procedure and specifications for removal and installation of vibration damper.
- Revised procedure for removal and installation of front oil seal and wear sleeve.
- Revised specification for crankshaft end play.
- Revised procedure for installation of flywheel.
- Revised procedure for clean and inspect crankshaft flange.
- Revised procedure for install crankshaft rear oil seal and wear sleeve.
- Revised procedure for remove flywheel housing.
- Revised procedure for removal and installation of crankshaft timing wheel.
- Revised procedures for removal and installation of crankshaft gear.

- Removed procedure for remove, inspect and install piston cooling orifices.
- Revised procedure and specifications for installation of flywheel housing.

### **SECTION 02—GROUP 050 (Camshaft, Balancer Shafts and Timing Gear Train)**

- Revised procedure for remove timing gear cover.
- Updated timing gear backlash specifications.
- Removed procedure for remove and install camshaft gear.
- Added procedure for inspect camshaft gear.
- Revised procedure for removal and installation of balancer shafts.
- Revised procedure for removal and installation of balancer shaft bushings.
- Revised procedure for remove cylinder block front plate.
- Revised procedure for install cylinder block front plate.
- Revised procedure for installation of camshaft.
- Revised procedure for installation of timing gear cover.
- Removed procedure for installation of crankshaft front wear sleeve and oil seal.
- Updated torque specification for magnetic pick-up.
- Removed procedure for mechanical tachometer adapter.
- Updated procedure for complete final assembly.

### **SECTION 02—GROUP 060 (Lubrication System)**

- Revised general lubrication system information.
- Revised procedure for removal and installation of oil filter base.
- Revised procedure for removal and installation of oil cooler assembly.
- Added procedure for remove and install oil filter bypass valve.
- Revised procedure for remove and install oil pressure regulating valve.
- Revised procedure for remove and install oil fill adapter.
- Revised procedure for remove and install dipstick tube with pan installed.

### **SECTION 02—GROUP 070 (Cooling System)**

- Added torque specification for bleed port plug.
- Revised procedure for remove and install coolant manifold and thermostats (dual thermostats).
- Revised procedure for remove coolant pump.
- Revised procedure for assemble coolant pump.
- Revised procedure for install coolant pump.
- Revised procedure for remove and install automatic (spring) belt tensioner.
- Revised procedure for manual belt tensioner adjustment using belt tension gauge.
- Added procedure for manual belt tensioner adjustment using belt tension tool.
- Updated tables for installation of fan drive assembly.

### **SECTION 02—GROUP 080 (Air Intake and Exhaust System)**

- Revised procedure for turbocharger inspection.
- Updated specifications for axial bearing end play.
- Updated specifications for radial bearing clearance.
- Revised procedure for install turbocharger.
- Revised turbocharger lube line torque specifications.
- Revised procedure for remove, inspect and install exhaust manifold.
- Added specification for installation of starting aid.

### **SECTION 02—GROUP 090 (Fuel System)**

*NOTE: Repair procedures for fuel systems has been moved to Section 02, Group 090 in four other technical manuals: CTM207—Mechanical Fuel Systems, CTM170—Level 4 Electronic Fuel Systems with Bosch VP44 Pump, CTM331—Level 12 Electronic Fuel Systems with Stanadyne DE10 Pump, and CTM284—Level 1 Electronic Fuel Systems with Delphi/Lucas DP201 Pump.*

### **SECTION 02—GROUP 100 (Starting and Charging Systems)**

- Starting and charging systems are covered in this section/group.

### **SECTION 03—GROUP 120 (Base Engine Operation)**

- Updated general engine operation.
- Updated lubrication system operation.

*NOTE: Fuel system theory of operation has been moved to Section 03, Group 130 in four other technical manuals: CTM207—Mechanical Fuel Systems, CTM170—Level 4 Electronic Fuel Systems with Bosch VP44 Pump, CTM331—Level 12 Electronic Fuel Systems with Stanadyne DE10 Pump, and CTM284—Level 1 Electronic Fuel Systems with Delphi/Lucas DP201 Pump.*

### **SECTION 04—GROUP 150 (Observable Diagnostics and Tests)**

- Added guidelines for acceptable oil consumption.
- Revised diagnostics.
- Updated specifications for test engine compression.
- Revised specification for checking engine oil pressure.
- Updated specification for testing cooling system and radiator cap.
- Revised procedure for measure intake manifold pressure.

- Revised procedure for check for exhaust air leaks.

*NOTE: Fuel system testing and diagnostics has been moved to Section 04, Group 150 in four other technical manuals: CTM207—Mechanical Fuel Systems, CTM170—Level 4 Electronic Fuel Systems with Bosch VP44 Pump, CTM331—Level 12 Electronic Fuel Systems with Stanadyne DE10 Pump, and CTM284—Level 1 Electronic Fuel Systems with Delphi/Lucas DP201 Pump.*

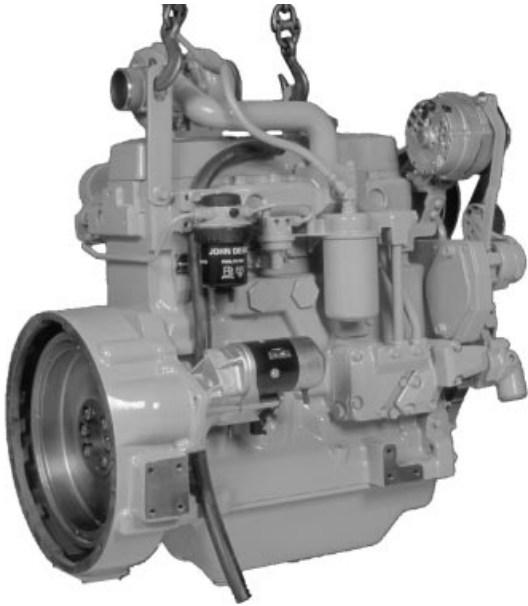
### **SECTION 5 (Tools and Other Materials)**

- All essential tools, service tools, dealer fabricated tools and other materials listed throughout this manual are consolidated in this section for ease of reference.

### **SECTION 6 (Specifications)**

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

**POWERTECH® 4.5 L Engine**



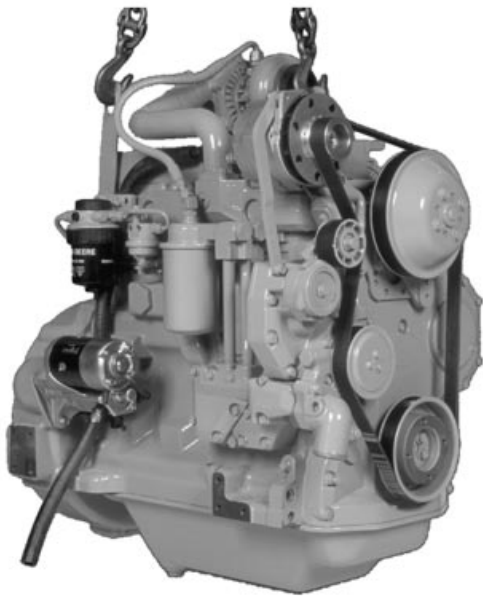
*3/4 Right Rear View*

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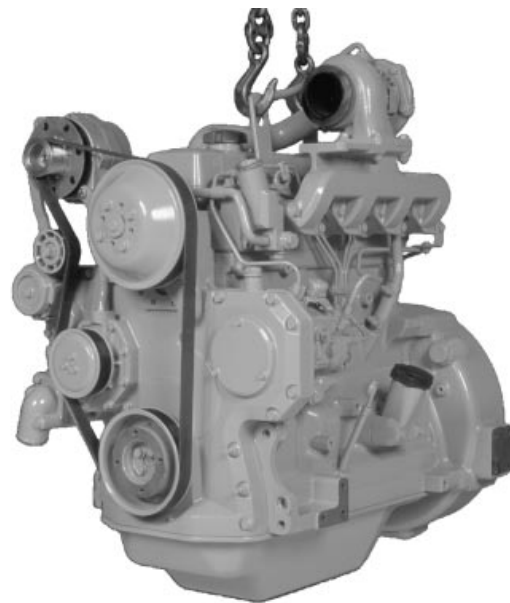
*3/4 Left Rear View*

RG7638 -UN-23NOV97



*3/4 Right Front View*

RG7639 -UN-23NOV97



*3/4 Left Front View*

RG7637 -UN-23NOV97

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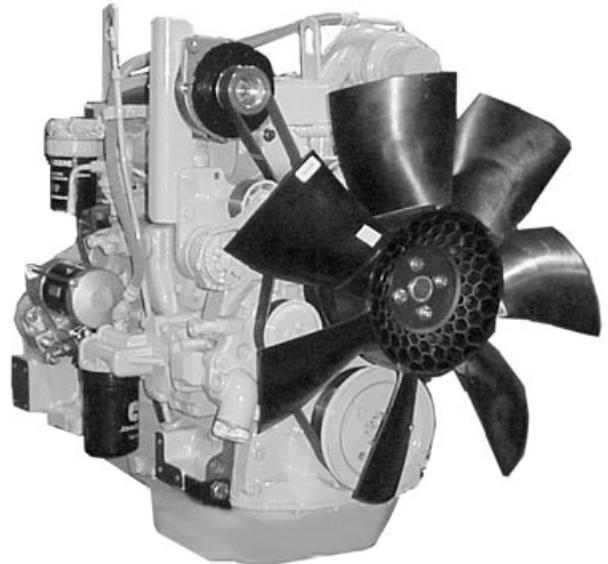
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**POWERTECH® 4.5 L Engine—Tier II**



3/4 Left Rear View

RG11931 -JN-06NOV01



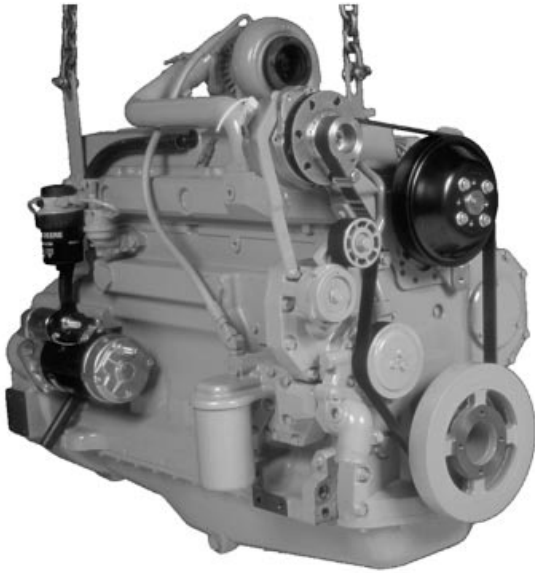
3/4 Right Front View

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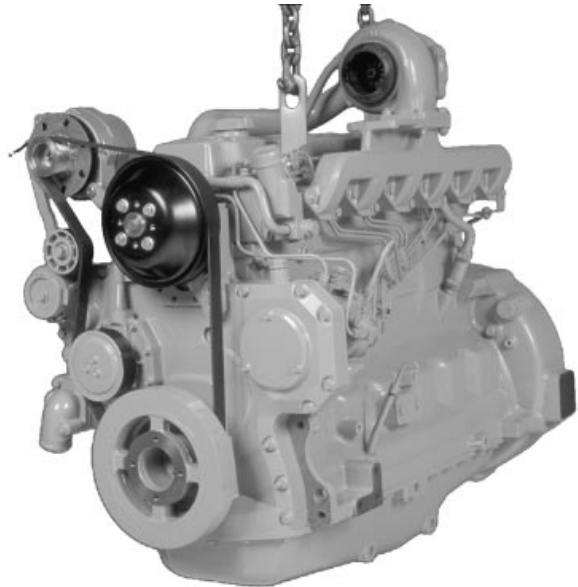
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**POWERTECH® 6.8 L Engine**



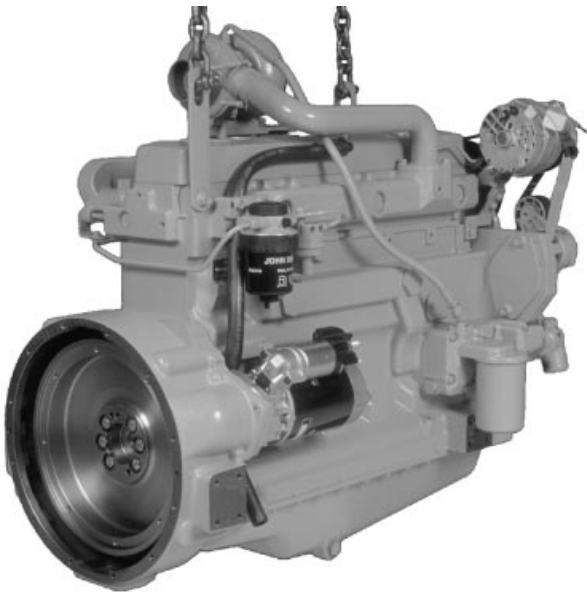
3/4 Right Front View

RG7641 -UN-23NOV97



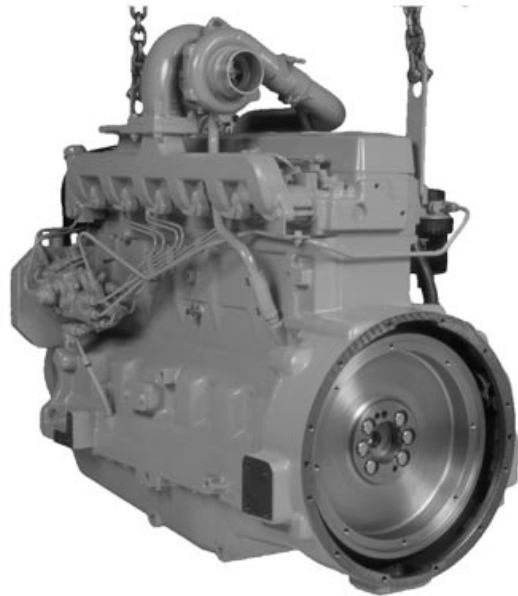
3/4 Left Front View

RG7640 -UN-23NOV97



3/4 Right Rear View

RG7643 -UN-23NOV97



3/4 Left Rear View

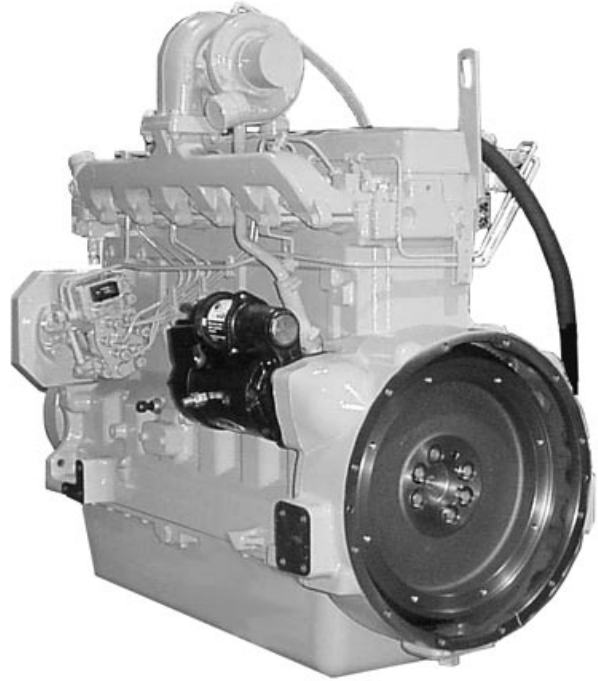
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DPSG,OUO1004,130 -19-15MAY98-1/2



**POWERTECH® 6.8 L Engine—Tier II**



*3/4 Left Rear View*

RG-11933 -UN-24OCT01



*3/4 Right Front View*

RG-11934 -UN-24OCT01

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DPSG,OUO1004,130 -19-15MAY98-2/2

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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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# Section 01

## General Information

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### Handle Fluids Safely—Avoid Fires

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

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

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

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



TS227 -JUN-23AUG88

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

### Handle Starting Fluid Safely

Starting fluid is highly flammable.

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

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

Do not incinerate or puncture a starting fluid container.



TS1356 -JUN-18MAR92

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

### Service Cooling System Safely

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



TS281 -JUN-23AUG88

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

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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).



TS204 -UN-23AUG88

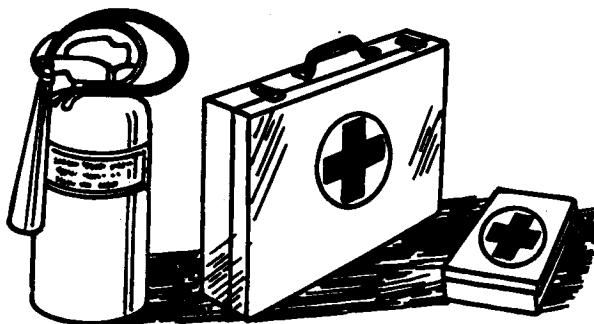
DX,SPARKS -19-03MAR93-1/1

## Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 -UN-23AUG88

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

## Handling Batteries Safely

**!** **CAUTION:** Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

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

Always remove grounded (-) battery clamp first and replace it last.

**!** **CAUTION:** 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.

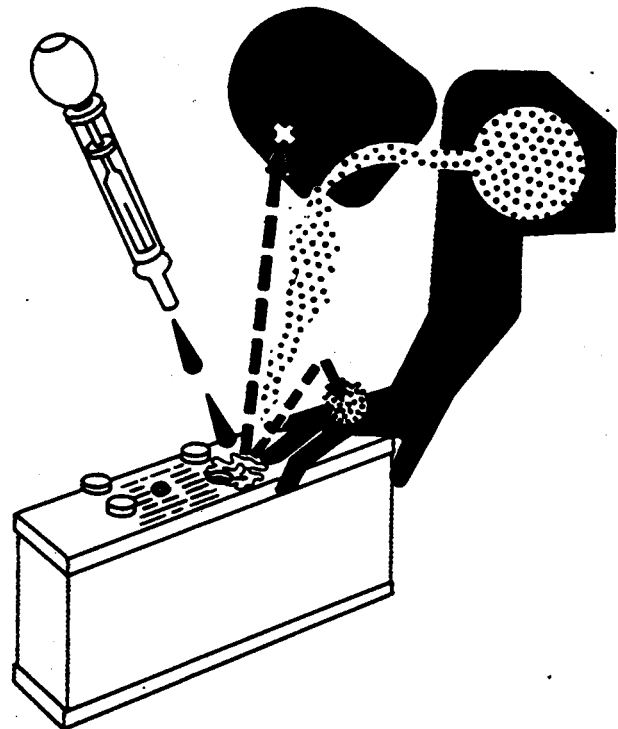
If you spill acid on yourself:

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.

**WARNING:** Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**



TS204 -UN-23AUG88

TS203 -UN-23AUG88

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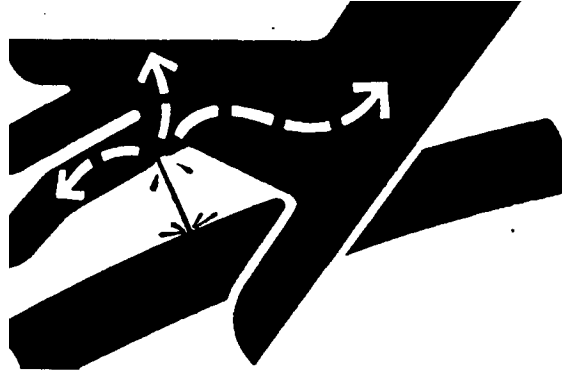
## Avoid High-Pressure Fluids

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.



X9811 -UN-23AUG88

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

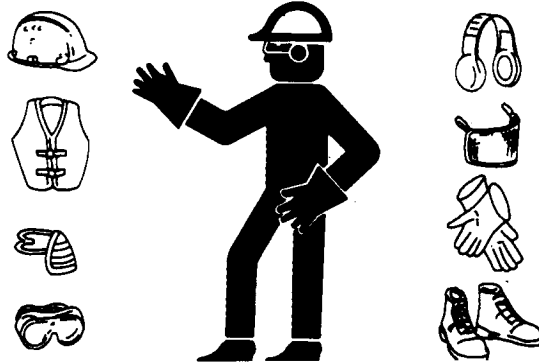
## Wear Protective Clothing

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.



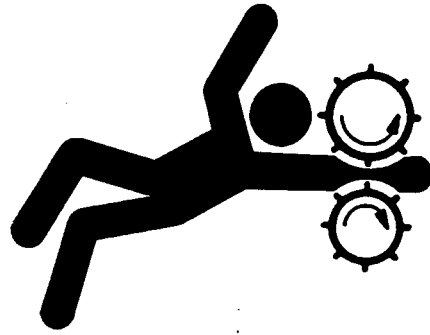
TS206 -UN-23AUG88

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

### Service Machines Safely

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

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



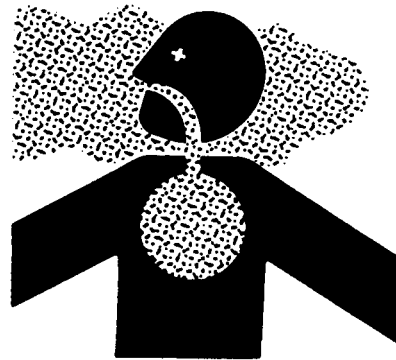
DX,LOOSE -19-04JUN90-1/1

TS228 -JUN-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



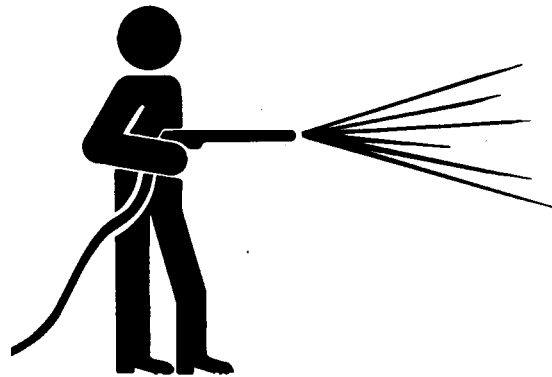
DX,AIR -19-17FEB99-1/1

TS220 -JUN-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 -19-04JUN90-1/1

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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.

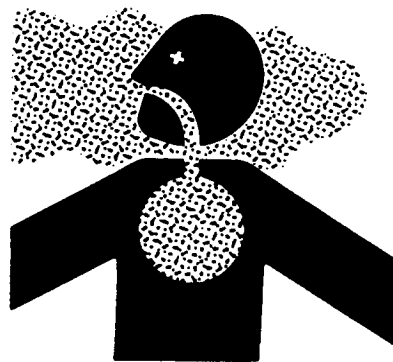
Remove paint before heating:

- Remove paint a minimum of 76 mm (3 in.) from area to be affected by 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.

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

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

Dispose of paint and solvent properly.



TS220 -UN-23AUG88

DX,PAINT -19-19JUL01-1/1

## Avoid Heating Near Pressurized Fluid Lines

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

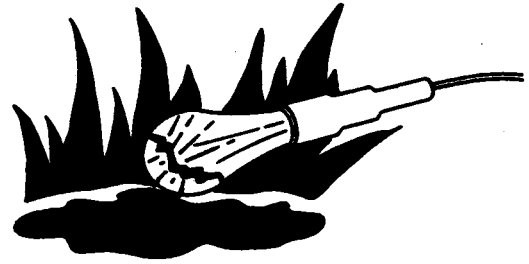


TS953 -UN-15MAY90

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

### Illuminate Work Area Safely

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



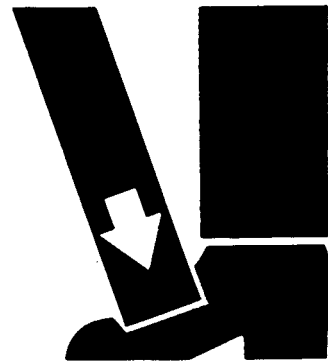
TS223 -JUN-23AUG88

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

### Use Proper Lifting Equipment

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

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



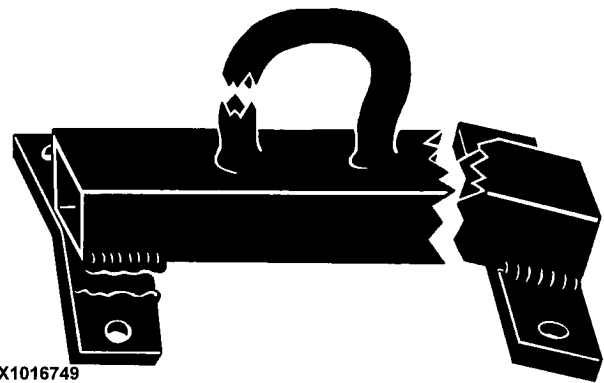
TS226 -JUN-23AUG88

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

### Construct Dealer-Made Tools Safely

Faulty or broken tools can result in serious injury. When constructing tools, use proper, quality materials and good workmanship.

Do not weld tools unless you have the proper equipment and experience to perform the job.



LX1016749

LX1016749 -JUN-01JUL97

Construct Dealer-Made Tools Safely

DPSG,OUO1004,899 -19-19MAY99-1/1

**Thank you very much for  
your reading. Please Click  
Here. Then Get COMPLETE  
MANUAL. NO WAITING**



**NOTE:**

**If there is no response to  
click on the link above,  
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document first and then  
click on it.**

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## 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.



*Keep Area Clean*

TS218 -UN-23AUG88

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

## Use Proper Tools

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.



*Use Proper Tools*

TS779 -UN-08NOV89

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

### Dispose of Waste Properly

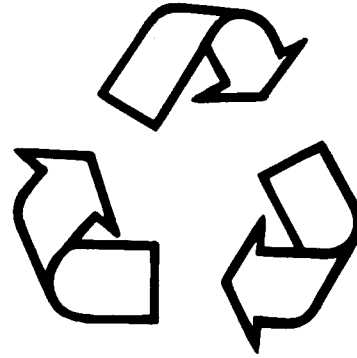
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

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

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

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



Recycle Waste

TS1133 -UN-26NOV90

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

### Live With Safety

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



Safety Systems

TS231 -19-07OCT88

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