PowerTech[™] 9.0 L OEM Diesel Engines Base Engine Repair

COMPONENT TECHNICAL MANUAL 9.0 L OEM Diesel Engines — Base Engine Repair

CTM400 29AUG11 (ENGLISH)

For complete service information also see:

9.0 L Diesel Engines — Level 14 Electronic	
Fuel System with Denso HPCR	

OEM Engine Accessories	CTM67
Application List	CTM106819

John Deere Power Systems

CTM385

Foreword

This repair manual is valid for the engines.

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

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.

Information in this manual is organized in sections and sub divided into groups.

Section 01 covers the safety measures to follow while repairing the engine; engine identification features, engine emission & application details, and information about the fuels, lubricants & coolants.

Section 02 covers the Repair and Adjustment procedures.

Section 03 explains Systems Theory of Operation.

Section 04 is the diagnostics section that provides troubleshooting procedures to find problems.

Section 05 lists all applicable service equipment and tools, other materials needed to do the job.

Section 06 details all specifications, wear tolerances, torque values and contains the wiring diagrams.

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.

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 component you are working on.

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

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

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.

RE38635,00000D9 -19-03SEP09-1/1

John Deere Dealers

Future changes to this manual will be documented below. For diagnostics and fuel system repair, and for electrical system repair, reference the following manuals.

- CTM400 (English) Base Engine
 CTM385 (English) —Level 14 Electronic Fuel Systems
- CTM77 (English) —Electrical (Starter and Alternator) Systems

SECTION 01, GROUP 001 (Engine Identification)

SECTION 01, GROUP 002 (Fuels, Lubricants, and Coolants)

SECTION 02, GROUP 010 (Engine Rebuild)

SECTION 02, GROUP 020 (Cylinder Head and Valves **Repair and Adjustment Serial Number**

SECTION 02, GROUP 050 (Camshaft and Timing Gear Train Repair and Adjustment)

SECTION 02, GROUP 060 (Lubrication System Repair and Adjustment)

SECTION 02, GROUP 070 (Cooling System Repair and Adjustment)

SECTION 02, GROUP 080 (Air Intake and Exhaust System Repair and Adjustments)

SECTION 02, GROUP 081 (Air Intake and Exhaust System Repair and Adjustments — POWERTECH AND POWERTECH E)

SECTION 03, GROUP 120 (Base Engine Operation)

SECTION 03, GROUP 121 (Base Engine Operation — **POWERTECH AND POWERTECH E)**

· Base engine theory of operation is covered in this new group.

SECTION 04, GROUP 150 (Observable Diagnostics and Tests)

• Base engine observable diagnostics and tests are covered in this new section/group.

SECTION 05 (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 06 (Specifications)

- All repair, test, and diagnostic specifications listed throughout this manual are consolidated in this section for ease of reference.
- Updated bolt and cap screw torque values.
- Updated General OEM specifications.
- Updated dynamometer specifications.

DPSG,OUO1004,898 -19-19MAY99-1/1

About this Manual

This component technical manual (CTM) covers the base engine for **PowerTech®** 9.0 L diesel engines produced in Waterloo, Iowa. This manual's coverage includes repair and basic diagnostic information for 9.0 L engines

Direction of engine crankshaft rotation in this manual is referenced as clockwise, as viewed from the rear of the engine. Front of engine is fan drive end.

Read each procedure completely before performing any service.

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IMPORTANT: For repair, diagnostics, and testing procedures on the fuel system, refer to the companion manuals:

> • CTM385 — 9.0 L Diesel Engines—Level 14 Electronic Fuel Systems with Denso **High Pressure Common Rail**

> > RE38635,0000076 -19-03SEP09-1/1

Introduction



Section 01—General

Group 000—Safety Group 001—Engine Identification Group 002—Fuels, Lubricants and Coolant

Section 02—Repair and Adjustments

Group 010—Engine Rebuild

Group 021—Cylinder Head and Valves Repair and Adjustment

- Group 030—Cylinder Block, Liners, Pistons, and Rods Repair and Adjustment
- Group 040—Crankshaft, Main Bearings and Flywheel Repair and Adjustment
- Group 050—Camshaft and Timing Gear Train Repair and Adjustment
- Group 060—Lubrication System Repair and Adjustment
- Group 070—Cooling System Repair and Adjustment
- Group 080—Air Intake and Exhaust System Repair and Adjustment
- Group 081—PowerTech E Air Intake and Exhaust System Repair and Adjustment
- Group 100—OEM Starting and Charging Systems Repair and Adjustment
- Section 03—Theory of Operation
 - Group 120—Base Engine Operation
 - Group 121—PowerTech E Base Engine Operation

Section 04—Diagnostics

Group 150—Observable Diagnostics and Tests

Section 05—Tools and Other Materials

- Group 170—Repair Tools and Other Materials
- Group 180—Diagnostic Service Tools
- Group 190—Dealer Fabricated Service Tools

Section 06—Specifications

Group 200—Repair and General OEM Specifications Group 210—Diagnostic Specifications

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

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NOTE:

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

Have any questions please write to me: admin@servicemanualperfect.com

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Group 000 Safety

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

Recognize Safety Information

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

Follow recommended precautions and safe operating practices.



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

Work in Clean Area

Before starting a job:

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



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.

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.

Handle fuel with care: it is highly flammable. Do not refuel the machine while smoking or when near open flame or

Always stop engine before refueling machine. Fill fuel

Prevent fires by keeping machine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.

Handle Fuel Safely—Avoid Fires

sparks.

tank outdoors.



01-000-2



DX,FIRE1 -19-03MAR93-1/1

PN=10



DX.DRAIN -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.



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

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.



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

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.



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 in English from Deere & Company Medical Department in



Moline, Illinois, U.S.A., by calling 1-800-822-8262 or +1 309-748-5636.

DX,FLUID -19-20AUG09-1/1

Use Proper Lifting Equipment

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

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



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

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.



Live With Safety

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

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,LIVE -19-25SEP92-1/1



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

Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)



Protect Against Noise

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.



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

Remove Paint Before Welding or Heating

Avoid potentially toxic fumes and dust.

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

Remove paint before heating:

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

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



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

Dispose of paint and solvent properly.

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

Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep tractor master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

Wear close fitting clothing. Stop the engine and be sure that PTO driveline is stopped before making adjustments, connections, or cleaning out PTO driven equipment.

Do not install any adapter device between the tractor and the primary implement PTO drive shaft that will allow a 1000 rpm tractor shaft to power a 540 rpm implement at speeds higher than 540 rpm.

Do not install any adapter device that results in a portion of the rotating implement shaft, tractor shaft, or the adapter to be unguarded. The tractor master shield shall overlap the end of the splined shaft and the added adaptor device as outlined in the table.

PTO Type	Diameter	Splines	n ± 5 mm (0.20 in.)
1	35 mm (1.378 in.)	6	85 mm (3.35 in.)
2	35 mm (1.378 in.)	21	85 mm (3.35 in.)
3	45 mm (1.772 in.)	20	100 mm (4.00 in.)



DX,PTO -19-30JUN10-1/1

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.



CTM400 (29AUG11)

Follow Safety Instructions

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this operator's manual.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.



If you do not understand any part of this manual and need assistance, contact your John Deere dealer.

DX,READ -19-16JUN09-1/1

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.

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.





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.



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

Understand Signal Words

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

ADANGER AWARNING ACAUTION

Replace Safety Signs

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

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 $16^{\circ}C$ ($60^{\circ}F$).

Spray from high pressure nozzles can penetrate the skin and cause serious injury. Keep spray from contacting hands or body.

If an accident occurs, see a doctor immediately. Any high pressure spray 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.

Avoid Heating Near Pressurized Fluid Lines

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

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

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.

Wait Before Opening High-Pressure Fuel System

High-pressure fluid remaining in fuel lines can cause serious injury. Only technicians familiar with this type of system should perform repairs. Before disconnecting fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system, wait a minimum of 15 minutes after engine is stopped.

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

Handle Agricultural Chemicals Safely

Chemicals used in agricultural applications such as fungicides, herbicides, insecticides, pesticides, rodenticides, and fertilizers can be harmful to your health or the environment if not used carefully.

Always follow all label directions for effective, safe, and legal use of agricultural chemicals.

Reduce risk of exposure and injury:

- Wear appropriate personal protective equipment as recommended by the manufacturer. In the absence of manufacturer's instructions, follow these general guidelines:
 - Chemicals labeled 'Danger': Most toxic. Generally require use of goggles, respirator, gloves, and skin protection.
 - Chemicals labeled 'Warning': Less toxic. Generally require use of goggles, gloves, and skin protections.
 - Chemicals labeled 'Caution': Least toxic. Generally require use of gloves and skin protection.
- Avoid inhaling vapor, aerosol or dust.
- Always have soap, water, and towel available when working with chemicals. If chemical contacts skin, hands, or face, wash immediately with soap and water. If chemical gets into eyes, flush immediately with water.
- Wash hands and face after using chemicals and before eating, drinking, smoking, or urination.
- Do not smoke or eat while applying chemicals.
- After handling chemicals, always bathe or shower and change clothes. Wash clothing before wearing again.
- Seek medical attention immediately if illness occurs during or shortly after use of chemicals.
- Keep chemicals in original containers. Do not transfer chemicals to unmarked containers or to containers used for food or drink.

 Always dispose of containers properly. Triple rinse empty containers and puncture or crush containers and dispose of properly.

DX,WW,CHEM01 -19-24AUG10-1/1

Handling Batteries Safely

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 grounded clamp last.

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

Avoid hazards by:

- Filling batteries in a well-ventilated area
- Wearing eye protection and rubber gloves
- Avoiding use of air pressure to clean batteries
- Avoiding breathing fumes when electrolyte is added
- Avoiding spilling or dripping electrolyte
- Using correct battery booster or charger procedure.

If acid is spilled on skin or in eyes:

- 1. Flush skin with water.
- 2. Apply baking soda or lime to help neutralize the acid.
- 3. Flush 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 qt.).
- 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.**

Install All Guards

Rotating cooling system fans, belts, pulleys, and drives can cause serious injury.

Keep all guards in place at all times during engine operation.

Wear close-fitting clothes. Stop the engine and be sure fans, belts, pulleys, and drives are stopped before making adjustments, connections, or cleaning near fans and their drive components.

Avoid Hot Exhaust

Servicing machine or attachments with engine running can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.

Exhaust parts and streams become very hot during operation. Exhaust gases and components reach temperatures hot enough to burn people, ignite, or melt common materials.

DX,EXHAUST -19-20AUG09-1/1