

Product: John Deere Series 220 Diesel Engines Service Repair Technical Manual

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# John Deere Series 220 Diesel Engines

## COMPONENT TECHNICAL MANUAL

John Deere  
Lawn & Grounds Care Division

**CTM3 (10AUG93)**

**Replaces CTM3 (28NOV89)**

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Litho in U.S.A.

## FOREWORD

0-diesel-engines-service-repair-technical-manual/

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.

Use this component technical manual in conjunction with the machine technical manual. An application listing in the Specifications and General Information section 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 organized so that all the information on a particular engine is kept together in a single section.

Information in each section 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, other materials needed to do the job and service parts kits. All specifications, wear tolerances, and torque values appear at the beginning of each section.

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.

## JOHN DEERE DEALERS

**IMPORTANT: The changes listed below make your current CTM obsolete. Discard CTM3, dated 28 NOV 89. Please remove this page and route through your service department.**

- The format or “style” of the book has been changed. The familiar “modular” layout has been replaced by a two-column “floating text” format. Also, a heavy emphasis on the use of “exploded” line art, to illustrate specific yet “simple” procedures, is used.
- The layout of the book also changed. It has been completely reorganized to cover a different engine “family” in its own section, similar to how a Technical manual is layed out, using sections and groups.
  - Sections 1 through 4 cover engine service. This includes; engine teardown, diagnosis, checks, tests, adjustments and operational tests.
  - Section 10 covers removal/installation and repair of accessories, primarily on Series 220 OEM Power Unit engines.
  - Section 20 covers Theory of Operation of the various engine systems.
  - Section 21 covers Electrical System component location and schematics for Series 220 OEM Power Unit engines.
- Turbocharger analysis, inspection and repair information has been added. See Accessories - Series 220 Power Unit Engines.
- Information/model designation for Series 220 engines (3009, 3011, 3014 and 4019) have been added wherever applicable.
- Engine application charts have been updated to include the latest product models. See Specifications and General Information section.
- The book’s title. The title was changed from “3TN and 4TN Series Yanmar Diesel Engines” to “John Deere 220 Series Diesel Engines”, to include information pertaining to the OEM Stand-alone power packs.
- A safety section, fuels, lubricants and coolant information and an alphabetical index have also been added.
- A nominal or “standard” specification has been added and listed with the “wear limit” specification.

## ABOUT THIS MANUAL

This Component Technical Manual (CTM3) covers the recommended repair and adjustment procedures for the following engines:

- 3 and 4TN Series Diesel Engines used in John Deere Lawn and Grounds Care and small Industrial products.
- Series 220 Diesel Engines offered as OEM units. Three different configurations are available: Base industrial engine, industrial power unit or a generator drive unit.

Before beginning repair of an engine, clean the engine and mount on a repair stand.

This manual contains SI Metric units of measure, followed immediately by the U.S. customary units of measure.

Direction of engine crankshaft rotation in this manual is referenced facing the flywheel looking toward the water pump. Front of engine is water pump end.

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

Read each story completely before performing service to check engine model differences in procedure or specifications.

Each section will be identified with a symbol, letter or a number.

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.

**Safety****S****Specifications and General Information****G****3TN66, 3TNA72 (3009)****1****3TN75, 3TN78, 3TNC78 (3011),  
3TN82, 3TNA82, 3TN84 (3014)****2****4TN78T, 4TN82, 4TN84(T) (4019)****3****4TN100****4****Accessories - Series 220  
Power Unit Engines****10****Engine, Air Intake and  
Fuel System****20****Electrical System - Series 220  
Power Unit Engines****21**

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# Introduction

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**RECOGNIZE SAFETY INFORMATION**

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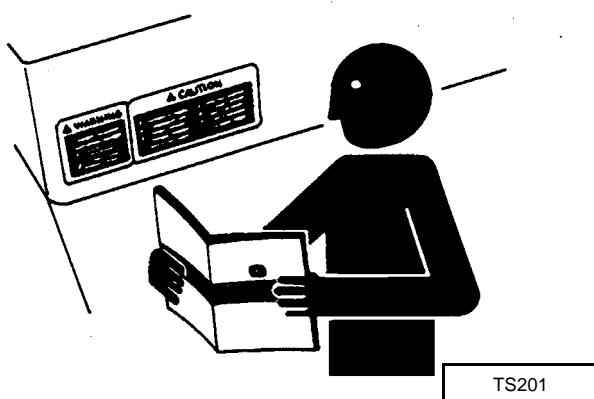
This is the safety-alert symbol. When you see this symbol on your engine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe servicing practices.

**Understand Signal Words**

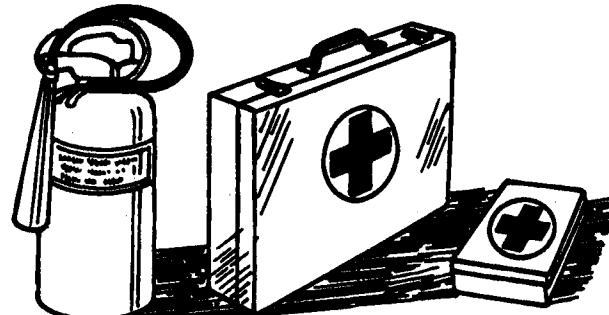
A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

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.

**REPLACE SAFETY SIGNS**

TS201

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

**HANDLE FLUIDS SAFELY-AVOID FIRES****Be Prepared For Emergencies**

TS291



TS227

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 engine is clean of trash, grease, and debris.

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

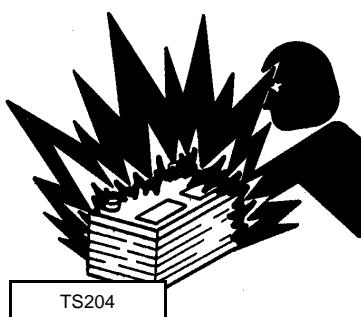
Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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

# Safety

## USE CARE IN HANDLING AND SERVICING BATTERIES



TS204



TS203

### 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).

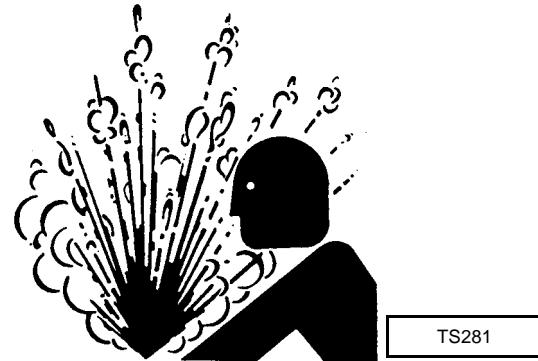
### Prevent Acid Burns

- 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 acid burns 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.
  4. 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 1.9 L (2 quarts).
3. Get medical attention immediately.

## SERVICE COOLING SYSTEM SAFELY



TS281

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.

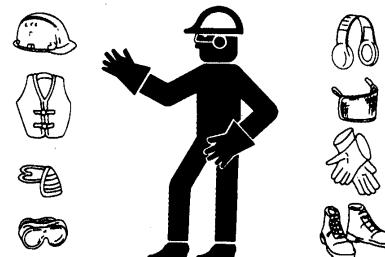
## USE SAFE SERVICE PROCEDURES

### 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 engine.

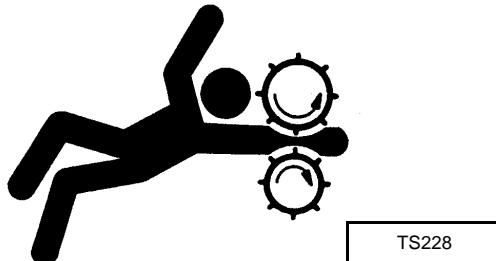


TS206

## Service Engines 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.

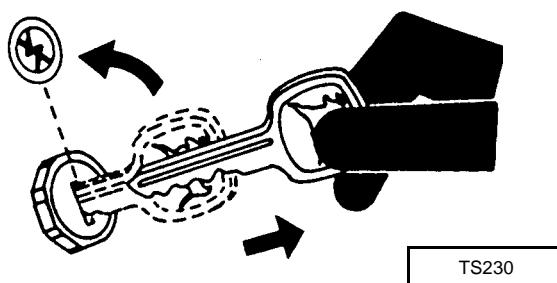
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



## Use Proper Tools

Use tools appropriate to the work. Makeshift tools 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. Use only service parts meeting John Deere specifications.

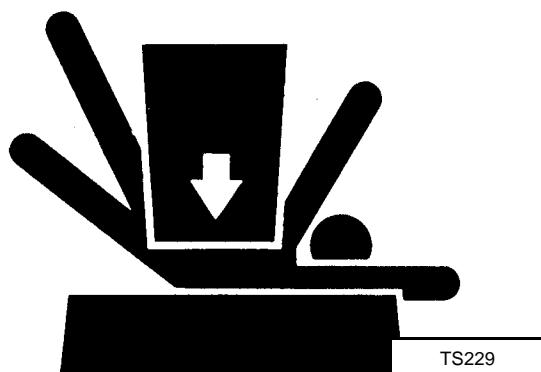
## Shut Down Engine



### • Before working on the engine:

1. Stop the engine and remove the key.
2. Disconnect the battery ground strap.
3. Hang a "DO NOT OPERATE" tag on the instrument panel.

## Support Engine Properly and Use Proper Lifting Equipment



If you must work on a lifted engine, securely support the engine.

Do not support the engine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under an engine that is supported solely by a jack. Follow recommended procedures in this manual.

Lifting heavy components incorrectly can cause severe injury or engine damage. Follow recommended procedure for removal and installation of components in the manual.

## Work In A Clean Area

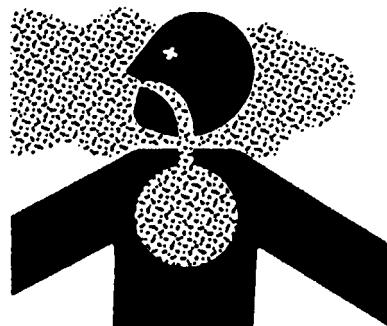
### • Before starting a job:

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

## Illuminate Your Work Area Safely

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

## Work In A Ventilated Area



TS220

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.

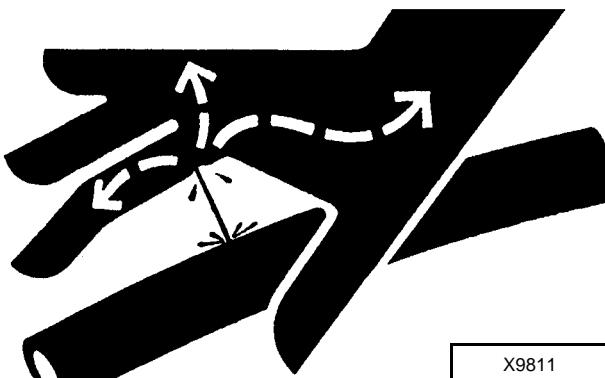
If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

## 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.

## USE CARE AROUND HIGH-PRESSURE FLUID LINES

### Avoid High-Pressure Fluids



X9811

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.

## Avoid Heating Near Pressurized Fluid Lines



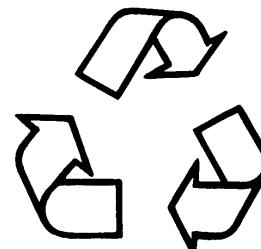
TS953

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.

## HANDLE CHEMICAL PRODUCTS SAFELY



TS1132



TS1133

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.

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

### **LIVE WITH SAFETY**



TS231

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



# **SPECIFICATIONS AND GENERAL INFORMATION**

General Information . . . . .	1
Engine Specifications . . . . .	4
Fuels, Lubricants and Coolant. . . . .	8
Repair Information . . . . .	15

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## ENGINE SERIAL NUMBER PLATE

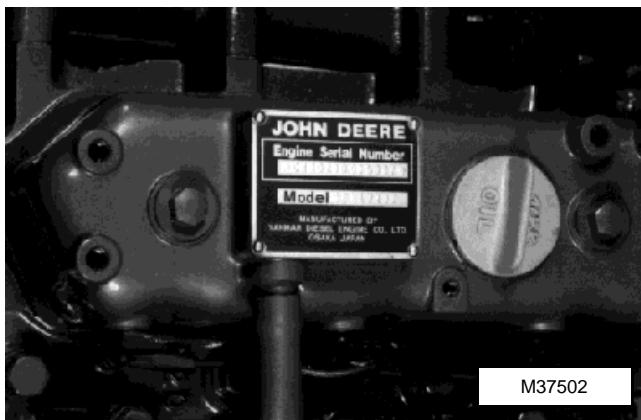
*NOTE: The engine serial number plate can be easily destroyed. Before "hot tank" cleaning the block, remove the plate or record the information elsewhere.*

### Location

All except 4TN100: The engine serial number plate is located on the rocker arm cover.

4TN100: The engine serial number plate is located on the side of the engine, under exhaust manifold.

Refer to the engine model designation on your engine's serial number plate to identify as to which section to use for repair information.



### Engine Serial Number Information

Each engine has a 13-digit John Deere engine serial number identifying the producing factory, engine model designation, and a 6-digit sequential number. The following are examples:

#### 3TN and 4TN Series Engines

**CH3029D000000**

CH..... Factory producing engine (Yanmar)  
3029D..... Engine model designation  
000000..... Sequential serial number

#### Series 220 OEM Engines

**CH3009D000000**

CH..... Factory producing engine  
3009D..... Engine model designation  
000000..... Sequential serial number

### Factory Code

CH..... Yanmar

### Engine Model Designation

3009D..... Definition explained following. (See "Engine Model Designation".)

### Sequential Number

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

### Engine Model Designation - 3TN and 4TN Series Engines

John Deere engine model designation includes number of cylinders, usage, engine type, bore diameter, fuel injection (type) and application. For example:

#### 3TNA72UJK Engine

3..... Number of cylinders  
T..... Usage (tractor)  
NA..... Engine type  
72..... Bore diameter  
U..... Fuel Injection (Type)  
JK..... Application

#### Engine Type

NA..... Diesel  
G..... Gasoline

#### Fuel Injection (Type)

U..... Indirect injection  
R..... Direct injection

#### Application

JK..... John Deere  
E-SP..... Export - Sperry Company

# General Information

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## Engine Model Designation -Series 220 OEM Engines

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

### 3009DF001 Engine

3 ..... Number of cylinders  
0.9 ..... Liter designation  
D ..... Aspiration code  
F0 ..... User code  
01 ..... Application code

#### Aspiration Code

D ..... Naturally aspirated  
T ..... Turbocharged

#### User Code

F0 ..... OEM

#### Application Code

01 ..... Bare industrial engine  
05 ..... Industrial power pack  
06 ..... Gen set power pack

## ENGINE APPLICATION CHART - LAWN AND GROUNDS CARE EQUIPMENT

### Machine Model No.

### Engine Model

#### LAWN AND GARDEN TRACTORS

330	3TN66UJ
332	3TN66UJ
430	3TNA72UJ*
455	3TNA72UJ3

#### FRONT MOWERS

F915	3TN66UJ
F925	3TNA72UJ
F935	3TNA72UJ
F1145	3TN75RJ

#### COMPACT UTILITY TRACTORS

655	3TN66UJ
670	3TNA72UJK
755	3TNA72UJ
770	3TNA82RJK
855	3TN75RJ
870	3TN84RJK
955	3TN84UJ
970	4TN82RJK
1070	4TN84RJK

#### SKID STEER LOADERS

375	3TN66E-SP
575	3TN82E-SP
675	4TN82E-SP

#### GOLF AND TURF

756 Compact Utility Tractor	3TNA72UJ
856 Compact Utility Tractor	3TN75RJ
3325 Professional Turf Mower	4TN82RJE
3365 Professional Turf Mower	4TN82RJE

\* 430 Lawn and Garden Tractors were built with two slightly different versions of 3TNA72UJ engines. In this manual, 3TNA72UJ engines, Serial Numbers ( - 5000), are referred to as "Early 3TNA72". Engines with Serial Numbers (5001 - ) are referred to as "Later 3TNA72".

**ENGINE APPLICATION CHART - INDUSTRIAL EQUIPMENT**

<b>Machine Model No.</b>	<b>Engine Model</b>
EXCAVATORS	
15 .....	3TNA72UJB
25 .....	3TN78RJB
30 .....	3TN82RJB
50 .....	4TN78TRJB
LOADERS	
84 .....	4TN100RJF
244E .....	4TN100LFB

**G****ENGINE APPLICATION CHART - OEM APPLICATION**

<b>Machine Model No.</b>	<b>Engine Model</b>
3009 .....	3TNA72
3011 .....	3TNC78
3014 .....	3TN84
4019D .....	4TN84
4019T .....	4TN84T

# General Engine Specifications

## BASIC ENGINE SPECIFICATIONS

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GENERAL	UNIT OF MEASURE	3TN66	3TNA72 (3009)	3TN75	3TN78
Number of Cylinders	----	3	3	3	3
Bore	mm (in.)	66 (2.60)	72 (2.83)	75 (2.95)	78 (3.07)
Stroke	mm (in.)	64.2 (2.53)	72 (2.83)	75 (2.95)	86 (3.39)
Displacement	L (cu in.)	0.658 (40.15)	0.879 (53.64)	0.994 (60.70)	1.232 (75.20)
Compression Ratio	----	23:1	22.3:1	17.8:1	17.75:1
Horsepower*	kW (hp)	10.4 - 12.7 (14 - 17)	12.7 - 16.4 (17 - 22)	17.9 (24)	17 (23)
Firing Order	----	1-3-2	1-3-2	1-3-2	1-3-2
Combustion System	----	Indirect Injection	Indirect Injection	Direct Injection	Direct Injection
Aspiration	----	Natural	Natural	Natural	Natural
Weight (dry)	kg (lbs)	85 (187)	118 (260)	160 (353)	123 (271)
Starter	----	Hitachi 0.8 kW	Nippondenso 1.0 kW (Hitachi 0.8 kW on 3009)	Nippondenso 1.0 kW	Hitachi 2.0 kW
Alternator	----	Kokosan 20A, Nippondenso 35 or 40A	Kokosan 20A, Nippondenso 35 or 40A	Nippondenso 35 or 40A	Hitachi 25A

\* Engine horsepower will vary by application. Refer to machine technical manual or operator's manual for specific engine horsepower.

# General Engine Specifications

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GENERAL	UNIT OF MEASURE	3TNC78 (3011)	3TN82	3TNA82	3TN84 (3014)
<b>Number of Cylinders</b>	----	3	3	3	3
<b>Bore</b>	mm (in.)	78 (3.07)	82 (3.23)	82 (3.23)	84 (3.31)
<b>Stroke</b>	mm (in.)	80 (3.15)	86 (3.39)	86 (3.39)	86 (3.39)
<b>Displacement</b>	L (cu in.)	1.146 (69.90)	1.362 (83)	1.362 (83)	1.429 (87.2)
<b>Compression Ratio</b>	----	18:1	18.06:1	18.1:1	17.8:1
<b>Horsepower*</b>	kW (hp)	16.9 - 20.2 (22.7 - 27.1)	18 - 24.6 (24 - 33)	17.2 (24)	20.9 - 24.9 (28 - 33.5)
<b>Firing Order</b>	----	1-3-2	1-3-2	1-3-2	1-3-2
<b>Combustion System</b>	----	Direct Injection	Direct Injection	Direct Injection	Direct Injection
<b>Aspiration</b>	----	Natural	Natural	Natural	Natural
<b>Weight (dry)</b>	kg (lbs)	160 (353)	190 (419)	190 (419)	153 (337)
<b>Starter</b>	----	Nippondenso 1.0 kW	Hitachi 2.0 kW, Nippondenso 1.4 kW	Nippondenso 1.0 or 1.2 kW	Nippondenso 1.0 or 1.2 kW
<b>Alternator</b>	----	Nippondenso 40A	Hitachi 25A, Nippondenso 35 or 40A	Kokosan 20A, Nippondenso 35A	Kokosan 20A, Nippondenso 35 or 40A

\* Engine horsepower will vary by application. Refer to machine technical manual or operator's manual for specific engine horsepower.

# General Engine Specifications

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GENERAL	UNIT OF MEASURE	4TN78T	4TN82	4TN84 (4019D)	4TN84T (4019T)
<b>Number of Cylinders</b>	----	4	4	4	4
<b>Bore</b>	mm (in.)	78 (3.07)	82 (3.23)	84 (3.31)	84 (3.31)
<b>Stroke</b>	mm (in.)	86 (3.39)	86 (3.39)	86 (3.39)	86 (3.39)
<b>Displacement</b>	L (cu in.)	1.643 (100)	1.816 (110.8)	1.906 (116.3)	1.906 (116.3)
<b>Compression Ratio</b>	----	17.75:1	18.1:1	17.8:1	17.8:1
<b>Horsepower*</b>	kW (hp)	29 (39)	24.6 - 28 (33 - 38)	28.1 - 33.4 (37.7 - 44.8)	34.4 - 40.3 (46.1 - 54)
<b>Firing Order</b>	----	1-3-4-2-1	1-3-4-2-1	1-3-4-2-1	1-3-4-2-1
<b>Combustion System</b>	----	Direct Injection	Direct Injection	Direct Injection	Direct Injection
<b>Aspiration</b>	----	Turbocharged	Natural	Natural	Turbocharged
<b>Weight (dry)</b>	kg (lbs)	230 (507)	220 (485)	194 (428)	199 (439)
<b>Starter</b>	----	Hitachi 0.8 kW	Nippondenso 1.0 or 1.4 kW, Hitachi 2.0 kW	Nippondenso 1.0 or 1.4 kW	Nippondenso 1.4 kW
<b>Alternator</b>	----	Hitachi 25A	Kokosan 20A, Nippondenso 35 or 40A	Kokosan 20A, Nippondenso 40A	Nippondenso 40A

\* Engine horsepower will vary by application. Refer to machine technical manual or operator's manual for specific engine horsepower.

# General Engine Specifications

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GENERAL	UNIT OF MEASURE	4TN100
<b>Number of Cylinders</b>	----	4
<b>Bore</b>	mm (in.)	100 (3.90)
<b>Stroke</b>	mm (in.)	110 (4.30)
<b>Displacement</b>	L (cu in.)	3.5 (211)
<b>Compression Ratio</b>	----	N/A
<b>Horsepower*</b>	kW (hp)	38.8 - 44 (52 - 59)
<b>Firing Order</b>	----	1-3-4-2-1
<b>Combustion System</b>	----	Direct Injection
<b>Aspiration</b>	----	Natural or Turbocharged
<b>Weight (dry)</b>	kg (lbs)	332 (731)
<b>Starter</b>	----	Nippondenso 1.4 kW
<b>Alternator</b>	----	Hitachi 25A

- \* Engine horsepower will vary by application. Refer to machine technical manual or operator's manual for specific engine horsepower.

## 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.

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

**IMPORTANT: If fuel sulfur content exceeds 0.5 percent, 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.

## 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. Use SAE 10W 30.**

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:

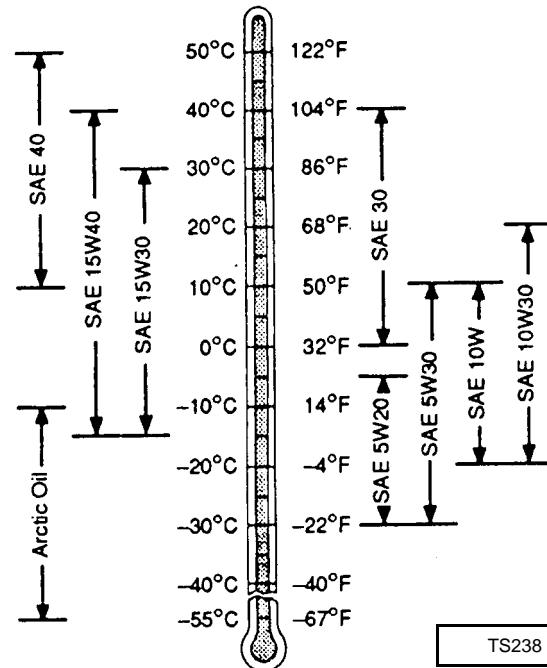
- API Service Classification CE or CD
- Military Specification MIL-L-2104E or MIL-L-2104D or MIL-L-2104C

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.



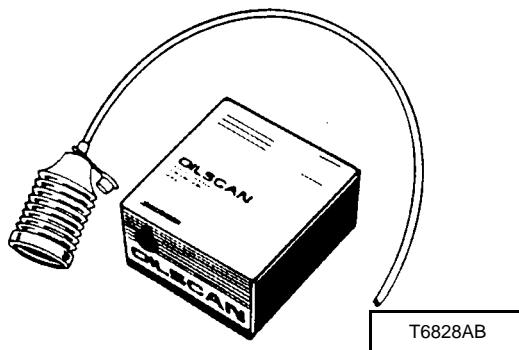
TS238

## OILSCAN® AND COOLSCAN™

OILSCAN and COOLSCAN are John Deere sampling programs to help you monitor machine performance and identify potential problems before they cause serious damage.

Oil and coolant samples should be taken from each system prior to its recommended change interval.

Check with your John Deere dealer for the availability of OILSCAN and COOLSCAN kits.



## GREASE

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

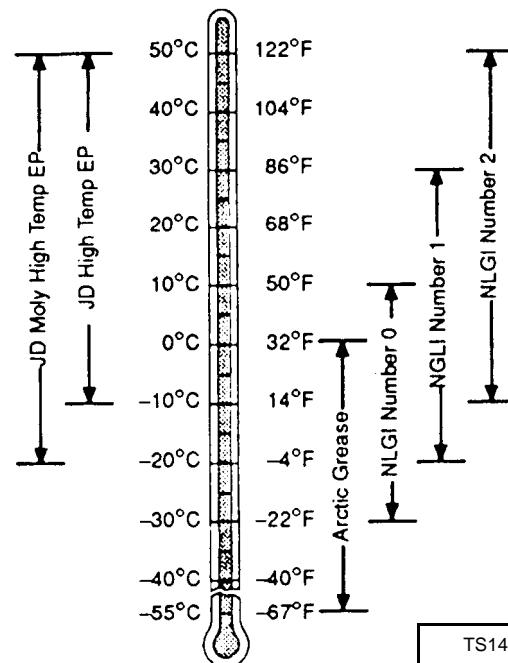
The following greases are preferred:

- John Deere MOLY HIGH TEMPERATURE EP GREASE
- John Deere HIGH TEMPERATURE EP GREASE
- John Deere GREASE-GARD™

Other greases may be used if they meet one of the following:

- SAE Multipurpose EP Grease with a maximum of 5% molybdenum disulfide
- SAE Multipurpose EP Grease

Grease meeting Military Specification MIL-G-10294F may be used as arctic grease.



TS1417

## 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.**

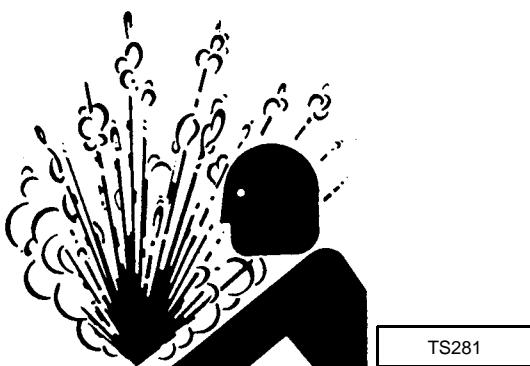
- Always maintain engine coolant at correct level.
- Coolant make-up should be mixed at same concentrations as original coolant, including inhibitors.

- In tropical areas where antifreeze of 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°C (-35°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 it is without dilution or mixing. John Deere Low Silicate Antifreeze is concentrated and should be mixed minimum 40% - maximum 60% antifreeze and distilled to deionized water. Consult your John Deere Parts Network for local availability.



## **ENGINE COOLANT SPECIFICATIONS**

### **Water Quality**

Distilled, de-ionized, or soft water is preferred for use in cooling systems. Mineral (hard/tap) water should NEVER be put in a cooling system unless first tested. However, water that meets the following water quality specifications is acceptable.

### **Water Quality Specifications**

Item	Parts Per Million	Grains Per Gallon
Chlorides (maximum) . . . . .	40	2.5
Sulfates (maximum) . . . . .	100	5.9
Total Dissolved Solids (maximum) . . . . .	340	20
Total Hardness (maximum) . . . . .	170	10
pH Level . . . . .		5.5 - 9.0

If Chlorides, Sulfates, or Total Dissolved Solids are higher than the above given specifications, the water must be distilled, de-mineralized, or de-ionized before using in cooling system.

If Total Hardness is higher than the above given specification, and all other parameters are within the given specifications, the water must be softened before using in cooling system.

### **Ethylene Glycol Concentrate (Antifreeze)**

**IMPORTANT: DO NOT use methyl alcohol or methoxy propanol base concentrate. This concentrate is not compatible with additives used in supplemental coolant additives. Damage can occur to rubber seals on cylinder liners which are in contact with coolant.**

**DO NOT use ethylene glycol concentrate sealer or stop-leak additives.**

**DO NOT use concentrate containing less than 10% ethylene glycol.**

**DO NOT use concentrate containing more than 0.1% anhydrous metasilicate. This type of concentrate, which is intended for use in aluminum engines, may cause a gel-like deposit to form that reduces heat transfer and coolant flow. Check container label or consult with supplier before using.**

John Deere Low Silicate Antifreeze is the ethylene glycol concentrate recommended for all John Deere Diesel Engines. This product is concentrated and should be mixed 50/50 with quality water. Add to the mixture 3% (by volume) supplemental coolant additives (SCA's).

John Deere Low Silicate Antifreeze is available in the following sizes:

- TY6377 - 208 L (55 U.S. Gal) container
- TY15886 - 3.8 L (1 U.S. Gal) container

Contact your John Deere Parts Network for local availability.

If John Deere Low Silicate Antifreeze is not available, use an ethylene glycol concentrate meeting ASTM D 4985, SAEJ1941, General Motors Performance Specification GM1899M, or formulated to GM6038M.

## Supplemental Coolant Additives (SCA's)

**IMPORTANT: Ethylene glycol concentrate (antifreeze) DOES NOT contain sufficient additives to prevent liner erosion or pitting which could occur in wet sleeve diesel engines. ALWAYS mix the coolant solution with a supplemental coolant additive such as John Deere Liquid Coolant Conditioner or spin-on coolant filter conditioner element.**

## CAUTION

**John Deere Liquid Coolant Conditioner contains alkali. Avoid contact with eyes. Avoid prolonged or repeated contact with skin. Do not take internally. In case of contact, immediately wash skin with soap and water. For eyes, flush with large amounts of water for at least 15 minutes. Call physician. KEEP OUT OF REACH OF CHILDREN.**

- John Deere Liquid Coolant Conditioner

**IMPORTANT: ALWAYS mix the 50/50 solution of ethylene glycol concentrate with quality water in a separate container BEFORE adding the SCA's. Then add solution to the radiator. NEVER pour cold water into a hot engine, as it may crack cylinder block or head.**

John Deere Liquid Coolant Conditioner MUST be added at a rate of 3% (by volume) to the coolant solution. When adding John Deere Liquid Coolant Conditioner, follow the supplier's recommendations printed on the container.

John Deere Liquid Coolant Conditioner is available in the following sizes:

- RE23182 473 mL (16 oz) container
- RE35992 3.8 L (1 gal) container

Contact your John Deere Parts Network for availability.

Other approved SCA's are:

- NALCOOL 3000®
- FLEETGARD®-DCA008-78L DCA2 in 473 mL (16 oz) container
- FLEETGARD®-DCA60-78L DCA4 in 473 mL (16 oz) container

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

**G** **DO NOT over-concentrate coolant solutions with supplemental coolant additives, as this can cause silicate-dropout. When this happens, a gel-type deposit is created which retards heat transfer and coolant flow. DO NOT use soluble oil.**

## JOHN DEERE ENGINE COOLING FLUID

In certain regions of the world, John Deere Engine Cooling Fluid is marketed for use in the engine cooling system. John Deere Cooling Fluid is premixed and contains the proper mixture of quality water, low silicate antifreeze to protect the engine from freezing down to -37°C (-35°F), and supplemental coolant additives (SCA's).

**IMPORTANT: Additional SCA's should NOT be added to the Cooling Fluid.**

John Deere Engine Cooling Fluid is available in the following sizes:

- AL66606 (formally DD14134) - 5 L (1.3 U.S. Gal) can
- AL66607 (formally DD14345) - 20 L (5.3 U.S. Gal) can
- AL67171 (formally DD14136) - 60 L (15.9 U.S. Gal) drum
- AL66608 (formally DD14346) 200 L (53 U.S. Gal) drum

Contact your John Deere Parts Network for local availability.

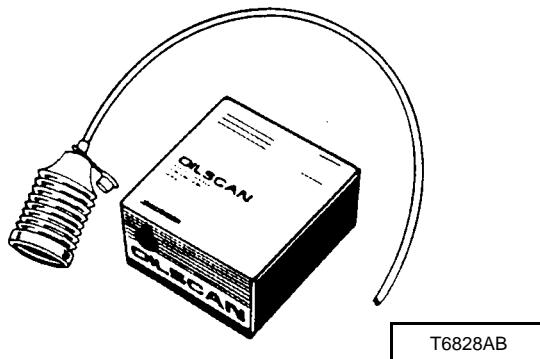
## CHECK EFFECTIVENESS OF COOLANT SOLUTION

Prior to the recommended change interval or if concentration of coolant solution is in question, a coolant sample should be taken and a COOLSCAN analysis performed.

COOLSCAN is a John Deere sampling program to help you monitor the effectiveness of your engine's coolant solution and identify potential problems before they cause serious damage.

Check with your John Deere dealer for the availability of DS0251 COOLSCAN kit. Refer to instructions provided with kit.

Usually recharging your engine coolant with the recommended amount of John Deere Liquid Coolant Conditioner at the appropriate time is adequate. However, with a COOLSCAN analysis report, you will be given a more thorough evaluation of your engine coolant condition along with a detailed service recommendation.



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## REPLENISHING SUPPLEMENTAL COOLANT ADDITIVES (SCA'S) BETWEEN COOLANT CHANGES

Through time and use, original additives eventually lose their effectiveness and must be recharged with additional supplemental coolant additives available in the form of liquid coolant conditioner.

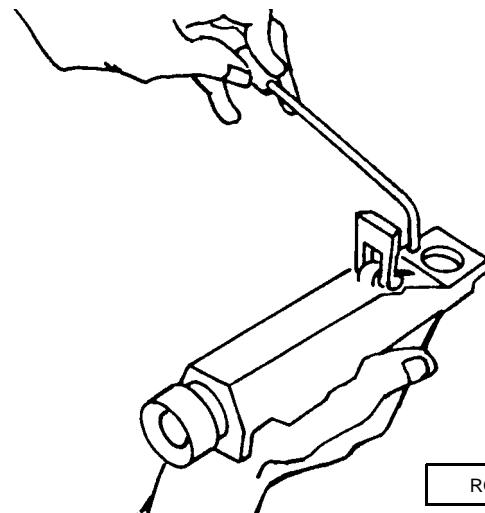
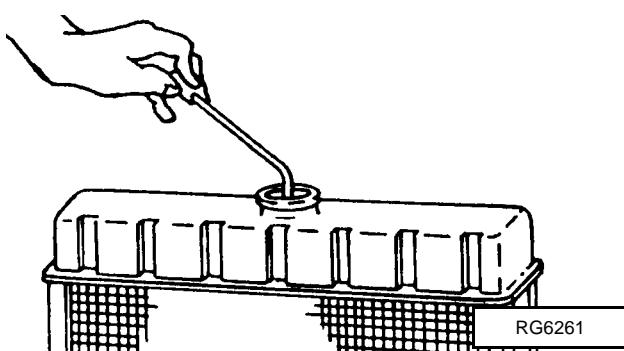
*NOTE: Service intervals listed are a recommended engineering guideline. Refer to your vehicle operator's manual for a specific service interval.*

At 600 hours or 1 year service interval, it is recommended to perform a COOLSCAN analysis as described earlier. If COOLSCAN analysis is not available, recharge system per instructions printed on bottle.

**IMPORTANT: DO NOT CHANGE** the spin-on filter element at the 600 hour or 1 year service interval. If the filter is replaced at this time, the result could be an overcharged system. This could cause "solder bloom" in the radiator because the over concentration of nitrite will attack the solder. Replace the filter only if the entire cooling system is drained and coolant replaced.

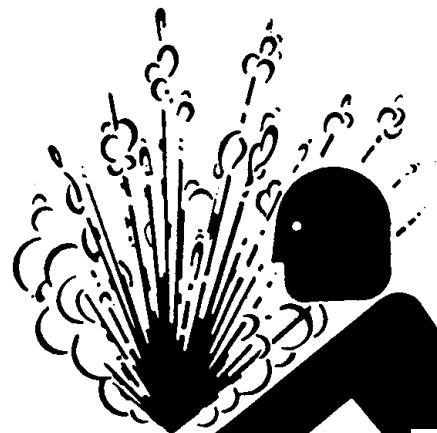
**IMPORTANT: ALWAYS** maintain coolant at correct level and concentration. DO NOT operate engine without coolant for even a few minutes.

If frequent coolant make-up is required, the glycol concentration should be checked with JT05460 Refractometer to assure that the desired freeze point is maintained. Follow manufacturer's instructions provided with refractometer.



See ENGINE COOLANT SPECIFICATIONS earlier in this group for proper mixing of coolant ingredients before adding to the cooling system.

## FLUSHING AND SERVICING COOLING SYSTEM



TS281

## 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.

# Fuels, Lubricants and Coolant

**IMPORTANT: Air must be expelled from cooling system when system is refilled. Follow procedure given in your operator's manual.**

**G**

**Engine coolant MUST BE drained and replaced at a maximum of 1200 hours or 2 years of engine operating time, whichever comes first.**

The ethylene glycol base (antifreeze) can become depleted of SCA's allowing various acids to form that will damage engine components. In addition, heavy metals, such as lead, copper and zinc, accumulate in the ethylene glycol base. The heavy metals come from corrosion that occurs to some degree within a cooling system. When a coolant is saturated to the point where it can no longer hold heavy metals and other dissolved solids, they settle out and act as abrasives on engine parts.

***NOTE: Service intervals listed are a recommended engineering guideline. Refer to your vehicle operator's manual for a specific service interval.***

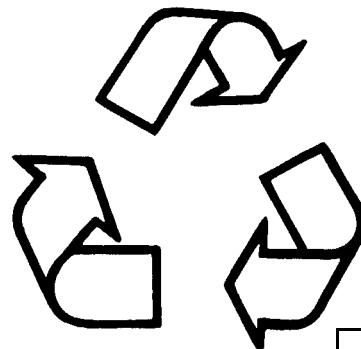
At 1200 hours/2-year service interval, flush cooling system and replace thermostats as described in your operator's manual. Clean cooling system with a heavy duty cooling system cleaner such as FLEETGARD® RESTORE™. Follow the instructions provided with cleaner. Refill cooling system with the appropriate coolant solution. See ENGINE COOLANT SPECIFICATIONS, earlier in this group.

**IMPORTANT: NEVER overflow the system. A pressurized system needs space for heat expansion without overflowing at the top of the radiator. Coolant level should be approximately 19 mm (3/4 in.) below bottom of radiator filler neck.**

After adding new coolant solution, run engine until it reaches operating temperature. This mixes the coolant solution uniformly and circulates it through the entire system. After running engine, check coolant level and entire cooling system for leaks.

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

## DISPOSING OF COOLANT



TS1133

Improperly disposing of coolant can threaten the environment and ecology.

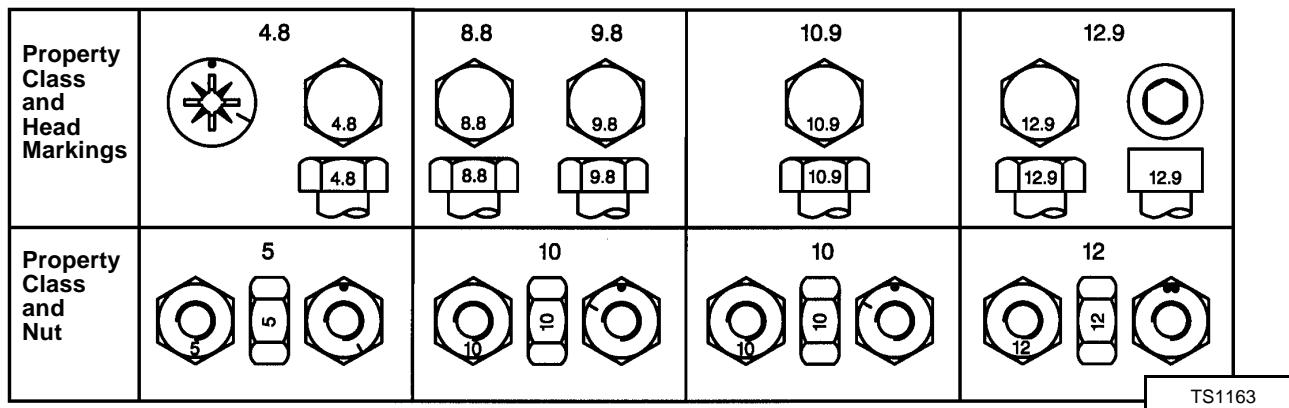
Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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

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

*FLEETGARD® is a registered trademark of the Cummins Engine Company.  
RESTORE™ is a registered trademark of FLEETGARD®.*

## METRIC BOLT AND CAP SCREW TORQUE VALUES



Property Class and Head Markings:

4.8	4.8	8.8	9.8	10.9	12.9

Property Class and Nut:

5	10	10	12

TS1163

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

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

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

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original. Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

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

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

# Repair Information

Product: John Deere Series 220 Diesel Engines Service Repair Technical Manual

## UNIFIED INCH BOLT AND CAP SCREW TORQUE VALUES

G

SAE Grade and Head Markings	No Marks	1 or 2 <sup>b</sup> 	5  5.1  5.2 	8  8.2 
SAE Grade and Nut Marking	No Marks	2 	5  5 	8  8 

TS1162

Size	Grade 1		Grade 2 <sup>b</sup>		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
	Lubricated <sup>a</sup>	Dry <sup>a</sup>						
1/4	3.7	2.8	4.7	3.5	6	4.5	7.5	5.5
5/16	7.7	5.5	10	7	12	9	15	11
3/8	14	10	17	13	22	16	27	20
7/16	22	16	28	20	35	26	44	32
1/2	33	25	42	31	53	39	67	50
9/16	48	36	60	45	75	56	95	70
5/8	67	50	85	62	105	78	135	100
3/4	120	87	150	110	190	140	240	175
7/8	190	140	240	175	190	140	240	175
1	290	210	360	270	290	210	360	270
1-1/8	470	300	510	375	470	300	510	375
1-1/4	570	425	725	530	570	425	725	530
1-3/8	750	550	950	700	750	550	950	700
1-1/2	1000	725	1250	925	990	725	1250	930

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

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

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original. Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

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

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

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

Sample of manual. Download All 718 pages at:

<https://www.arepairmanual.com/downloads/john-deere-series-220-diesel-engines-service-repair-technical-manual/>