John Deere Series 220 Diesel Engines

COMPONENT TECHNICAL MANUAL

John Deere
Lawn & Grounds Care Division

CTM3 (10AUG93)

Replaces CTM3 (28NOV89)

Litho in U.S.A.

FOREWORD

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

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

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 The familiar "modular" layout has been replaced by a two-column "floating text" format.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.

RECOGNIZE SAFETY INFORMATION

T81389

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.

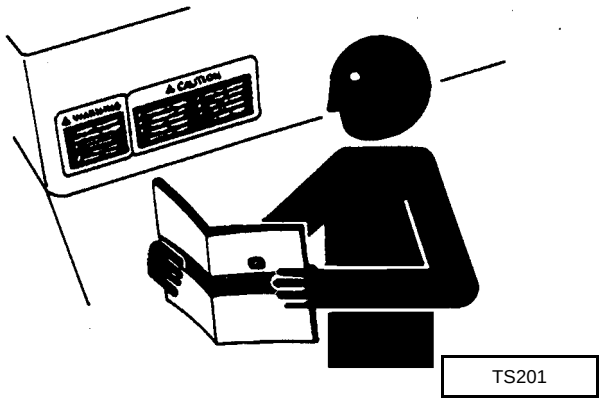
Follow recommended precautions and safe servicing practices.

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

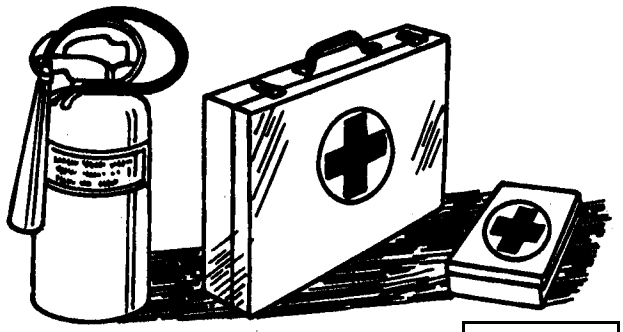


TS201

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.

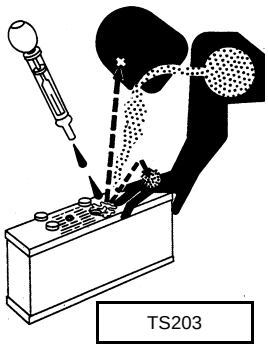
Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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

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.

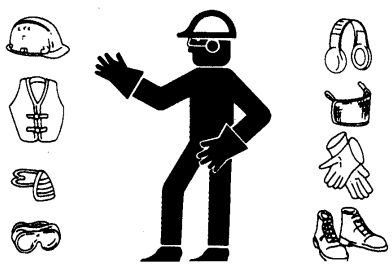
USE SAFE SERVICE PROCEDURES

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.

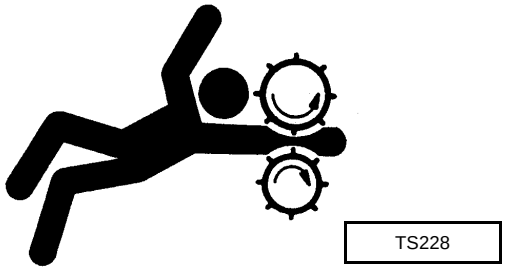
Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating engine.


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.

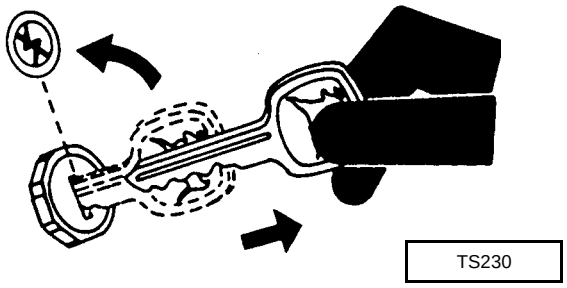
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



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.

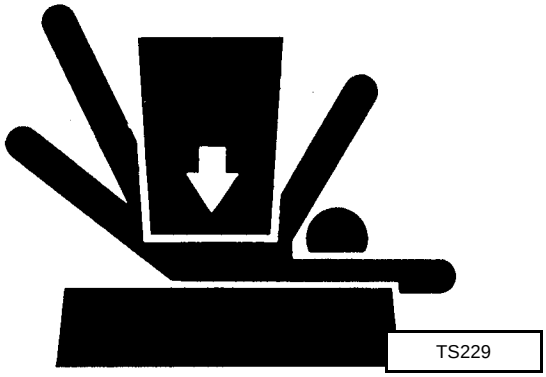
Shut Down Engine



- **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:**

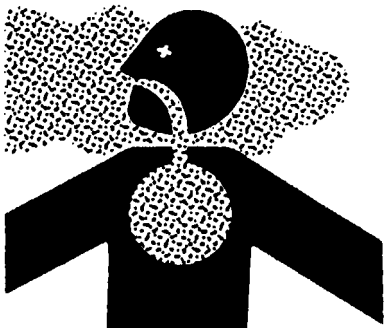
1. Clean work area and engine.
2. Make sure you have all necessary tools to do your job.
3. Have the right parts on hand.
4. Read all instructions thoroughly; do not attempt shortcuts.

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.

S

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.

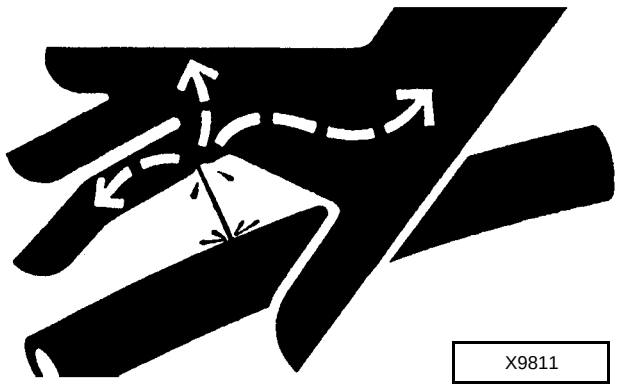
If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

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

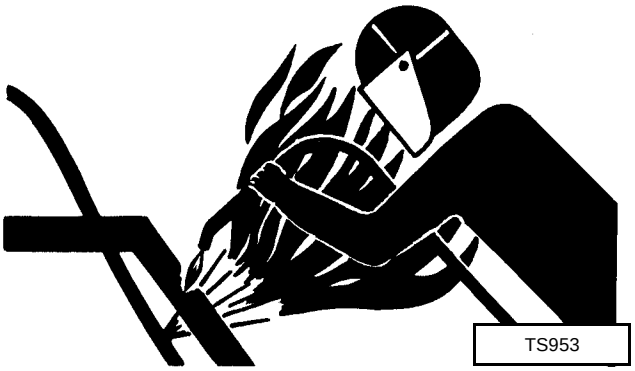
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

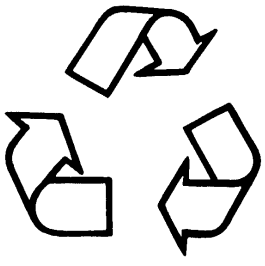


TS953

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

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

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

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

ENGINE APPLICATION CHART - OEM APPLICATION

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

BASIC ENGINE SPECIFICATIONS

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	UNIT OF MEASURE	3TNC78 (3011)	3TN82	3TNA82	3TN84 (3014)
Number of Cylinders	----	3	3	3	3
Bore	mm (in.)	78 (3.07)	82 (3.23)	82 (3.23)	84 (3.31)
Stroke	mm (in.)	80 (3.15)	86 (3.39)	86 (3.39)	86 (3.39)
Displacement	L (cu in.)	1.146 (69.90)	1.362 (83)	1.362 (83)	1.429 (87.2)
Compression Ratio	----	18:1	18.06:1	18.1:1	17.8:1
Horsepower*	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)
Firing Order	----	1-3-2	1-3-2	1-3-2	1-3-2
Combustion System	----	Direct Injection	Direct Injection	Direct Injection	Direct Injection
Aspiration	----	Natural	Natural	Natural	Natural
Weight (dry)	kg (lbs)	160 (353)	190 (419)	190 (419)	153 (337)
Starter	----	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
Alternator	----	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	UNIT OF MEASURE	4TN78T	4TN82	4TN84 (4019D)	4TN84T (4019T)
Number of Cylinders	----	4	4	4	4
Bore	mm (in.)	78 (3.07)	82 (3.23)	84 (3.31)	84 (3.31)
Stroke	mm (in.)	86 (3.39)	86 (3.39)	86 (3.39)	86 (3.39)
Displacement	L (cu in.)	1.643 (100)	1.816 (110.8)	1.906 (116.3)	1.906 (116.3)
Compression Ratio	----	17.75:1	18.1:1	17.8:1	17.8:1
Horsepower*	kW (hp)	29 (39)	24.6 - 28 (33 - 38)	28.1 - 33.4 (37.7 - 44.8)	34.4 - 40.3 (46.1 - 54)
Firing Order	----	1-3-4-2-1	1-3-4-2-1	1-3-4-2-1	1-3-4-2-1
Combustion System	----	Direct Injection	Direct Injection	Direct Injection	Direct Injection
Aspiration	----	Turbocharged	Natural	Natural	Turbocharged
Weight (dry)	kg (lbs)	230 (507)	220 (485)	194 (428)	199 (439)
Starter	----	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
Alternator	----	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.