

John Deere K Series Liquid-cooled Engines

COMPONENT TECHNICAL MANUAL

**John Deere
Lawn & Grounds Care Division
CTM39 (Oct93)
Replaces CTM39 (28JAN91)**

**John Deere K Series
Liquid Cooled Engines**

CTM39 (Oct93)



This component technical manual is written for an experienced technician. It covers recommended repair procedures, starting with the engine removed from the machine and on a workbench or engine stand. Some components may be serviced in the machine. Determine the repair procedure before removing the engine. Use this manual in conjunction with the machine technical manual. It is a part of a total product support program. Use the Fundamental Of Service (FOS) manual as reference for fundamentals of service and basic theory of operation.

The manual is organized so that all the information on a particular system is kept together. The order of grouping is as follows:

- Table of Contents
- Safety
- Specifications
- Theory of Operation
- Repair

Note: Depending on the particular section or system being covered, not all of the above groups may be used.

Each section will be identified with a symbol rather than a number. The pages within a section will be consecutively numbered.

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.

We appreciate your input on this manual. To help, there are postage paid post cards included at the back. If you find any errors or want to comment on the layout of the manual please fill out one of the cards and mail it back to us.

Safety



Specifications and Information



Intake, Muffler & Breather



Fuel System & Governor



Cylinder Head & Valves



Cylinder Block, Pistons & Rods



Camshaft, Crankshaft & Flywheel



Lubrication System



Cooling System



Electrical System



Troubleshooting



Component Analysis



Miscellaneous



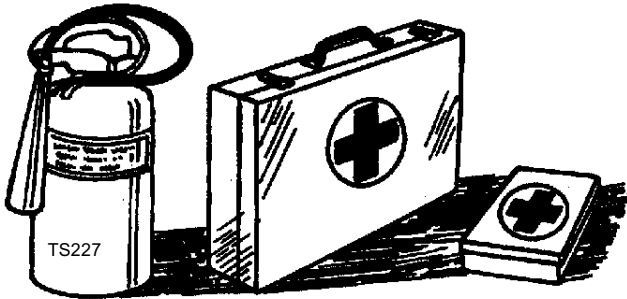
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SAFETY



HANDLE FLUIDS SAFELY-AVOID FIRES

- BE PREPARED FOR EMERGENCIES



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.

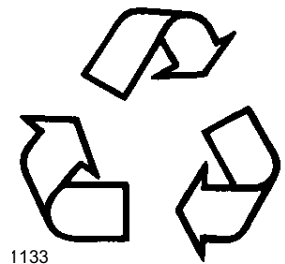
Do not store oily rags; they can ignite and burn spontaneously.

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.

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.

- DISPOSE OF WASTE PROPERLY

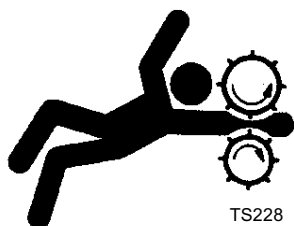
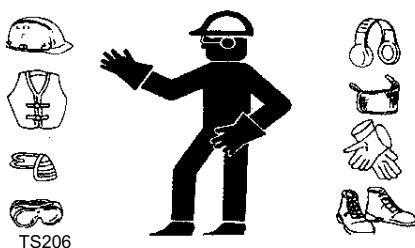
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries. Use leakproof containers when draining fluids. Do not use food or beverage containers that may 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.

USE SAFE SERVICE PROCEDURES

• WEAR PROTECTIVE CLOTHING

Wear close fitting clothing and safety equipment appropriate for 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.



• 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.

• 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.

• WORK IN CLEAN AREA

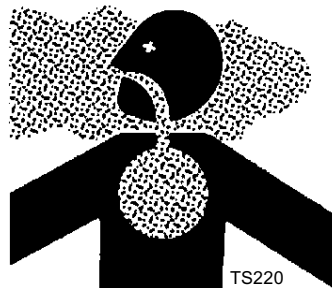
• Before starting a job

1. Clean work area and machine:
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 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.

• 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.

**Thanks very much for your reading,
Want to get more information,
Please click here, Then get the complete
manual**

JustClickHere 

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**

SAFETY



• 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.

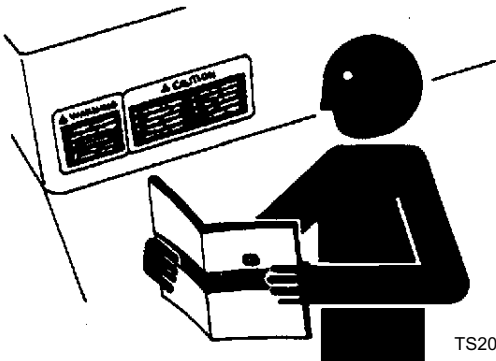
• AVOID HARMFUL ASBESTOS DUST

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

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

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

REPLACE SAFETY SIGNS



TS201

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

LIVE WITH SAFETY

TS231



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

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BASIC ENGINE SPECIFICATIONS

ENGINE	FD440V AS00	FD501V AS00	FD590V- AS00/02	FD590V- AS03	FD620D AS04/11	FD620D AS02	FD620D AS00/01
HORSEPOWER	11.1 kW (15 HP)	12.6kW (17 HP)	13.4 kW (18 HP)	14.9kW(20 HP)	13.4 kW (18 HP)	14.9kW (20 HP)	16.4 kW (22 HP)
CYLINDER	2	2	2	2	2	2	2
CYCLE	4	4	4	4	4	4	4
BORE	67 mm (2.64 in.)	67 mm (2.64 in.)	74 mm (2.90 in.)	74 mm (2.90 in.)	76 mm (2.99 in.)	76 mm (2.99 in.)	76 mm (2.99 in.)
STROKE	62 mm (2.44 in.)	62 mm (2.44 in.)	68 mm (2.66 in.)	68 mm (2.66 in.)	68 mm (2.66 in.)	68 mm (2.66 in.)	68 mm (2.66 in.)
DISPLACEMENT	437 cm ³ (26.7 cu. in.)	437 cm ³ (26.7 cu. in.)	585 cm ³ (35.7 cu. in.)	585 cm ³ (35.7 cu. in.)	617 cm ³ (35.7 cu. in.)	617 cm ³ (35.7 cu. in.)	617 cm ³ (35.7 cu. in.)



ENGINE APPLICATIONS

NOTE: Refer to the engine application chart to identify product-model/engine type-model relationship.

Lawn Tractors

Machine Engine Model No.

LX178.....	FD440V - AS00
LX188.....	FD501V - AS00

Lawn And Garden Tractors

285 Standard.....	FD590V - AS00
285 w/Fuel Injection.....	FD590V - AS01
320.....	FD590V - AS00
425.....	FD620D - AS02
445.....	FD620D - AS01

Front Mowers

F911.....	FD620D - AS00
F725.....	FD590V - AS03

Golf And Turf Equipment

1800 Utility Vehicle.....	FD620D - AS04
2243 Professional Greensmower.....	FD590V - AS02
2653 Professional Utility Mower.....	FD620D - AS04
6X4 Gator Utility Vehicles.....	FD620D - AS11

SPECIFICATIONS & INFORMATION

ENGINE MODEL CONFIGURATION CHANGES



FD590V

The following is a list of the major differences between the model configurations of the FD590V-AS00 through the FD590V-AS03.

- The FD590V-AS00 is the first configuration used and its first application was in the 285 Lawn and Garden Tractor.
- FD590V-AS01 was converted to a electronic fuel injection system. The carburetor was replaced by a throttle body and a water temperature sensor was added.
- FD590V-AS02 engine is used in the 2243 Triplex Professional Greensmower.
- FD590V-AS03 is used in the F725 Front Mower. The power was increased from 18 to 20 horsepower. To obtain the higher horsepower the following components were changed:
 - A larger redesigned intake manifold
 - The cylinder head induction passage and combustion chamber was redesigned.
 - A larger carburetor is used.

NOTE: The FD440V, FD501V and FD590V are vertical shaft engines. The FD620D is a horizontal shaft engine.

FD620D

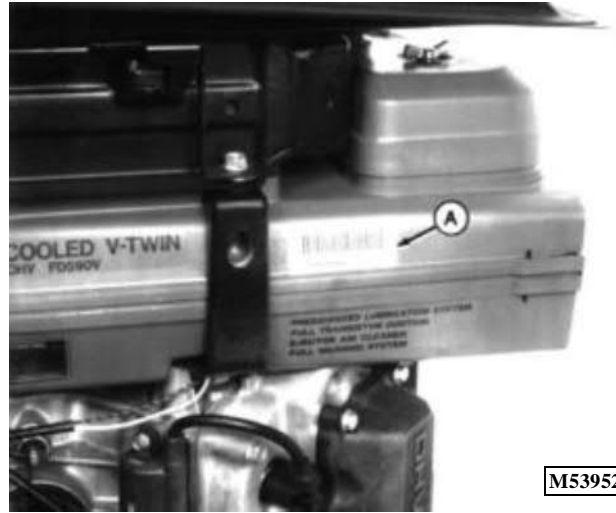
The differences in horsepower are due to the following:

- rpm that the engine must run for the application.
- the efficiencies of fuel injection on the FD620 - AS01.

ENGINE SERIAL NUMBER PLATE LOCATIONS

NOTE: Refer to the engine model designation on the engine serial number plate to identify repair information covered in the Component Technical Manual

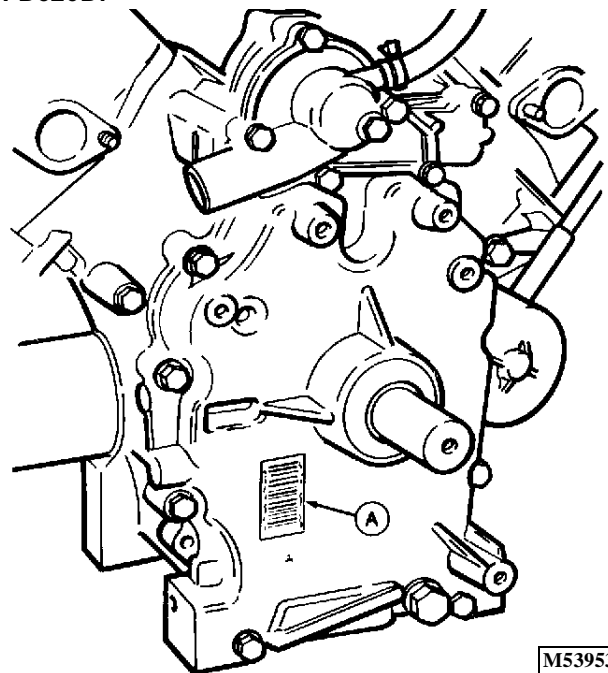
FD440V/FD501V/FD590V:



M53952

The engine serial number (A) is located on the side of the cooling air duct.

FD620D:



M53953

The engine serial number (A) is located on the crankcase cover.

CARBURETOR SERIAL NUMBER LOCATIONS

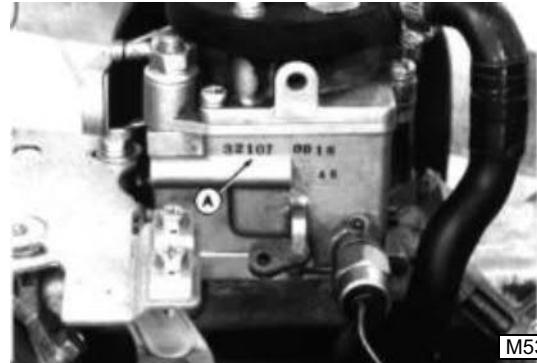
FD440V/FD501V/FD590V:



M53957

The carburetor serial number (A) is located on the top of carburetor.

FD620D:



M53958

The carburetor serial number (A) is located on the side of carburetor.



TEST & ADJUSTMENT SPECIFICATIONS

Engine:

- Oil pressure sensor activates 98 kPa (14.2 psi)
- Oil pressure (minimum) 276 kPa (40 psi)
- Oil filter bypass valve opening pressure 78.5—117.5 kPa (11.4—17.1 psi)
- Cylinder compression pressure (minimum) 1171 kPa (170 psi)
- Maximum compression pressure variation between cylinders 138 kPa (20 psi)
- Crankcase vacuum (minimum) 25 mm (1 in.) water
- Intake and exhaust valve clearance (cold) 0.25 mm (0.01 in.)
- Intake and exhaust valve adjustment interval 300 hrs.
- Valve clearance adjusting nut torque 9 N•m (79 lb-in)

Fuel/Air System:

Fuel Pump

- Minimum flow 105 ml (3.5 oz) in 15 seconds
- Minimum pressure 10 kPa (1.5 psi)
- Carburetor SLOW idle mixture screw initial setting 1 Turn
- Carburetor SLOW idle stop screw setting 50 rpm less than throttle control arm SLOW idle stop screw setting
- Throttle Cable Throttle control arm SLOW idle stop screw setting 1175+25 / -50 rpm
- Throttle control arm FAST idle stop screw setting 3650 ± 75 rpm
- Air Restriction Indicator
 - Normal restriction vacuum 102—178 mm (4—7 in.)
 - Maximum restriction vacuum 381 mm (15 in.)

Fuel Tank

- Check valve opening pressure (maximum) 3 kPa (0.4 psi)

Cooling System:

Radiator cap

- Maximum test pressure 117 kPa (17 psi)
- Minimum pressure after 15 seconds 90 kPa (13 psi)
- Opening pressure 83—96 kPa (12—14 psi)
- Minimum pressure 76 kPa (11 psi)

Thermostat

- Begin-to-open temperature approximately 63°C (145°F)
- Full-open temperature approximately 80°C (176°F)
- Full-closed temperature approximately 63°C (145°F)

REPAIR SPECIFICACATIONS

FD440V/501V



Crankcase

Oil Capacity

With Filter	1.7 L (3.59 pt)
Without Filter	1.5 L (3.20 pt)
Cover Cap Screw Torque	21 N•m (186 lb-in.)
Drain Plug Torque	23 N•m (204 lb-in.)

Fuel System

Carburetor Nut Torque	8 N•m (71 lb-in.)
Intake Manifold Cap Screw Torque	8 N•m (71 lb-in.)
Fuel Pump Push Rod Maximum Bend	0.05 mm (0.002 in.)

CYLINDER HEAD AND VALVES

Valve Clearance	0.15 mm (0.006 in.)
Rocker Arm	
Minimum Shaft O.D.	11.95 mm (0.470 in.)
Maximum Bearing I.D.	12.07 mm (0.475 in.)
Adjusting Nut Torque	9 N•m (79 lb-in.)
Push Rod Maximum Bend	0.80 mm (0.031 in.)
Valves and Springs	
Minimum Valve Spring Free Length	27.30 mm (1.074 in.)
Minimum Valve Stem O.D.	
Intake	4.93 mm (0.194 in.)
Exhaust	4.92 mm (0.193 in.)
Maximum Valve Guide I.D.	5.06 mm (0.199 in.)
Maximum Valve Stem Bend	0.03 mm (0.001 in.)
Standard Valve Seating Surface	0.80 mm (0.031 in.)
Valve Seating Width Tolerance	0.50 - 1.10 mm (0.020 - 0.043 in.)
Valve Seat and Face Angle	45°
Minimum Valve Margin	0.50 mm (0.020 in.)
Valve Narrowing Angle	30°

Cylinder Head

Maximum Cylinder Head Flatness	0.06 mm (0.002 in.)
Cap Screw Torque In Sequence (Lubricated)	
Initial Torque	13 N•m (115 lb-in.)
Final Torque	21 N•m (186 lb-in.)
Spark Plug Torque	17 N•m (150 lb-in.)

FLYWHEEL

Flywheel Nut Torque	90 N•m (66 lb-ft)
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CAMSHAFT AND TAPPETS

Camshaft

Minimum End Journals O.D.	13.91 mm (0.548 in.)
Minimum Lobe O.D.	24.43 mm (0.962 in.)
Minimum Fuel Pump Lobe Height	19.50 mm (0.760 in.)
Maximum Cover Bearing I.D.	14.05 mm (0.553 in.)
Maximum Crankcase Bearing I.D.	14.07 mm (0.554 in.)

PISTON, CONNECTING ROD AND CRANKSHAFT

Piston

Maximum Ring Groove Clearance

Top Ring	0.10 mm (0.004 in.)
Oil Ring	Not Measured

Maximum Ring End Gap

Top Ring	1.0 mm (0.040 in.)
Oil Ring	Not Measured
Minimum Pin O.D.	15.98 mm (0.629 in.)
Maximum Pin Bore I.D.	16.04 mm (0.631 in.)

Distance from bottom of piston skirt

Height of piston O.D. measurement	13.5 mm (0.531 in.)
Piston O.D.	66.950 - 66.965 mm (2.6358 - 2.6364 in.)
Piston-to-Cylinder Bore Clearance.	0.015 - 0.150 mm (0.00059 - 0.0059 in.)

Connecting Rod

Maximum Crankshaft Bearing I.D.	31.06 mm (1.223 in.)
Maximum Piston Pin Bearing I.D.	16.05 mm (0.632 in.)
End-Cap Screw Torque	12 N•m (106 lb-in.)

Crankshaft

Minimum Side Journal O.D.	29.92 mm (1.178 in.)
Minimum Connecting Rod Journal.	30.93 mm (1.218 in.)
Maximum T.I.R. (Total Indicated Runout)	0.05 mm (0.002 in.)

Plain Bearings

Maximum Crankcase and Cover I.D.	30.09 mm (1.185 in.)
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CYLINDER BLOCK

Cylinder Bore

Standard I.D.	66.98 - 67.00 mm (2.637 - 2.638 in.)
Maximum I.D.	67.06 mm (2.640 in.)

Rebore Cylinder

Oversize Diameter	
0.50 mm	67.46 - 67.48 mm (2.656 - 2.657 in.)

LUBRICATION SYSTEM

Oil Pump

Minimum Rotor Shaft O.D.	10.92 mm (0.430 in.)
Maximum Rotor Shaft Bearing I.D.	11.07 mm (0.436 in.)
Minimum Outer Rotor O.D.	40.43 mm (1.592 in.)
Maximum Outer Rotor Bearing I.D.	40.80 mm (1.606 in.)
Minimum Valve Spring Free Length	19 mm (0.748 in.)

GOVERNOR

Governor Arm Nut Torque	8 N•m (72 lb-in.)
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IGNITION AND CHARGING SYSTEM

See Ignition and Charging Specifications in this Group.



ELECTRIC STARTER

See this group for continuity checks.

- Minimum Brush Length 6 mm (0.240 in.)
- Maximum No Load Starter Draw 50 amps at 6000 rpm (min)



COOLING SYSTEM

- Engine Coolant Capacity 2.10 L (2.2 qt)

Thermostat

- Begin Opening Temperature 82°C (180°F)
- Fully Open Temperature. 95°C (203°F)

Water Pump

- Minimum Shaft O.D. 9.94 mm (0.391 in.)
- Maximum Pump and Crankcase Housing Bore I.D. 10.09 mm (0.397 in.)
- Cap Screw Torque 8 N•m (70 lb-in.)
- Crankcase Cover Cap Screw Torque 21 N•m (186 lb-in.)

Over-flow Reservoir

- Mounting Cap Screw Torque 4 N•m (31 lb-in.)

FD590V

Crankcase

Oil Capacity	2.1 L (4.44 pt)
Cover Cap Screw Torque	21 N•m (186 lb-in.)
Drain Plug Torque	23 N•m (204 lb-in.)



FUEL SYSTEM

Carburetor Nut Torque	
(M6)	8 N•m (71 lb-in.)
(M8)	15 N•m (133 lb-in.)

Intake Manifold

Cap Screw Torque	6 N•m (53 lb-in.)
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Fuel Pump

Push Rod Maximum Bend	0.05 mm (0.002 in.)
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CYLINDER HEAD AND VALVES

Valve Clearance	0.25 mm (0.010 in.)
Rocker Arm	
Minimum Shaft O.D.	11.95 mm (0.470 in.)
Maximum Bearing I.D.	12.07 mm (0.475 in.)
Adjusting Nut Torque	9 N•m (79 lb-in.)
Push Rod	
Maximum Bend	0.80 mm (0.031 in.)
Valves and Springs	
Minimum Spring Free Length	29.70 mm (1.170 in.)
Minimum Valve Stem O.D.	
Intake	5.94 mm (0.234 in.)
Exhaust	5.92 mm (0.233 in.)
Maximum Valve Guide I.D.	6.05 mm (0.238 in.)
Maximum Valve Stem Bend	0.03 mm (0.001 in.)
Standard Valve Seating Surface	0.80 mm (0.031 in.)
Valve Seating Width Tolerance.	0.50 - 1.10 mm (0.020 - 0.043 in.)
Valve Seat and Face Angle	45°
Minimum Valve Margin	0.60 mm (0.024 in.)
Valve Narrowing Angle	30°

Cylinder Head

Maximum Cylinder Head Flatness	0.06 mm (0.002 in.)
Cap Screw Torque In Sequence (Lubricated)	
Initial Torque	13 N•m (115 lb-in.)
Final Torque	21 N•m (186 lb-in.)
Spark Plug Torque	20 N•m (177 lb-in.)

FLYWHEEL

Flywheel Nut Torque	98 - 118 N•m (72 - 87 lb-ft)
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CAMSHAFT AND TAPPETS

Camshaft



Minimum End Journals O.D.	15.91 mm (0.626 in.)
Minimum Lobe O.D.	25.23 mm (0.993 in.)
Minimum Fuel Pump Lobe Height	19.50 mm (0.760 in.)
Maximum Cover and Crankcase Bearing I.D.	16.07 mm (0.633 in.)

PISTON, CONNECTING ROD, AND CRANKSHAFT

Piston

Maximum Ring Groove Clearance Top and Second Ring	0.10 mm (0.004 in.)
Oil Ring Not Measured	
Maximum Ring End Gap	1.00 mm (0.040 in.)
Minimum Pin O.D.	16.98 mm (0.668 in.)
Maximum Pin Bore I.D.	17.04 mm (0.671 in.)
Distance from bottom of piston skirt Height of piston O.D. measurement	11 mm (0.433 in.)
Piston O.D.	73.935 - 73.950 mm (2.9108 - 2.9114 in.)
Piston-to-Cylinder Bore Clearance.	0.030 - 0.170 mm (0.00118 - 0.00670 in.)

Connecting Rod

Maximum Crankshaft Bearing I.D.	34.06 mm (1.341 in.)
Maximum Piston Pin Bearing I.D.	17.05 mm (0.671 in.)
End-Cap Screw Torque	21 N•m (186 lb-in.)

Crankshaft

Minimum Side Journal O.D.	33.91 mm (1.335 in.)
Minimum Connecting Rod Journal.	33.93 mm (1.336 in.)
Maximum T.I.R.	0.05 mm (0.002 in.)

Plain Bearings

Maximum Crankcase and Cover I.D	34.07 mm (1.341 in.)
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CYLINDER BLOCK

Cylinder Bore

Standard I.D.	73.98 - 74.00 mm (2.915 - 2.916 in.)
Maximum I.D.	74.07 mm (2.918 in.)

Rebore Cylinder

Oversize Diameter 0.50 mm	74.46 - 74.48 mm (2.934 - 2.935 in.)
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LUBRICATION SYSTEM

Oil Pump

Minimum Rotor Shaft O.D.	10.92 mm (0.430 in.)
Maximum Rotor Shaft Bearing I.D.	11.07 mm (0.436 in.)
Minimum Outer Rotor O.D.	40.43 mm (1.592 in.)
Maximum Outer Rotor Bearing I.D.	40.80 mm (1.606 in.)
Minimum Valve Spring Free Length	19.50 mm (0.770 in.)

GOVERNOR

Governor Arm Nut Torque 8 N•m (72 lb-in.)

IGNITION AND CHARGING SYSTEM

See Ignition and Charging Specifications in this Group.



ELECTRIC STARTER

See this group for continuity checks.

Minimum Brush Length 6 mm (0.240 in.)
Maximum No Load Starter Draw 30 amps at 6000 rpm (min)

COOLING SYSTEM

Engine Coolant Capacity 3.04 L (3.2 qt)
Thermostat
Opening Temperature 82°C (180°F)
Fully Open Temperature 95°C (203°F)

Water Pump

Minimum Shaft O.D. 9.94 mm (0.391 in.)
Maximum Pump and Crankcase Housing Bore I.D. 10.09 mm (0.397 in.)
Cap Screw Torque 8 N•m (70 lb-in.)
Crankcase Cover Cap Screw Torque 21 N•m (186 lb-in.)

Over-flow Reservoir

Mounting Cap Screw Torque 4 N•m (31 lb-in.)

FD620D

Crankcase



Oil Capacity	1.5 L (3.2 pt)
Cover Cap Screw Torque	21 N•m (186 lb-in.)
Drain Plug Torque	23 N•m (204 lb-in.)

FUEL SYSTEM

Carburetor Mounting Nuts	17 N•m (12 lb-ft)
Intake Manifold	
Cap Screw Torque	6 N•m (53 lb-in.)

CYLINDER HEAD AND VALVES

Valve Clearance	0.25 mm (0.010 in.)
Rocker Arm	
Minimum Shaft O.D.	11.95 mm (0.470 in.)
Maximum Bearing I.D.	12.07 mm (0.475 in.)
Adjusting Nut Torque	9 N•m (79 lb-in.)
Push Rod Maximum Bend	0.80 mm (0.031 in.)
Valves and Springs	
Spring Free Length	29.70 mm (1.170 in.)
Minimum Valve Stem O.D.	
Intake	5.94 mm (0.234 in.)
Exhaust	5.92 mm (0.233 in.)
Maximum Valve Guide I.D.	6.05 mm (0.238 in.)
Maximum Valve Stem Bend	0.03 mm (0.001 in.)
Standard Valve Seating Surface	0.80 mm (0.031 in.)
Valve Seating Width Tolerance.	0.50 - 1.10 mm (0.020 - 0.043 in.)
Valve Seat and Face Angle	45°
Minimum Valve Margin.	0.60 mm (0.024 in.)
Valve Narrowing Angle.	30°

Cylinder Head

Cylinder Head Flatness	0.06 mm (0.002 in.)
Cap Screw Torque In Sequence (Lubricated)	
Initial Torque.	13 N•m (115 lb-in.)
Final Torque	21 N•m (186 lb-in.)
Spark Plug Torque	20 N•m (177 lb-in.)

FLYWHEEL

Flywheel Nut Torque	108 N•m (80 lb-ft)
Sheave Half Cap Screw Torque	15 N•m (130 lb-in.)

CAMSHAFT AND TAPPETS

Camshaft

Minimum End Journals O.D.	15.91 mm (0.626 in.)
Minimum Lobe O.D.	
Intake	25.21 mm (0.993 in.)
Exhaust	25.46 mm (1.002 in.)
Maximum Cover and Crankcase Bearing I.D.	16.07 mm (0.633 in.)

PISTON, CONNECTING, AND RODCRANKSHAFT

Piston

Maximum Ring Groove Clearance

Top Ring	0.14 mm (0.006 in.)
Second Ring.	0.12 mm (0.005 in.)
Oil Ring	Not Measured
Maximum Ring End Gap	1.20 mm (0.050 in.)
Minimum Pin O.D.	16.98 mm (0.668 in.)
Maximum Pin Bore I.D.	17.04 mm (0.671 in.)
Distance from bottom of piston skirt (Area to measure piston O.D.)	11 mm (0.433 in.)
Piston O.D.	75.935 - 75.950 mm (2.989 - 2.990 in.)
Piston-to-Cylinder Bore Clearance.	0.030 - 0.170 mm (0.00118 - 0.00670 in.)



Connecting Rod

Maximum Crankshaft Bearing I.D.	34.06 mm (1.341 in.)
Maximum Piston Pin Bearing I.D.	17.05 mm (0.671 in.)
End-Cap Screw Torque	21 N•m (186 lb-in.)

Crankshaft

Minimum Side Journal O.D.	33.91 mm (1.335 in.)
Minimum Connecting Rod Journal.	33.93 mm (1.336 in.)
Maximum T.I.R.	0.05 mm (0.002 in.)
Plain Bearings	
Maximum Crankcase Cover I.D.	34.07 mm (1.341 in.)
Maximum Crankcase I.D.	34.11 mm (1.343 in.)

CYLINDER BLOCK

Cylinder Bore

Standard I.D.	75.98 - 76.00 mm (2.994 - 2.995 in.)
Maximum I.D.	76.07 mm (2.997 in.)

Rebore Cylinder

Oversize Diameter	
0.50 mm	76.46 - 76.48 mm (3.012 - 3.013 in.)

LUBRICATION SYSTEM

Oil Pump

Minimum Rotor Shaft O.D.	10.92 mm (0.430 in.)
Maximum Rotor Shaft Bearing I.D.	11.07 mm (0.436 in.)
Minimum Outer Rotor O.D.	40.43 mm (1.592 in.)
Maximum Outer Rotor Bearing I.D.	40.80 mm (1.606 in.)
Minimum Valve Spring Free Length	19.50 mm (0.770 in.)

GOVERNOR

Governor Arm Nut Torque	8 N•m (72 lb-in.)
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IGNITION AND CHARGING SYSTEM

See Ignition and Charging Specifications in this Group.

ELECTRIC STARTER

See this group for continuity checks.

- Minimum Brush Length 6 mm (0.240 in.)
- Maximum No Load Starter Draw 30 amps at 6000 rpm (min)



COOLING SYSTEM

- Sheeve/Half Cap Screw Torque 15 N•m (130 lb-in.)

Thermostat

- Opening Temperature 65°C (148°F)
- Fully Open Temperature. 80°C (176°F)

Water Pump

- Minimum Shaft O.D. 9.94 mm (0.391 in.)
- Maximum Pump and Crankcase Housing Bore I.D. 10.09 mm (0.397 in.)
- Cap Screw Torque 8 N•m (70 lb-in.)
- Crankcase Cover Cap Screw Torque 21 N•m (186 lb-in.)

METRIC TORQUE VALUES

Property Class and Head Markings	4.8		8.8		9.8		10.9		12.9	
Property Class and Nut Markings	5		10		10		10		12	



SIZE	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated ^a		Dry ^a		Lubricated ^a		Dry ^a		Lubricated ^a		Dry ^a		Lubricated ^a		Dry ^a	
	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft
M6	48	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	109
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.

^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.

GASOLINE SPECIFICATIONS

CAUTION:

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Handle fuel with care, it is highly flammable. **DO NOT** refuel machine:

- Indoors. Always fill fuel tank outdoors.
- While you smoke.
- When machine is near and open flame or sparks.
- When engine is running. **STOP** engine.
- When engine is hot. Allow it to cool.

Help prevent fires:

- Fill fuel tank only to bottom of filler neck.
- Clean oil, grease and dirt from machine.
- Clean up spilled fuel immediately.
- Do not store machine with fuel in tank in a building where fumes may reach an open flame or spark.

To prevent fire and explosion caused by static electric discharge while you fill tank:

- Use approved, non-metal fuel container.
- When using a funnel, **MAKE SURE** it is **PLASTIC**.
- Avoid using a funnel which has a metal screen or filter.

IMPORTANT: To avoid engine damage:

DO NOT mix oil with gasoline
 Use only clean oil and fuel
 Use clean approved containers and funnels.
 Store oil and fuel in an area protected from dust, moisture and other contamination.

Unleaded fuel is recommended because it burns cleaner and leaves less unburned deposits in engine combustion chamber. Regular leaded gasoline with an anti-knock index of 87 or higher may be used. Use of gasohol is acceptable as long as the ethyl alcohol blend does not exceed 11 percent. Unleaded gasohol is preferred over leaded gasohol.

Fill fuel tank at end of each day's operation. Fill only to bottom of filler neck.

FUEL STORAGE

Keep fuel in a clean container in a protected area. Water and sediment must be removed before fuel gets to the engine. Do not use deicers to remove water from fuel. Do not depend on fuel filters to remove water.

If possible, install a water separator at the storage tank outlet.

IMPORTANT: Keep all dirt, scale, water or other foreign material out of fuel.

If vehicle is either stored or used during the winter, add TY6295 John Deere Gasoline Storage Stabilizer or an equivalent to the fuel. Follow directions on can.