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# 1001

## SAFETY RULES SERVICE MANUAL INTRODUCTION AND TORQUE SPECIFICATIONS

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English*

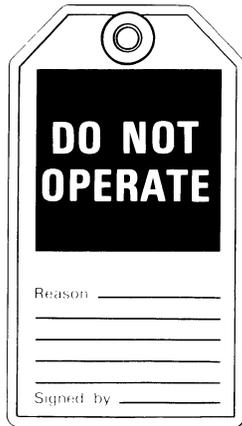
## SAFETY RULES

 **This symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED.** The message that follows the symbol contains important information about safety. Carefully read the message. Make sure you fully understand the causes of possible injury or death. 1-1-C

**NOTE:** To prevent injury on job, follow the Warning, Caution, and Danger notes in this section and other sections throughout this manual. Follow the instructions carefully.

The procedures recommended and shown in this manual are good, effective service methods. However, all possible procedures and service hazards may not be covered. Therefore, if you use a tool or procedure not recommended, you must make sure that the method you select is a safe method.

Put the warning tag shown below on the key for the key switch when you are servicing or repairing this machine. One warning tag is on every new machine. You can buy additional warning tags, part number 331-4614, from Service Parts Supply.



780449

 **WARNING:** Read operator's manual to familiarize yourself with control lever functions. 46-27

 **WARNING:** Operate tractor and equipment controls from the seat position only. Any other method could result in serious injury. 48-55

 **WARNING:** This is a one man machine, no riders allowed. 35-8

 **WARNING:** Before starting engine, study operator's manual safety messages. Read all safety signs on machine. Clear the area of other persons. Learn and practice safe use of controls before operating. It is your responsibility to understand and follow manufacturer's instructions on machine operation, service, and to observe pertinent laws and regulations. Operator's and service manuals may be obtained from your J I Case dealer. 45-2

 **WARNING:** If you wear clothing that is too loose or do not use the correct safety equipment for your job, you can be injured. Always wear clothing that will not catch on objects. Extra safety equipment that can be required includes hard hat, safety shoes, ear protection, eye or face protection, heavy gloves and reflector clothing. 45-3-A



 **WARNING:** When working in the area of the fan belt with the engine running, avoid loose clothing if possible, and use extreme caution. 35-4



**WARNING:** When doing checks and tests on the equipment hydraulics, follow the procedures as they are written. **DO NOT** change the procedure. 47-44



**WARNING:** When putting the hydraulic cylinders on this machine through the necessary cycles to check operation or to remove air from a circuit, make sure all people are out of the way. 47-45



**WARNING:** Use insulated gloves or mittens when working with hot parts. 47-41A



**CAUTION:** Lower all attachments to the ground or use stands to safely support the attachments before you do any maintenance or service. 49-11



**CAUTION:** Pin sized and smaller streams of hydraulic oil under pressure can penetrate the skin and result in serious infection. If hydraulic oil under pressure does penetrate the skin, seek medical treatment immediately. Maintain all hoses and tubes in good condition. Make sure all connections are tight. Make a replacement of any tube or hose that is damaged or thought to be damaged. **DO NOT** use your hand to check for leaks; use a piece of cardboard or wood. 40-6-A



**CAUTION:** When removing hardened pins such as a pivot pin, or a hardened shaft, use a soft head (brass or bronze) hammer or use a driver made from brass or bronze and a steel head hammer. 46-17



**CAUTION:** When using a hammer to remove and install pivot pins or separate parts, using compressed air or using a grinder, wear eye protection that completely encloses the eyes (approved goggles or other approved eye protectors). 46-13



**CAUTION:** When servicing or repairing the machine, keep the shop floor and operator's compartment and steps free of oil, water, grease, tools, etc. Use an oil absorbing material and/or shop cloths as required. Use safe practices at all times. 40-8



**CAUTION:** Use suitable floor (service) jacks or chain hoists to raise wheels or track off the floor. Always block machine in place with suitable safety stands. 40-7-A



**CAUTION:** Some components of this machine are very heavy. Use suitable lifting equipment or additional help as instructed in this service manual. 40-10



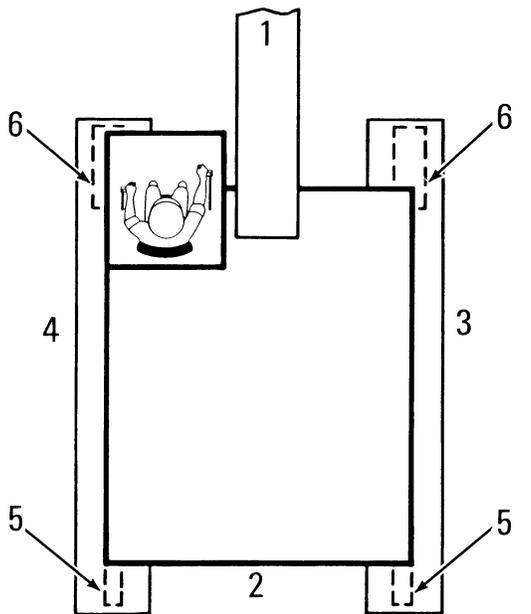
**DANGER:** Engine exhaust fumes can cause death. If it is necessary to start the engine in a closed place, remove the exhaust fumes from the area with an exhaust pipe extension. If you do not have an exhaust pipe extension, open the doors and get outside air into the area. 48-56

## SERVICE MANUAL INTRODUCTION

This service manual has been prepared with the latest service information available. Troubleshooting, removal, disassembly, inspection and installation procedures, and complete specifications and tightening references can be found in most sections. Some sections have drawings but no written procedure because the job is so easily done.

### Right, Left, Front, and Rear

The terms right-hand and left-hand and front and rear as used in this manual indicate the right and left sides, and front and rear of the machine as seen from the operator's seat for correct operation of the machine or attachment.



1. Front                      4. Left Side  
2. Rear                        5. Drive Sprocket  
3. Right Side                6. Idler Wheel

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### Table of Contents

A Table of Contents is in the front of this manual. The Table of Contents shows the main divisions and the sections that are in each division. The individual sections also have a Table of Contents.

### Page Numbers

All page numbers are made of two numbers separated by a dash, such as 4002-9. The number before the dash is the section number. The number following the dash is the page number in that section. Page numbers will be found at the upper right or left of each page.

### Illustrations

Illustrations are put as near as possible to the text and are to be used as part of the text.

### Clear and Simple English

This manual is written in C.A.S.E. (Clear and Simple English). C.A.S.E. is easier to read and understand than "regular" English because C.A.S.E. uses a small number of common words and has special rules for writing.

All sections written in C.A.S.E. are indicated by the symbol below.

Written In *Clear  
And  
Simple  
English*

### Special Tools

Special tools are needed to remove and install, disassemble and assemble, check and adjust some component parts of this machine. Some special tools can be easily made locally and the necessary information to make the tool is in this service manual. Other special tools are more difficult to make locally and are available from Service Tools in the U.S. and from Jobborn Manufacturing in Canada. Use these tools according to the instructions in this service manual for your personal safety and to do the job correctly.

Order special tools from either of the following companies.

Service Tools  
P.O. Box 314  
Owatonna, Minnesota 55060

Jobborn Manufacturing Co.  
97 Frid Street  
Hamilton, Ontario L8P 4M3  
Canada

## TORQUE SPECIFICATIONS - U.S. HARDWARE

Use the torques in this chart when special torques are not given. These torques apply to fasteners with both UNC and UNF threads as received from suppliers, dry, or when lubricated with engine oil. Not applicable if special graphites, moly-disulfide greases, or other extreme pressure lubricants are used.

<b>Grade 5 Bolts, Nuts, and Studs</b>			
			
Size	Pound-Feet	Newton metres	Kilogram metres
<b>1/4 in</b> 6.4 mm	9-11	12-15	1.2-1.5
<b>5/16 in</b> 7.9 mm	17-21	23-28	2.4-2.9
<b>3/8 in</b> 9.5 mm	35-42	48-57	4.8-5.8
<b>7/16 in</b> 11.1 mm	54-64	73-87	7.5-8.8
<b>1/2 in</b> 12.7 mm	80-96	109-130	11.1-13.3
<b>9/16 in</b> 14.3 mm	110-132	149-179	15.2-18.2
<b>5/8 in</b> 15.9 mm	150-180	203-244	20.8-24.9
<b>3/4 in</b> 19.0 mm	270-324	366-439	37.3-44.8
<b>7/8 in</b> 22.2 mm	400-480	542-651	55.3-66.4
<b>1.0 in</b> 25.4 mm	580-696	787-944	80.2-96.2
<b>1-1/8 in</b> 28.6 mm	800-880	1085-1193	111-122
<b>1-1/4 in</b> 31.8 mm	1120-1240	1519-1681	155-171
<b>1-3/8 in</b> 34.9 mm	1460-1680	1980-2278	202-232
<b>1-1/2 in</b> 38.1 mm	1940-2200	2631-2983	268-304

<b>Grade 8 Bolts, Nuts, and Studs</b>			
			
Size	Pound-Feet	Newton metres	Kilogram metres
<b>1/4 in</b> 6.4 mm	12-15	16-20	1.7-2.1
<b>5/16 in</b> 7.9 mm	24-29	33-39	3.3-4.0
<b>3/8 in</b> 9.5 mm	45-54	61-73	6.2-7.5
<b>7/16 in</b> 11.1 mm	70-84	95-114	9.7-11.6
<b>1/2 in</b> 12.7 mm	110-132	149-179	15.2-18.2
<b>9/16 in</b> 14.3 mm	160-192	217-260	22.1-26.5
<b>5/8 in</b> 15.9 mm	220-264	298-358	30.4-36.5
<b>3/4 in</b> 19.0 mm	380-456	515-618	52.5-63.0
<b>7/8 in</b> 22.2 mm	600-720	814-976	83.0-99.5
<b>1.0 in</b> 25.4 mm	900-1080	1220-1465	124-149
<b>1-1/8 in</b> 28.6 mm	1280-1440	1736-1953	177-199
<b>1-1/4 in</b> 31.8 mm	1820-2000	2468-2712	252-277
<b>1-3/8 in</b> 34.9 mm	2380-2720	3227-3688	329-376
<b>1-1/2 in</b> 38.1 mm	3160-3560	4285-4827	437-492

## TORQUE SPECIFICATIONS - STEEL HYDRAULIC FITTINGS

Tube OD Hose ID	Thread Size	Pound- Feet	Newton metres	Kilogram metres
<b>37 Degree Flare Fittings</b>				
<b>1/4 in</b> 6.4 mm	7/16-20	6-12	8-16	0.8-1.7
<b>5/16 in</b> 7.9 mm	1/2-20	8-16	11-21	1.1-2.2
<b>3/8 in</b> 9.5 mm	9/16-18	10-25	14-33	1.4-3.5
<b>1/2 in</b> 12.7 mm	3/4-16	15-42	20-56	2.1-5.8
<b>5/8 in</b> 15.9 mm	7/8-14	25-58	34-78	3.5-8.0
<b>3/4 in</b> 19.0 mm	1-1/16-12	40-80	54-108	5.5-11.1
<b>7/8 in</b> 22.2 mm	1-3/16-12	60-100	81-135	8.3-13.9
<b>1.0 in</b> 25.4 mm	1-5/16-12	75-117	102-158	10.4-16.2
<b>1-1/4 in</b> 31.8 mm	1-5/8-12	125-165	169-223	17.3-22.8
<b>1-1/2 in</b> 38.1 mm	1-7/8-12	210-250	285-338	29.0-34.6

Tube OD Hose ID	Thread Size	Pound- Feet	Newton metres	Kilogram metres
<b>Straight Threads with O-ring</b>				
<b>1/4 in</b> 6.4 mm	7/16-20	12-19	16-25	1.7-2.6
<b>5/16 in</b> 7.9 mm	1/2-20	16-25	22-33	2.2-3.5
<b>3/8 in</b> 9.5 mm	9/16-18	25-40	34-54	3.5-5.5
<b>1/2 in</b> 12.7 mm	3/4-16	42-67	57-90	5.8-9.3
<b>5/8 in</b> 15.9 mm	7/8-14	58-92	79-124	8.0-12.7
<b>3/4 in</b> 19.0 mm	1-1/16-12	80-128	108-174	11.1-17.8
<b>7/8 in</b> 22.2 mm	1-3/16-12	100-160	136-216	13.8-22.1
<b>1.0 in</b> 25.4 mm	1-5/16-12	117-187	159-253	16.2-25.9
<b>1-1/4 in</b> 31.8 mm	1-5/8-12	165-264	224-357	22.8-36.5
<b>1-1/2 in</b> 38.1 mm	1-7/8-12	250-400	339-542	34.6-55.3

<b>Split Flange Mounting Bolts</b>			
Size	Pound- Feet	Newton metres	Kilogram metres
5/16-18	15-20	20-27	2.1-2.8
3/8-16	20-25	26-33	2.8-3.5
7/16-14	35-45	47-61	4.7-6.2
1/2-13	55-65	74-88	7.6-9.0
5/8-11	140-150	190-203	19.4-20.7

# 1002

## MAINTENANCE AND LUBRICATION

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And  
*Simple*  
English

## FLUIDS AND LUBRICANTS

**Fuel tank**

Capacity ..... 122 U.S. gallons (462 litres)  
 Specifications ..... See Operators Manual

**Cooling system**

Capacity ..... 8.5 U.S. gallons (32.2 litres)  
 Specifications ..... Mix ethylene glycol antifreeze and water according to the antifreeze manufacturers instructions.

**Engine crankcase (1187 Machines)**

Capacity (Case engine)  
 Without filter change ..... 19 U.S. quarts (18 litres)  
 With filter change ..... 23 U.S. quarts (21.8 litres)

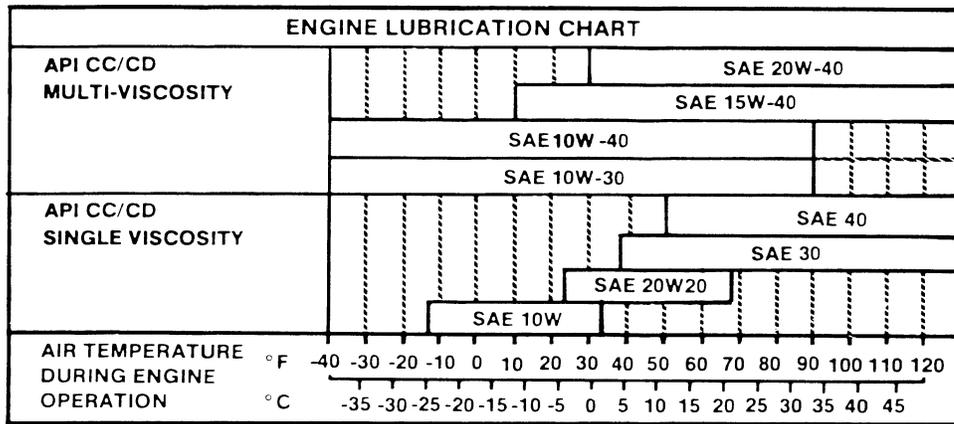
Capacity (Detroit Diesel)  
 Without filter change ..... 14 U.S. quarts (13.2 litres)  
 With filter change ..... 16 U.S. quarts (15.1 litres)

**Engine crankcase (1187B Machines)**

Capacity (Case engine)  
 Without filter change ..... 24 U.S. quarts (22.7 litres)  
 With filter change ..... 28 U.S. quarts (26.5 litres)

Capacity (Detroit Diesel)  
 Without filter change ..... 18 U.S. quarts (17 litres)  
 With filter change ..... 20 U.S. quarts (19 litres)

Specifications (Case engine) ..... Case HDM oil



Specifications (Detroit Diesel) ..... See the Detroit Diesel Service Manual

**Hydraulic system**

Capacity  
 Total system ..... 55 U.S. gallons (208 litres)  
 Reservoir ..... 25.3 U.S. gallons (95.7 litres)  
 Specifications ..... Case TCH Fluid  
 Alternate oil ..... C3 hydraulic fluid

**Final drive transmission**

Capacity  
 1187 machine (each) ..... 12 U.S. quarts (11.4 litres)  
 1187B machine (each) ..... 16.5 quarts (15.6 litres)  
 Specifications ..... Case FDL Fluid  
 Alternate oil ..... SAE 80 to 90 API-GL-5

**Swing gearbox**

Capacity ..... 17 U.S. quarts (16.1 litres)  
Specifications ..... Case FDL Fluid  
Alternate oil ..... SAE 80 to 90 API-GL-5

**Rotary cutter flywheel housing**

Capacity ..... 3 U.S. pints (1.4 litres)  
Specifications ..... Case FDL Fluid  
Alternate oil ..... SAE 80 to 90 API-GL-5

**Turntable ring gear**

Specifications ..... Symquip Spray Lube for Open Gears (OGLD-20)  
Case part number 331-437

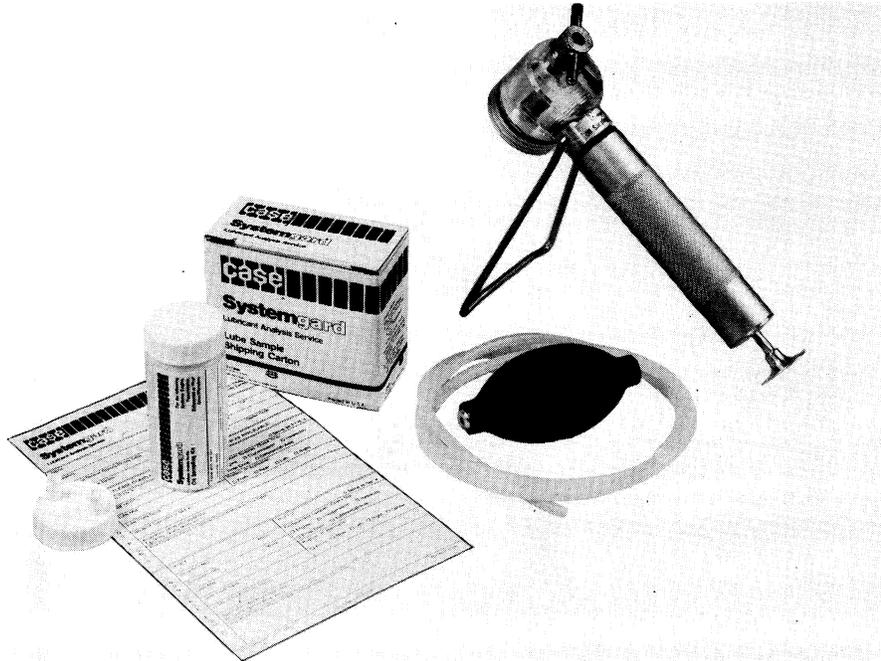
**Batteries**

Specifications ..... Clean or distilled water

**Grease fittings**

Specifications ..... Case molydisulfide grease

## SYSTEMGARD LUBRICANT ANALYSIS SERVICE



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Through this service your machine lubricants are tested in a laboratory. The results of these tests show lubricant contamination and component wear rates. You will get service recommendations to increase the life of your machine. See your Case dealer for more information.

### Systemgard Testing Schedule

Get samples of lubricants for Systemgard analysis at the intervals shown below. Follow the instructions with the Systemgard kits.

**NOTE:** *Get your sample before you drain the lubricant.*

- Engine oil .....Every 250 hours of operation or every oil change
- Hydraulic fluid .....Every 500 hours of operation or 3 times each year
- Final Drive transmission fluid .....Every 500 hours of operation or 3 times each year
- Swing gearbox oil .....Every 500 hours of operation or 3 times each year

### RUN-IN PERIOD

During the first hours of operation for a new machine, or a machine with a rebuilt engine, make sure you do the following:

1. Operate the machine with normal bucket loads for the first 8 hours.
2. Keep the engine at normal operating temperatures.
3. Do not run the engine at idle speeds for long periods of time.
4. See the Run-In Maintenance Chart on this page for additional information.
5. After the first 20 hours of machine operation, do the After Delivery Check in the Operators Manual.

## RUN-IN MAINTENANCE SCHEDULE

The items listed in this maintenance chart are to be done during the run-in-period and are in addition to the items listed under the Maintenance Schedule.

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### After First 20 Hours of Operation

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Change the engine oil .....	See Operators Manual
Change the engine oil filter(s) .....	See Operators Manual
Check the drive belt tension .....	See Section 4007
Change the hydraulic oil filters .....	See Section 8201
Check the torque for the turntable bearing mounting bolts .....	See Section 9216

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### After First 250 Hours of Operation

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Check the torque for the turntable bearing mounting bolts .....	See Section 9216
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## MAINTENANCE SCHEDULE

The items listed below are separated into maximum hourly intervals. These intervals are based on “average” operating conditions. When operating under “severe” conditions, such as excessive heat, cold, dust, mud or water, shorten the intervals.

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### As Required

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Check and adjust track tension .....	See Section 5503
Service the air cleaner if the service indicator red band is in full view .....	See Section 2001
Replace hydraulic filters elements if warning lamp illuminates .....	See Section 8201
Clean debris from muffler area .....	See Operators Manual
Clean debris from shear or rotary cutter .....	See Operators Manual

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### Every 10 Hours of Operation or Each Day Whichever Occurs First

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Check the air cleaner restriction indicator .....	See Section 2001
Check the radiator coolant level .....	See Operators Manual
Check the fuel sediment bowl for contamination (Case engine only) .....	See Operators Manual
Check the engine oil level .....	See Operators Manual
Check feller buncher shear for correct knife alignment .....	See Section 9212
Check the hydraulic reservoir fluid level .....	See Section 8201

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**Every 10 Hours of Operation or Each Day  
Whichever Occurs First**

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Check swing gearbox reservoir oil level .....	See Section 9210
Check the drive brakes for correct operation .....	See Operators Manual
Check swing brake for proper operation .....	See Operators Manual
Lubricate the turntable ring gear .....	See Section 9216
Lubricate the boom, arm, and attachments .....	See Operators Manual

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**Every 50 Hours of Operation**

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Check oil level for the rotary cutter (if equipped) .....	See Operators Manual
Drain water from the fuel tank and sediment bowl .....	See Operators Manual
Clean swing gearbox reservoir breather .....	See Operators Manual
Clean the air cleaner dust valve .....	See Section 2001
Lubricate the turntable pivot pins .....	See Operators Manual
Lubricate the pivot pins for the leveler (tilt) cylinders .....	See Operators Manual
Lubricate the turntable bearing raceway .....	See Operators Manual
Lubricate the drive belt pulley (Detroit Diesel only) .....	See Operators Manual

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**Every 100 Hours of Operation**

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Change engine oil and filters .....	See Operators Manual
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**Every 250 Hours of Operation**

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Clean debris from cooler and radiator .....	See Operators Manual
Check the fluid level for each battery .....	See Section 4005
Check the oil level for each final drive transmission .....	See Section 6317 or 6318
Check the drive belt tension .....	See Section 4007
Check the torque of the turntable bearing mounting bolts .....	See Section 9216
Lubricate hydraulic swivel grease fitting .....	See Operators Manual
Lubricate control lever pivot points .....	See Operators Manual
Check the torque of pivot pin bolt on rotary cutter (if equipped) .....	See Section 9213

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### Every 500 Hours of Operation

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- Replace fuel filters ..... See Section 3010
- Replace the hydraulic filters ..... See Section 8201
- Replace the 25 micron inline filter element ..... See Section 8201
- Clean the hydraulic reservoir breather ..... See Operators Manual

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### Every 1000 Hours of Operation or 6 Months

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- Clean battery case, posts and connections ..... See Section 4005
- Change the oil for the rotary cutter (if equipped) ..... See Operators Manual
- Change the oil of each final drive transmission ..... See Section 6317 or 6318
- Change the oil in the swing gearbox ..... See Section 9210
- Check blower screen and clean if required  
(Detroit Diesel) ..... See Detroit Diesel Operators Manual

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### Every 2000 Hours of Operation or Each Year

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- Change the hydraulic oil and clean the screens ..... See Section 8201
- Drain engine coolant, flush and refill ..... See Operators Manual



# Section 1010

## GENERAL ENGINE SPECIFICATIONS

### 1187 Logger Crawler

(504 DIESEL TURBOCHARGED ENGINE)

Written In *Clear  
And  
Simple  
English*

## 504 DIESEL TURBOCHARGED ENGINE

### General

Type .....	6 Cylinder, 4 Stroke Cycle, Valve-In-Head, Turbocharged
Firing Order .....	1-5-3-6-2-4
Bore .....	4-5/8 Inch (117.48 mm)
Stroke .....	5 Inch (127.00 mm)
Piston Displacement .....	504 Cubic Inch (8 259 cm <sup>3</sup> )
Compression Ratio .....	15.8 to 1
No Load Governed Speed .....	2280 to 2320 RPM
Rated Engine Speed .....	2100 RPM
Engine Idle Speed .....	700 to 750 RPM
Valve Tappet Clearance (Exhaust) .....	(Cold) 0.025 Inch (0.635 mm)
(Intake) .....	(Cold) 0.015 Inch (0.381 mm)
Intake and Exhaust Valve Rotators .....	Positive Type
Thermostat Operating Range .....	175°F to 202TF (79°C to 94°C)

### Piston and Connecting Rods

Rings Per Piston .....	3
Number of Compression Rings .....	2
Number of Oil Rings .....	1
Type Pins .....	Full Floating
Type Bearing .....	Replaceable, Precision Steel Back Liners

### Main Bearings

Number of Bearings .....	7
Type Bearings .....	Replaceable, Precision Steel Back Liners

### Engine Lubricating System

Oil Pressure .....	45 to 60 PSI (310 to 414 kPa)(3.10 to 4.14 bar) with Engine Warm and Operating at Rated Engine Speed
Type System .....	Pressure and Spray Circulation
Oil Pump .....	Gear Type
Oil Filter .....	Full Flow Turn On Type
Oil Capacity (With Filter) .....	23 Quarts (21.77 Litres)
(Without Filter) .....	19 Quarts (17.98 Litres)

### Fuel System

Fuel Injection Pump .....	Robert Bosch
Pump Timing .....	27 Degrees Before Top Center
Fuel Injectors .....	Pencil Type, Opening Pressure (New) 3950 to 4100 PSI (27 235 to 28 270 kPa)(272 to 283 bar)
Fuel Transfer Pump .....	Plunger Type, Integral Part of Injection Pump
Governor .....	Variable Speed, Fly-Weight Centrifugal Type, Integral Part of Injection Pump
First Stage Fuel Filter .....	Full Flow Turn On Type
Second Stage Fuel Filter .....	Full Flow Turn On Type

**NOTE:** The J I Case Company reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.

# Section 1055

## GENERAL CLEANING INSTRUCTIONS

Written In *Clear  
And  
Simple  
English*

## GENERAL CLEANING INSTRUCTIONS

### Complete Assemblies

Completely assembled components can be steam cleaned on the OUTSIDE only, before removal or disassembly. All openings and breathers must be closed before steam cleaning to prevent water or moisture entering the component.

### Rough Parts

Rough parts, for example — housings, castings, etc., can be cleaned in hot solution tanks with mild alkali solutions ONLY IF these parts do not have ground or machined surfaces. Leave the parts in the hot solution tank long enough to be completely cleaned and heated. Flush the parts completely with clear water after cleaning to remove all residue of the cleaning solution.

### Finished or Machined Parts

Parts which have ground or machined surfaces, for example — gears, bearings, shafts and collars, can be cleaned in a solvent that is not flammable.

**IMPORTANT:** DO NOT clean machined parts in hot solution tanks with water and alkaline solutions.



**WARNING:** To prevent injury from burns, always use a solvent that is not flammable for cleaning component parts. DO NOT use gasoline or other flammable substances.

### Rubber Parts

Clean rubber parts by washing in clean denatured alcohol. DO NOT use cleaning solvents with a mineral base, for example — acetone or paint thinner. If a mineral base solvent is used, the rubber will start to wear away and continue to wear away after the part is put back into service. This rapid wearing away of the rubber part can cause failure of the component in service.

### Drying

After cleaning, all parts must be dried immediately. Use compressed air free of moisture, and a soft cloth free of lint and abrasive materials.

Bearings can be dried with compressed air, but make sure the air is moved across the bearings in a direction which prevents spinning. DO NOT let bearings spin when drying. Bearings can be turned slowly by hand to shorten the drying time.

### Corrosion Prevention

Parts that have been cleaned, dried, inspected and are to be immediately assembled into the component — Apply a light oil to prevent corrosion. If these parts are to be put in storage for any length of time, apply a good RUST PREVENTIVE then put the parts in special paper or other material to prevent corrosion.

# Section 1320

## SPECIFICATION DETAILS

### 504BDT ENGINE

Written In *Clear  
And  
Simple  
English*

**FRACTION to DECIMAL to MILLIMETER CONVERSION TABLE**

Fraction	Decimal	MM	Fraction	Decimal	MM	Fraction	Decimal	MM
1/64	.0156	0.397	23/64	.3593	9.128	45/64	.7031	17.859
1/32	.0312	0.794	3/8	.3750	9.525	23/32	.7187	18.256
3/64	.0468	1.191	25/64	.3906	9.922	47/64	.7343	18.653
1/16	.0625	1.587	13/32	.4062	10.319	3/4	.7500	19.050
5/64	.0781	1.984	27/64	.4218	10.716	49/64	.7656	19.447
3/32	.0937	2.381	7/16	.4375	11.113	25/32	.7812	19.844
7/64	.1093	2.778	29/64	.4531	11.509	51/64	.7968	20.240
1/8	.1250	3.175	15/32	.4687	11.906	13/16	.8125	20.637
9/64	.1406	3.572	31/64	.4843	12.303	53/64	.8281	21.034
5/32	.1562	3.969	1/2	.5000	12.700	27/32	.8437	21.431
11/64	.1718	4.366	33/64	.5156	13.097	55/64	.8593	21.828
3/16	.1875	4.762	17/32	.5312	13.494	7/8	.8750	22.225
13/64	.2031	5.159	35/64	.5468	13.890	57/64	.8906	22.622
7/32	.2187	5.556	9/16	.5625	14.287	29/32	.9062	23.019
15/64	.2343	5.953	37/64	.5781	14.684	59/64	.9218	23.415
1/4	.2500	6.350	19/32	.5937	15.081	15/16	.9375	23.812
17/64	.2656	6.747	39/64	.6093	15.478	61/64	.9531	24.209
9/32	.2812	7.144	5/8	.6250	15.875	31/32	.9687	24.606
19/64	.2968	7.541	41/64	.6406	16.272	63/64	.9843	25.003
5/16	.3125	7.937	21/32	.6562	16.669	1	1.0000	25.400
21/64	.3281	8.334	43/64	.6718	17.065			
11/32	.3437	8.731	11/16	.6875	17.462			

**INCH to MILLIMETER CONVERSION TABLE**

Inch	MM	Inch	MM	Inch	MM	Inch	MM
1	25.400	6	152.000	10	254.000	60	1,524.000
2	50.800	7	177.800	20	508.000	70	1,778.000
3	76.200	8	203.200	30	762.000	80	2,032.000
4	101.600	9	228.600	40	1,016.000	90	2,286.000
5	127.000	10	254.000	50	1,270.000	100	2,540.000

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## RUN-IN INSTRUCTIONS

### Engine Lubrication

Fill the engine crankcase with CASE HDM oil and install new engine oil filters, after an engine has been rebuilt.

**NOTE:** Use a *SERIES 3 DS or CD SERVICE CLASSIFICATION* oil that has the correct viscosity rating for ambient air temperature, if CASE HDM oil is not used.

Change the engine oil while the engine is hot and replace the engine oil filters, after the first 20 hours of operation.

Change the engine oil and filters at the given intervals, after the 20 hours, as found in the Operator's Manual.

### Run-In Procedure For Rebuilt Engines (With A Dynamometer)

The following procedure must be followed when using a PTO dynamometer to run-in the engine. The dynamometer will make sure of the control of the engine load at each speed and will remove stress on new parts during run-in.

During the run-in, continue to check the oil pressure, coolant level and coolant temperature.

STEP	TIME	ENGINE SPEED	DYNAMOMETER SCALE LOAD*
1	**10 Minutes	1000 RPM	Not Any
2	**10 Minutes	1800 RPM	Not Any
3	20 Minutes	1800 RPM	1/3
4	20 Minutes	1800 RPM	1/2
5	***30 Minutes	100 RPM below rated speed	3/4
6	Tighten the cylinder head bolts to the torque that is found in Section 2015 of the service manual.		

\* According to normal dynamometer scale load at rated speed for the specific vehicle model. Decrease this scale load as shown.

\*\* The best run-in procedure will constantly change the throttle between 750 to 1000 RPM, for the first 10 minutes and from 1000 to 1800 RPM, for the next 10 minutes. The purpose of this changing RPM is to change the lubrication and coolant flow.

\*\*\* 30 minutes at 3/4 load is a minimum amount of time the engine can be run. It is best that when possible, the engine (especially a turbocharged diesel) must be run for four (4) hours or more, at the above speed and load before checking the full engine horsepower or before using the engine for heavy field work.

### Run-In Procedure For Rebuilt Engines (Without A Dynamometer)

STEP	TIME	ENGINE SPEED	LOAD
1	*10 Minutes	1000 RPM	Not Any
2	*10 Minutes	1800 RPM	Not Any
3	30 Minutes	2/3 Rated RPM	Light Load
4	1 Hour	Full RPM (not over 2000 RPM)	80 to 90%
5	Tighten the cylinder head bolts to the torque that is found in Section 2015 of the service manual.		

\* If engine must then run at or near full load to operate the machine, remove the load for the first hour and run at high idle for several minutes at 15 minute intervals.

### Run-In Procedure

Keep in one gear lower than normal for the first 8 hours of field operation. DO NOT "lug" the engine for the next 12 hours. Prevent "lugging" by moving the shift lever to a lower gear. The engine must not be "lugged" below the Rated Engine RPM during the early hours of life.

## ENGINE SPECIFICATION DETAILS

### Cylinder Sleeves

	U.S. Value	Metric Value
Type .....	Wet, Can Be Replaced	
Material .....	Cast Iron	
I.D. of Sleeve .....	4.6250 to 4.6263"	117.475 to 117.508 mm
Maximum Service Limit .....	4.6283"	117.559 mm
Sleeve Out of Round (Installed in Block) .....	0.002"	0.0508 mm
Maximum Service Limit .....	0.002"	0.0508 mm
Taper (Installed in Block) .....	0.001"	0.0254 mm
Maximum Service Limit .....	0.002"	0.051 mm
Clearance at Bottom of Piston,		
90 Degrees to Piston Pin .....	0.0052 to 0.0075"	0.1321 to 0.1905 mm
Maximum Service Limit .....	0.0100"	0.2540 mm

### Piston

Type .....	Cam Ground	
Material .....	Aluminum Alloy	
O.D. At Bottom, 90 Degrees to Piston Pin .....	4.6188 to 4.6198"	117.3175 to 117.3429 mm
Minimum Service Limit .....	4.6178"	117.2921 mm
I.D. of Piston Pin Bore .....	1.6251 to 1.6253"	41.2775 to 41.2826 mm
Maximum Service Limit .....	1.6258"	41.295 mm
Width of 1st Ring Groove .....	Can Not Be Measured	
Width of 2nd Ring Groove .....	Can Not Be Measured	
Width of 3rd Ring Groove .....	0.188 to 0.189"	4.775 to 4.801 mm
Maximum Service Limit .....	0.1895"	4.813 mm

### Piston Rings

Number One Compression (Top) .....	Keystone Type With Chrome Face	
End Gap in 4.625" (117.475 mm) I.D. Sleeve .....	0.015 to 0.025"	0.381 to 0.635 mm
Maximum Service Limit .....	0.030"	0.762 mm
Number Two Compression (Intermediate) .....	Keystone Type With Tapered Face	
End Gap in 4.625" (117.475 mm) I.D. Sleeve .....	0.013 to 0.023"	0.330 to 0.584 mm
Maximum Service Limit .....	0.030"	0.762 mm
Number Three Oil Control Ring (Bottom) .....	Two Piece	
Width .....	0.1860 to 0.1865"	4.7244 to 4.7371 mm
End Gap in 4.625" (117.475 mm) I.D. Sleeve .....	0.016 to 0.026"	0.406 to 0.660 mm
Maximum Service Limit .....	0.031"	0.787 mm
Side Clearance .....	0.0015 to 0.003"	0.038 to 0.076 mm
Maximum Service Limit .....	0.0035"	0.089 mm

**Piston Pin**

	U.S. Value	Metric Value
Type .....	Floats	
O.D. of Pin .....	1.6244 to 1.6246"	41.260 to 41.625 mm

**Connecting Rod**

Bushing .....	Replaceable	
Bushing I.D., Installed (Ream to Size) .....	1.6254 to 1.6258"	41.285 to 41.295 mm
Maximum Service Limit .....	1.6265"	41.313 mm
Bearing Liners .....	Replaceable	
Bearing Liner Width .....	1.586 to 1.596"	40.284 to 40.538 mm
Bore I.D. Without Bearing Liners .....	2.9003 to 2.9013"	73.668 to 73.693 mm
Bearing Oil Clearance .....	0.0011 to 0.0041"	0.028 to 0.104 mm
Maximum Service Limit .....	0.0046"	0.117 mm
Undersize Bearings for Service .....	0.002, 0.010, 0.012, 0.020, 0.030"	0.051, 0.254, 0.305, 0.508, 0.762 mm
Side Clearance .....	0.007 to 0.016"	0.178 to 0.406 mm

**Crankshaft**

Type .....	Forged, Heat Treated and Balanced	
Main Bearing Liners .....	Replaceable	
Lateral Movement, Number Five Main Bearing Cap .....	0.003 to 0.015"	0.076 to 0.381 mm
Thrust Bearing, Standard Thickness .....	0.184 to 0.186"	4.674 to 4.724 mm
Thrust Bearing, Oversize Thickness for Service .....	0.190 to 0.192"	4.826 to 4.877 mm
Connecting Rod Journal, Standard O.D. ....	2.748 to 2.749"	69.799 to 69.825 mm
0.010" (0.254 mm) O.D. Undersize, Grind to .....	2.738 to 2.739"	69.545 to 69.571 mm
0.020" (0.508 mm) O.D. Undersize, Grind to .....	2.728 to 2.729"	69.291 to 69.317 mm
0.030" (0.762 mm) O.D. Undersize, Grind to .....	2.718 to 2.719"	69.037 to 69.063 mm
Connecting Rod Journal Maximum Taper .....	0.0005"	0.0127 mm
Journals Out of Round .....	0.0005"	0.0127 mm
Main Bearing Liner Width, 1st, 3rd, 5th and 7th .....	2.1515 to 2.1615"	54.648 to 54.902 mm
Main Bearing Liner Width, 2nd, 4th and 6th .....	1.151 to 1.161"	29.235 to 29.489 mm
Undersize Main Bearing Liners for Service .....	0.002, 0.010, 0.012, 0.020, 0.030"	0.051, 0.254, 0.305, 0.508, 0.762 mm
Main Bearing Oil Clearance .....	0.0016 to 0.0046"	0.041 to 0.117 mm
Maximum Service Limit .....	0.005"	0.127 mm
Main Bearing Journal, Standard O.D. ....	2.998 to 2.999"	76.149 to 76.175 mm
0.010" (0.254 mm) O.D. Undersize, Grind to .....	2.988 to 2.989"	75.895 to 75.921 mm
0.020" (0.508 mm) O.D. Undersize, Grind to .....	2.978 to 2.979"	75.641 to 75.667 mm
0.030" (0.762 mm) O.D. Undersize, Grind to .....	2.968 to 2.969"	75.387 to 75.413 mm
Main Bearing Journal Bore I.D. Without Liners .....	3.191 to 3.192"	81.051 to 81.077 mm
Main Journal Width		
2nd, 4th and 6th .....	1.555 to 1.570"	39.497 to 39.878 mm
3rd and 7th .....	2.6175 to 2.6325"	66.485 to 66.866 mm
5th .....	2.623 to 2.627"	66.624 to 66.726 mm
Connecting Rod Journal Width .....	1.9975 to 2.0025"	50.737 to 50.864 mm

## Camshaft

	U.S. Value	Metric Value
Type .....	Parabolic	
Bushing .....	Five, Replaceable	
Bushing Lubrication .....	Under Pressure	
I.D. of Bushing .....	2.2484 to 2.2514"	57.109 to 57.186 mm
Maximum Service Limit .....	2.2524"	57.211 mm
Bushing Width		
1st (Front) .....	1.6460 to 1.6660"	41.808 to 42.316 mm
2nd, 3rd and 4th .....	1.4275 to 1.4475"	36.259 to 36.767 mm
5th .....	1.1462 to 1.1662"	29.113 to 29.622 mm
O.D. of Each Bearing Surface .....	2.2460 to 2.2470"	57.048 to 57.074 mm
Minimum Service Limit .....	2.2455"	57.306 mm
Thrust Washer Thickness .....	0.1225 to 0.1275"	3.1115 to 3.2385 mm
Minimum Service Limit .....	0.1215"	3.086 mm
Thrust Plunger Spring		
Free Length .....	3.6250"	92.075 mm
O.D. of Spring .....	0.406"	10.3175 mm
Compress to 2.750" (69.85 mm) .....	45 to 55 lbs.	200 to 245N

## Valve Push Rod Lifters

O.D. of Lifter Stem, Standard .....	0.8097 to 0.8102"	20.566 to 20.579 mm
O.D. of Lifter Stem, Oversize for Service .....	0.8190 to 0.8195"	20.803 to 20.815 mm
I.D. of Block Bore, Standard .....	0.8118 to 0.8130"	20.620 to 20.650 mm
Maximum Service Limit .....	0.8135"	20.663 mm
I.D. of Block Bore, Oversize for Service .....	0.8215 to 0.8225"	20.866 to 20.891 mm

## Gear Train

Backlash		
Crankshaft Gear to Camshaft Gear .....	0.004 to 0.011"	0.1016 to 0.2794 mm
Idler Drive Gear to Idler Gear .....	0.003 to 0.010"	0.0762 to 0.2540 mm
Idler Gear to Fuel Pump Gear .....	0.004 to 0.012"	0.1016 to 0.3048 mm
Crankshaft Gear to Oil Pump Idler Gear .....	0.006 to 0.011"	0.1524 to 0.2794 mm
Crankshaft Gear to Fuel Pump Gear .....	0.027" Max.	0.6858 mm Max.
O.D. of Idler Gear Shaft .....	1.7325 to 1.7330"	44.0055 to 44.0182 mm
I.D. of Idler Gear Bushing .....	1.7345 to 1.7355"	44.0563 to 44.0817 mm
Maximum Service Limit .....	1.7375"	44.132 mm
Idler Gear Thrust Washer Thickness .....	0.061 to 0.063"	1.5494 to 1.6002 mm
Idler Gear End Play .....	0.002 to 0.012"	0.051 to 0.305 mm

**Oil Pump**

	U.S. Value	Metric Value
Positive Displacement Pump .....	Gear Type	
Backlash		
Pump Gear to Crankshaft Gear .....	0.006 to 0.011"	0.1524 to 0.2794 mm
Pump Gears to Body Radial Clearance .....	0.0005 to 0.004"	0.013 to 0.102 mm
Pump Gears to Pump Cover Clearance .....	0.0015 to 0.005"	0.038 to 0.127 mm
Oil Pressure at High Idle, Hot Oil .....	40 to 65 PSI	275 to 448 kPa
Relief Valve Spring		
Number of Coils .....	11	11
Wire Diameter .....	0.080"	2.03 mm
Minimum I.D. ....	0.469"	11.913 mm
Free Length .....	2.00"	50.8 mm
Compress to 1.252" (31.801 mm) .....	23.8 to 25.6 lbs.	106 to 114 N
Relief Valve Cup Plug Depth .....	0.450	11.43 mm

**Cylinder Head**

Warpage .....	0.005" max.	0.127 mm
---------------	-------------	----------

**Exhaust Valve**

Tappet Clearance .....	0.025"	0.635 mm
Face Angle .....	44 Degrees	44 Degrees
Face Run-Out .....	0.002" max.	0.051 mm
O.D. of Head .....	1.745 to 1.755"	44.323 to 44.577 mm
O.D. of Stem .....	0.402 to 0.403"	10.211 to 10.236 mm
Minimum Service Limit .....	0.4018"	10.206 mm
O.D. of Taper at 4.2675" (108.395 mm) .....	0.401 to 0.402"	10.185 to 10.211 mm
Minimum Service Limit .....	0.4008"	10.180 mm
Length .....	6.4195 to 6.4405"	163.055 to 163.589 mm
Insert Seat Angle .....	45 Degrees	45 Degrees
Seat Contact Width .....	0.0775 to 0.1000"	1.9685 to 2.5400 mm
Seat Run-Out .....	0.002" max.	0.051 mm
Insert Height .....	0.313 to 0.316"	7.950 to 8.026 mm
O.D. of Insert .....	1.9455 to 1.9465"	49.4157 to 49.4411 mm
I.D. of Insert .....	1.571 to 1.577"	39.903 to 40.056 mm

## Intake Valve

	U.S. Value	Metric Value
Tappet Clearance .....	0.015"	0.381 mm
Face Angle .....	44 Degrees	44 Degrees
Face Run-Out .....	0.002 max.	0.051 mm
O.D. of Stem .....	0.402 to 0.403"	10.211 to 10.236 mm
Minimum Service Limit .....	0.4018"	10.206 mm
O.D. of Head .....	1.995 to 2.005"	50.673 to 50.927 mm
Length .....	6.4195 to 6.4405"	163.055 to 163.589 mm
Seat Angle .....	45 Degrees	45 Degrees
Seat Contact Width .....	0.0750 to 0.0975"	1.905 to 2.477 mm
Seat Run-Out .....	0.002" max.	0.051 mm

## Intake and Exhaust Valve Guides

Length .....	3.219"	81.763 mm
O.D. of Guide .....	0.7510 to 0.7515"	19.075 to 19.088 mm
I.D. of Guide (Installed and Reamed) .....	0.4045 to 0.4055"	10.274 to 10.300 mm
Maximum Service Limit .....	0.4065"	10.325 mm
Protrusion Above Cylinder Head .....	0.953"	24.206 mm

## Valve Spring

Free Length .....	2.18"	55.372 mm
Number of Coils .....	7-1/4	7-1/4
Wire Diameter .....	0.192"	4.877 mm
Compress Spring to 1.484" (37.694 mm), Valve Open .....	153 to 167 lbs.	681 to 743 N
Compress Spring to 1.937" (49.200 mm), Valve Closed .....	50.5 to 60.5 lbs.	225 to 269 N

## Rocker Arm Assembly

O.D. of Shaft .....	0.860 to 0.866"	21.844 to 21.996 mm
I.D. of Arm Bore .....	0.8745 to 0.8755"	22.212 to 22.238 mm
Shaft Assembly Lateral Movement (Both Ends) .....	0.010" to 0.030"	0.254 to 0.762 mm
Shaft Spring		
Number of Working Coils .....	4	4
Wire Diameter .....	0.080"	2.032 mm
Compress Spring to 1.562" (39.675 mm) .....	8.5 to 11.5 lbs.	38 to 51 N
Lubrication .....	Engine Oil, Camshaft Metering	
Shaft Oil Holes .....	Toward Valve Side of Engine	
	Shaft Can Not Be Turned	

## Intake Valve Timing

Valve Timing ..... With the Number One Intake Valve to Rocker Arm Clearance Set at 0.015" (0.381 mm) and the Dial Indicator on the Number One Valve Retainer, 0.053" (1.346 mm) Movement of the Valve From the Seat (Clockwise Pulley Rotation) Will Give 7 Degrees After TDC Timing Indication on the Crank Pulley.

## Special Torque

	U.S. Value	Metric Value
Camshaft Nut With Hardened Washer .....	195 to 205 Ft. Lbs.	264 to 278 Nm (26.4 to 27.8 kgm)
Connecting Rod Bolts (Add Lubrication to Threads and Under Bolt Heads With 30W Oil) .....	95 to 105 Ft. Lbs.	129 to 142 Nm (12.9 to 14.2 kgm)
Crankshaft Pulley Bolt .....	100 to 110 Ft. Lbs.	136 to 149 Nm (13.6 to 14.9 kgm)
Crankshaft Main Bearing Bolts With Hardened Washers .....	200 to 210 Ft. Lbs.	271 to 285 Nm (27.1 to 28.5 kgm)
Cylinder Block Oil Cooler Outlet Cover Screw .....	35 to 42 Ft. Lbs.	48 to 57 Nm (4.8 to 5.7 kgm)
Cylinder Head Bolts .....	200 to 210 Ft. Lbs.	271 to 285 Nm (27.1 to 28.5 kgm)
Cylinder Head Cover Stud Nut .....	8 to 10 Ft. Lbs.	11 to 14 Nm (1.1 to 1.4 kgm)
Flywheel to Crankshaft Bolts Without Hardened Washers .....	180 to 190 Ft. Lbs.	244 to 258 Nm (24.4 to 25.8 kgm)
With Hardened Washers .....	230 to 250 Ft. Lbs.	312 to 339 Nm (31.2 to 33.9 kgm)
Intake and Exhaust Manifold Studs .....	25 to 30 Ft. Lbs.	34 to 41 Nm (3.4 to 4.1 kgm)
Intake Manifold Hex Nuts (Heavy) .....	35 to 42 Ft. Lbs.	48 to 57 Nm (4.8 to 5.7 kgm)
Exhaust Manifold Hex Nuts .....	25 to 30 Ft. Lbs.	34 to 41 Nm (3.4 to 4.1 kgm)
Oil Pan Capscrews .....	15 to 20 Ft. Lbs.	20 to 27 Nm (2.0 to 2.7 kgm)
Oil Pan Drain Plug .....	29 to 31 Ft. Lbs.	39 to 42 Nm (3.9 to 4.2 kgm)
Oil Pump Idler Gear Shaft Bolt .....	40 to 45 Ft. Lbs.	54 to 61 Nm (5.4 to 6.1 kgm)
Oil Pump Suction Tube Nut .....	90 to 100 Ft. Lbs.	122 to 136 Nm (12.2 to 13.6 kgm)
Rocker Arm Adjusting Screw Locknut .....	20 to 25 Ft. Lbs.	27 to 34 Nm (2.7 to 3.4 kgm)
Rocker Arm Bracket Stud Nut or Bolt .....	40 to 45 Ft. Lbs.	54 to 61 Nm (5.4 to 6.1 kgm)

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