

**780C LOADER BACKHOE**  
**TABLE OF CONTENTS**

SERIES/SECTION	SECTION NO.	FORM NO.
<b>1 GENERAL</b>		
Safety Rules, Service Manual Introduction, and Torque		
Specifications .....	1001	8-44360
Maintenance and Lubrication .....	1002	8-44650
General Engine Specifications .....	1010	8-26390
Detailed Engine Specifications .....	1024	8-26061
<b>2 ENGINES</b>		
Engine Removal and Installation .....	2000	8-44650
Engine Accessories (Air Cleaner, Ether Injection, Turbocharger) .....	2001	8-44650
Engine Stall Tests .....	2003	8-44650
Cylinder Head and Valve Train .....	2415	8-26071
Cylinder Block, Pistons, Rods, Camshaft, Main Bearings, Oil Seals, and Flywheel .....	2425	8-26081
Lubrication System .....	2445	8-26091
Cooling System .....	2455	8-26101
Turbocharger .....	2465	8-26110
Turbocharger Failure Analysis .....	2565	8-78235
<b>3 FUEL SYSTEM</b>		
Fuel Lines, Fuel Tank, and Engine Controls .....	3001	8-44650
Fuel System and Filters .....	3410	8-26131
Bosch Fuel Injection Pump, Drive Gear, and Timing .....	3412	8-26141
Fuel Injectors .....	3413	8-26150
<b>4 ELECTRICAL</b>		
Removal and Installation of Electrical Components .....	4001	8-44361
Electrical System Specifications and Troubleshooting .....	4002	8-44361
Wiring Schematics .....	4003	8-44361
Batteries .....	4005	8-44360
Starter and Starter Solenoid, Nippondenso .....	4006	8-42191
Alternator, Delco-Remy .....	4007	8-42241
Instrument Cluster and Instrument Panel .....	4009	9-69300
Alternator, Bosch .....	4019	8-42851
<b>5 STEERING</b>		
Steering System Troubleshooting .....	5002	8-44360
Steering Control Valve and Steering Column .....	5007	9-69311
Steering Cylinders .....	5010	9-69310
Circuit Relief Valve and Check Valves .....	5011	9-69311
Front Axle .....	5021	9-69310
<b>6 POWER TRAIN</b>		
General Transmission Information and Troubleshooting .....	6202	8-44650
Transmission .....	6210	8-44360
Transmission Controls .....	6211	9-69300
Drive Shaft .....	6222	9-69300
Differential and Planetaries .....	6226	9-69301
Wheels and Tires .....	6229	9-69310

**7 BRAKES**

Removal and Installation of Air Compressor .....	7101	8-44360
Troubleshooting Charts, Operation of the Air System, Air System Diagram .....	7102	8-44360
Air Compressor, Governor, Reservoir, and Relief Valve .....	7103	8-44360
Brake Valve .....	7105	9-69300
Brake Actuator .....	7107	9-69311
Alcohol Evaporator .....	7111	8-44360
Pressure Reducer Valve, Pressure Protection Valve, Clutch Cutout Valve, and Stoplamp Switch .....	7113	9-69300
Brakes .....	7123	9-69300
Parking Brake Control Valve and Quick Release Valve .....	7126	8-44360

**8 HYDRAULICS**

Removal and Installation of Hydraulic Pumps .....	8001	8-44360
Hydraulic System Schematics, Specifications, and Troubleshooting .....	8002	8-44360
Cleaning the Hydraulic System .....	8003	9-69300
Hydraulic Pump .....	8005	8-44360
Flow Control Valve .....	8006	9-69311
Loader Control Valve .....	8007	9-69311
Cylinders .....	8090	8-44360
Backhoe Relief Valve .....	8106	8-44360
Backhoe Control Valve .....	8107	9-69300
Removal and Installation of Stabilizer Control Valve .....	8108	8-44360
Stabilizer Control Valve .....	8109	8-42190
Boom Lock System .....	8121	8-44360

**9 MOUNTED EQUIPMENT**

Air Conditioning Troubleshooting and System Checks .....	9002	9-69270
Air Conditioning System .....	9003	8-44360
Loader .....	9010	8-44360
Rops Cab and Canopy .....	9061	9-69310
Seat, Seat Belts, and Seat Support .....	9064	9-69300
Backhoe .....	9100	9-69300
Noise Control .....	9203	9-69300

**REAR POCKET**

Electrical Schematic (24 Volt System) .....	850572A
Instrument Cluster (12 Volt System) .....	870586
Main Harness (12 Volt System) .....	870263
Engine Harness (12 Volt System) .....	870264
Rear Harness (12 Volt System) .....	870265
Cab Harness (12 Volt System) .....	870266
Canopy Harness (12 Volt System) .....	870267
Hydraulic Schematic .....	851051

# 1001

## SAFETY RULES, SERVICE MANUAL INTRODUCTION, AND TORQUE SPECIFICATIONS

### TABLE OF CONTENTS

Safety Rules .....	1001-2
Service Manual Introduction .....	1001-4
Torque Specifications - U.S. Hardware .....	1001-5
Torque Specifications - Metric Hardware .....	1001-6
Torque Specifications - Steel Hydraulic Fittings .....	1001-7

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And  
Simple  
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.

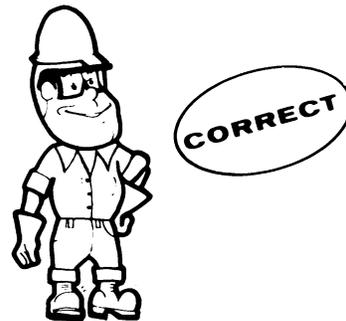


 **WARNING:** This is a one man machine, no riders allowed. 35-8

 **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:** 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:** 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



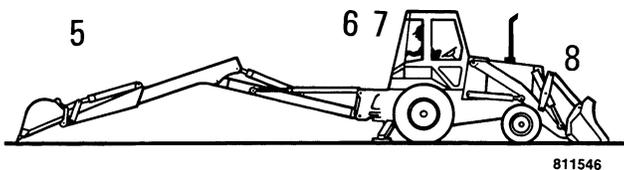
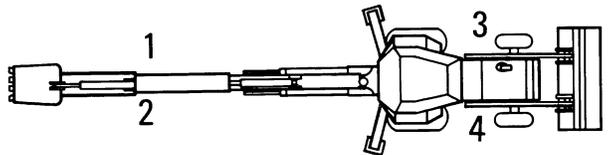
**DANGER:** Engine exhaust fumes can cause death. If it is necessary to start the engine in a closed place, remove the exhaust fumes from the area with an exhaust pipe extension. If you do not have an exhaust pipe extension, open the doors and get outside air into the area. 48-56

## 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. This service manual is one of the most important tools available to the service technician.

### 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. <i>Right Side-Backhoe</i> | 5. <i>Front-Backhoe</i> |
| 2. <i>Left Side-Backhoe</i>  | 6. <i>Rear-Backhoe</i>  |
| 3. <i>Left Side-Machine</i>  | 7. <i>Rear-Machine</i>  |
| 4. <i>Right Side-Machine</i> | 8. <i>Front-Machine</i> |

### 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 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 - METRIC HARDWARE

Use the following torques when special torques are not given.

These values apply to fasteners with coarse threads as received from supplier, plated or unplated, or when lubricated with engine oil. These values do not apply if graphite or moly-disulfide grease or oil is used.

Grade 8.8 Bolts, Nuts, and Studs			
			
Size	Pound-Feet	Newton metres	Kilogram metres
<b>M4</b> 0.15 in	2-3	3-4	0.3-0.4
<b>M5</b> 0.19 in	5-6	6.5-8	0.7-0.8
<b>M6</b> 0.23 in	8-9	10.5-12	1.1-1.2
<b>M8</b> 0.31 in	19-23	26-31	2.6-3.2
<b>M10</b> 0.39 in	38-45	52-61	5.3-6.2
<b>M12</b> 0.46 in	66-79	90-107	9.1-10.9
<b>M14</b> 0.55 in	106-127	144-172	14.7-17.6
<b>M16</b> 0.62 in	160-200	217-271	22.1-27.7
<b>M20</b> 0.78 in	320-380	434-515	44.2-52.5
<b>M24</b> 0.94 in	500-600	675-815	69.1-83.0
<b>M30</b> 1.17 in	920-1100	1250-1500	127-152
<b>M36</b> 1.40 in	1600-1950	2175-2600	221-270

Grade 10.9 Bolts, Nuts, and Studs			
			
Size	Pound-Feet	Newton metres	Kilogram metres
<b>M4</b> 0.15 in	3-4	4-5	0.4-0.5
<b>M5</b> 0.19 in	7-8	9.5-11	1.0-1.1
<b>M6</b> 0.23 in	11-13	15-17.5	1.5-1.8
<b>M8</b> 0.31 in	27-32	37-43	3.7-4.4
<b>M10</b> 0.39 in	54-64	73-87	7.5-8.8
<b>M12</b> 0.46 in	93-112	125-150	12.9-15.5
<b>M14</b> 0.55 in	149-179	200-245	20.6-24.7
<b>M16</b> 0.62 in	230-280	310-380	31.8-38.7
<b>M20</b> 0.78 in	450-540	610-730	62.2-74.7
<b>M24</b> 0.94 in	780-940	1050-1275	108-130
<b>M30</b> 1.17 in	1470-1770	2000-2400	203-245
<b>M36</b> 1.40 in	2580-3090	3500-4200	357-427

### Grade 12.9 Bolts, Nuts, and Studs



Usually the torque values specified for grade 10.9 fasteners can be used satisfactorily on grade 12.9 fasteners.

## 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

### TABLE OF CONTENTS

<b>Fluids and Lubricants</b> .....	1002-2	<b>Run-In Period</b> .....	1002-3
<b>Maintenance Schedule</b> .....	1002-3	<b>Run-In Maintenance Schedule</b> .....	1002-3
<b>Systemgard Testing Schedule</b> .....	1002-3	<b>Maintenance Schedule</b> .....	1002-4

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And  
Simple  
English*

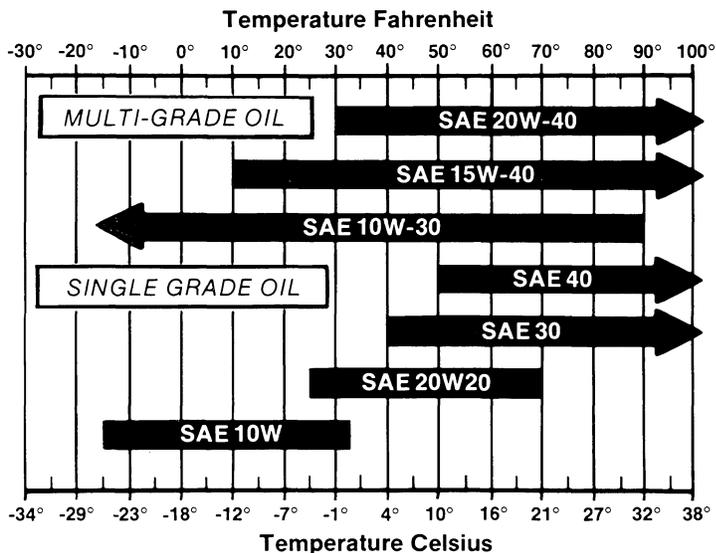
## FLUIDS AND LUBRICANTS

### Fuel Tank

Capacity ..... 43 U.S. gallons (163 litres)  
 Specifications ..... See the Operators Manual

### Engine crankcase

Capacity - without filter change ..... 15 U.S. quarts (14.2 litres)  
                   with filter change ..... 16 U.S. quarts (15 litres)  
 Specifications ..... Case HDM engine oils



### Hydraulic system

Capacity - Reservoir ..... 18.9 U.S. gallons (71.5 litres)  
                   Complete system ..... 48 U.S. gallons (181.7 litres)  
 Specifications ..... Case TCH Fluid  
 Alternate ..... C3 hydraulic fluid

### Transmission

Capacity ..... 16 U.S. quarts (15.1 litres)  
 Specifications ..... Case TCH Fluid  
 Alternate ..... C3 hydraulic fluid

### Rear axle

Capacity - Differential ..... 8 U.S. quarts (7.6 litres)  
                   Planetary (each) ..... 2 U.S. quarts (1.9 litres)  
 Specifications ..... Case FDL  
 Alternate ..... SAE 85/140 API GL-5

### Engine cooling system

Capacity - With heater ..... 27 U.S. quarts (25.6 litres)  
                   Without heater ..... 25 U.S. quarts (23.7 litres)  
 Specifications ..... Mix ethylene glycol antifreeze and water. See the Operators Manual

### Alcohol evaporator

Capacity ..... one U.S. pint (0.47 litre)  
 Specifications ..... Clean methyl alcohol

**Battery** ..... Drinking or distilled water

**Grease fittings** ..... Case molydisulfide grease

**Front wheel bearings** ..... Number 2 wheel bearing grease

## 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 .....	Every 250 hours of operation (every oil change)
Hydraulic Reservoir .....	Every 500 hours of operation or 3 times each year
Transmission .....	Every 500 hours of operation or 3 times each year
Rear Axle .....	Every 500 hours of operation or 3 times each year

## RUN-IN PERIOD

During the first 20 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 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 times.
4. See the Run-In Maintenance Schedule on this page for additional information.

## RUN-IN MAINTENANCE SCHEDULE

The following items are to be done during the Run-In Period and are in addition to the items in the Maintenance Schedule on the following page.

### After The First 2 Hours Of Operation

Tighten the wheel nuts and bolts until the nuts and bolts remain tight .....	Section 6229
Tighten the rear axle mounting bolts .....	Section 6226
Tighten the swing cylinder mounting bolts (Trunnion mounting plates) .....	Section 9100
Check the upper nut of the swing pivot pin .....	Section 9100

### After The First 20 Hours Of Operation

Have your Case dealer do the After Delivery Check .....	See Operators Manual
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### After The First 50 and First 100 Hours Of Operation

Replace the transmission fluid filter .....	See Operators Manual
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### After The First 100 Hours Of Operation

Tighten all hose clamps .....	-----
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## MAINTENANCE SCHEDULE

The items in this maintenance schedule are at maximum intervals. If you are operating the machine under severe conditions (high temperatures, mud, dust, water, etc.), shorten the intervals.

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### As Required

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Check the fan drive belt .....	Replace as required
Service the air cleaner if the air cleaner warning lamp illuminates .....	See Section 2001
Replace the hydraulic filter if the hydraulic filter warning lamp illuminates .....	See Operators Manual
Drain water and remove sediment from the fuel system .....	See Operators Manual
After a wheel has been removed and installed, check the wheel bolt torque every two hours of operation until the bolts remain tight .....	See Section 6229
Fill the alcohol evaporator (if equipped) .....	See Operators Manual

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### Every 10 Hours Of Operation Or Each Day Whichever Occurs First

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Lubricate the loader pivot points (24 grease fittings) .....	See Operators Manual
Lubricate the backhoe pivot points (25 grease fittings) .....	See Operators Manual
Lubricate the 4-in-1 bucket pivot points (6 grease fittings) if equipped .....	See Operators Manual
Lubricate the Extendahoe dipper slide (12 holes) if equipped .....	See Operators Manual
Lubricate the front axle pivots (2 remote grease fittings) one each side .....	See Operators Manual
Check the engine oil level .....	See Operators Manual
Drain water from the air reservoir .....	See Operators Manual
Clean or replace all safety decals and instruction decals that cannot be read .....	See Operators Manual

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### Every 50 Hours Of Operation

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Lubricate the anti-rollback pivot point (two grease fittings) .....	See Operators Manual
Lubricate the front axle kingpins (2 grease fittings) one each side .....	See Operators Manual
Lubricate the drive shaft universal joints and slip spline (3 grease fittings) .....	See Operators Manual
Lubricate the brake shafts and brake adjusters (4 grease fittings) .....	See Operators Manual
Check the hydraulic fluid level .....	See Operators Manual
Check the air cleaner dust valve and cover wing nut .....	See Operators Manual
Check the coolant reservoir fluid level .....	See Operators Manual
Check the transmission oil level .....	See Operators Manual
Check the fuel tank for water .....	See Operators Manual

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### Every 100 Hours Of Operation

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- Lubricate the boom release pivot pin (one grease fitting) ..... See Operators Manual
- Clean the spark arresting muffler ..... See Operators Manual
- Check the tire pressure and tire condition ..... See Section 6229

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### Every 250 Hours Of Operation

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- Lubricate the seat post (one grease fitting) ..... See Operators Manual
- Lubricate the backhoe and loader control lever pivots (9 standard backhoe, 10 extendahoe, and one optional loader control lever) ..... See Operators Manual
- Change the engine oil and replace the engine oil filter ..... See Operators Manual
- Check the rear axle oil level at the center bowl and at each planetary end. .... See Operators Manual
- Check the tension of the air conditioning and air compressor drive belts ..... See Sections 7103 and 9003
- Check the radiator fluid level (with coolant cold) ..... See Operators Manual
- Clean the batteries and check the battery fluid level ..... See Section 4005

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### Every 500 Hours Of Operation

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- Replace the fuel filters ..... See Operators Manual
- Replace the transmission filter ..... See Operators Manual
- Lubricate the front wheel bearings ..... See Operators Manual

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### Every 1000 Hours Of Operation

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- Change the transmission oil ..... See Operators Manual
- Clean the transmission suction screen ..... See Operators Manual
- Replace the hydraulic fluid filter ..... See Operators Manual
- Change the hydraulic reservoir fluid ..... See Operators Manual
- Clean the hydraulic fluid suction screen ..... See Operators Manual
- Change the rear axle oil ..... See Operators Manual
- Check the engine valve adjustment ..... See Section 2415
- Clean the cab air filter ..... See Operators Manual

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### Every 2000 Hours Of Operation Or Each Year

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- Drain, flush, and refill the engine cooling system ..... See Operators Manual



# Section 1010

## GENERAL ENGINE SPECIFICATIONS

Written In *Clear  
And  
Simple  
English*

**IMPORTANT:** *This engine was made using the metric measurement system. All measurements and checks must be made with metric tools to make sure of an accurate reading when inspecting parts.*

## ENGINE SPECIFICATIONS

### General

Type .....	6 Cylinder, 4 Stroke Cycle, Valve-In-Head
Firing Order .....	1,5,3,6,2,4
Bore .....	102 mm
Stroke .....	120 mm
Piston Displacement .....	5.88 Litres
Compression Ratio .....	17.0 to 1
No Load Governed Speed .....	2345 to 2440 RPM
Rated Engine Speed .....	2305 to 2385 RPM
Engine Idle Speed .....	700 to 750 RPM
Valve Tappet Clearance (Exhaust)(Cold) .....	0.508 mm
(Intake)(Cold) .....	0.254 mm
Thermostat Operating Range .....	181°F to 203°F (83°C to 95°C)

### Piston and Connecting Rods

Rings Per Piston .....	3
Number of Compression Rings .....	2
Number of Oil Rings (two piece) .....	1
Type of Pins .....	Full Float
Type Bearings .....	Steel Back Leaded Bronze

### Main Bearings

Number of Bearings .....	7
Type of Bearings .....	Replaceable

### Engine Lubricating System

Oil Pressure .....	42 to 54 PSI (290 to 372 kPa)(2.90 to 3.72 bar) with Engine Warm at Rated Engine Speed
Type of System .....	Pressure and Spray Lubrication
Oil Pump .....	Rotor Type
Oil Filter .....	Full Flow Turn-on Type
Oil Capacity (with filter) .....	16 Quarts (15 litres)
(without filter) .....	15 Quarts (14.3 litres)

### Fuel System

Fuel Injection Pump .....	CAV
Pump Timing .....	Top Center
Fuel Injectors .....	Bosch 17 mm Opening Pressure (New) 3190 to 3310 PSI (21 994 to 22 822 kPa)(220 to 228 Bar)
Governor .....	Variable Speed, a Part of the Injection Pump
First Stage Fuel Filter .....	Turn on Type
Second Stage Fuel Filter .....	Turn on Type
Lift Pump .....	5 to 7 PSI (34 to 48 kPa)(0.34 to 0.48 Bar)

**NOTE:** The CASE CORPORATION 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 1024

## SPECIFICATION DETAILS

Written In *Clear  
And  
Simple  
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**IMPORTANT:** *This engine was made using the metric measurement system. All measurements and checks must be made with metric tools to make sure of an accurate reading when inspecting parts.*

## TABLE OF CONTENTS

RUN-IN INSTRUCTIONS .....	3
ENGINE SPECIFICATION DETAILS	
Cylinder Block .....	4
Service Cylinder Sleeve .....	4
Piston .....	4
Piston Pin .....	4
Piston Rings .....	5
Cylinder Head .....	5
Tappets .....	5
Connecting Rod .....	5
Crankshaft .....	6
Camshaft .....	7
Valve Push Rod Lifters .....	7
Gear Train .....	7
Rocker Arm Assembly .....	7
Turbocharger .....	7
Intake Valve .....	8
Exhaust Valve .....	8
Valve Springs .....	8
SPECIAL TORQUES .....	9-11

## RUN-IN INSTRUCTIONS

### Engine Lubrication

Fill the 6-590 engine crankcase with CC or CD service classification oil that has the correct viscosity rating for the ambient air temperature. Install new oil filters, after the engine has been rebuilt.

Fill the 6T-590 and the 6TA-590 engine crankcase with CD service classification oil that has the correct viscosity rating for the ambient air temperature. Install new oil filters, after the engine has been rebuilt.

### Run-In Procedure For Rebuilt Engine

- Step 1 Disconnect the wire to the electric shut-off on the injection pump so that the engine will not start. Crank the engine for 30 seconds until there is oil pressure, then reconnect the wire.
- Step 2 Remove the air from the cooling system at the temperature sending unit for the 6-590 and 6T-590 engine. Loosen the upper plug on the aftercooler to remove the air from the cooling system for the 6TA-590 engine.
- Step 3 Run the engine at 1000 RPM minimum load for 5 minutes and check for oil leaks.
- Step 4 During the Run-In, continue to check the oil pressure, coolant level, and coolant temperature.

### 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 control 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	5 Minutes	1000 RPM	50
2	5 Minutes	1100 RPM	1/2
3	5 Minutes	2200 RPM	Full

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

STEP	TIME	ENGINE SPEED	LOAD
1	5 Minutes	1000 RPM	No Load
2	5 Minutes	1100 RPM	Light Load
3	5 Minutes	2200 RPM	Full

### Run-In Procedure (Agriculture Tractors)

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

### Run-In Procedure (Construction Equipment)

For the first 8 hours, operate the engine at full throttle maintaining a normal load. DO NOT "baby" the engine, but avoid converter or hydraulic stall. The engine must not be "lugged" below the Rated Engine RPM (Do not stall the engine more than 10 seconds).

## ENGINE SPECIFICATION DETAILS

<b>Cylinder Block</b>	Metric Value
Type .....	Non-Sleeved
Material .....	Cast Iron
ID of Cylinder .....	102.00 to 102.04 mm
Maximum Service Limit .....	102.116 mm
Cylinder Out of Round (Maximum) .....	0.038 mm
Cylinder Taper (Maximum) .....	0.076 mm
<b>0.5 mm Oversize Piston</b>	
Machine Cylinder Bore to .....	102.40 to 102.44 mm
Hone Cylinder Bore to .....	102.50 to 102.54 mm
<b>1.00 mm Oversize Piston</b>	
Machine Cylinder Bore to .....	102.900 to 102.960 mm
Hone Cylinder Bore to .....	103.00 to 103.04 mm

### Service Cylinder Sleeve

Type .....	Dry, Can Be Replaced
Material .....	Cast Iron
Machine Cylinder Block Bore to .....	104.485 to 104.515 mm
Installation .....	Press Fit
Hone Cylinder Bore to .....	102.00 to 102.10 mm

### Piston

Type .....	Cam Ground
Material .....	Aluminum alloy
<b>OD at 12 mm From the Bottom, 90 Degrees From Piston Pin</b>	
Standard Size Piston .....	101.873 to 101.887 mm
Minimum Service Limit .....	101.823 mm
0.5 mm Oversize Piston .....	102.373 to 102.387 mm
Minimum Service Limit .....	102.323 mm
1.0 mm Oversize Piston .....	102.873 to 102.887 mm
Minimum Service Limit .....	102.823 mm
ID of Piston Pin Bore .....	40.006 to 40.012 mm
Maximum Service Limit .....	40.025 mm
Width of 1st Ring Groove (Top) .....	2.465 to 2.485 mm
Width of 2nd Ring Groove (Intermediate) .....	2.425 to 2.445 mm
Width of 3rd Ring Groove (Oil Ring) .....	4.040 to 4.060 mm
Protrusion Above Cylinder Block (Maximum) .....	0.660 mm

### Piston Pin

Type .....	Full Float
OD of Pin .....	39.997 to 40.003 mm
Minimum Service Limit .....	39.990 mm

## Piston Rings

No. 1 Compression (6T-590 and 6TA-590 Engine)	Key Stone Type (Barrel Face)
End Gap in 102.02 ID	0.40 to 0.70 mm
No. 1 Compression 6-590 Engine	Rectangular Type (Barrel Face)
End Gap in 102.02 ID	0.25 to 0.55 mm
Maximum Service Limit	0.806 mm
Side Clearance	0.075 to 0.120 mm
Maximum Service Limit	0.15 mm
No. 2 Compression	Rectangular Type (Taper Face)
End Gap in 102.02 ID	0.25 to 0.55 mm
Maximum Service Limit	0.806 mm
Side Clearance	0.075 to 0.120 mm
Maximum Service Limit	0.15 mm
No. 3 Oil Control Rings	Two Piece
End Gap in 102.02 ID	0.25 to 0.55 mm
Maximum Service Limit	0.806 mm
Side Clearance	0.130 mm

## Cylinder Head

Warpage (Maximum)	0.20 mm
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## Lifters

Material	Hardened Iron
OD of Lifter	15.961 to 15.977 mm
Minimum Service Limit	15.960 mm
Bore Diameter in Block	16.000 to 16.030 mm
Maximum Service Limit	16.055 mm

## Connecting Rod

Bushing	Steel Backed Leaded Bronze
Bushing ID Installed (Ream to Size)	40.053 to 40.067 mm
Maximum Service Limit	40.092 mm
Bearing Liners	Replaceable
Journal ID Without Bearing Liners	72.987 to 73.013 mm
Bearing Oil Clearance	0.038 to 0.116 mm
Maximum Service Limit	0.129 mm
Side Clearance	0.100 to 0.300 mm
Maximum Service Limit	0.330 mm
Connecting Rod Bend (Maximum)	
Without Bushing	0.200 mm
With Bushing	0.150 mm
Connecting Rod Twist (Maximum)	
Without Bushing	0.500 mm
With Bushing	0.300 mm

## Crankshaft

Type .....	Hardened Steel, Balanced
Main Bearing Liners .....	Replaceable
Crankshaft End Clearance .....	0.137 to 0.264 mm
Center Main Bearing Thrust Surface Thickness .....	2.50 mm
Connecting Rod Journal	
OD, Standard .....	68.987 to 69.013 mm
Maximum Service Limit .....	68.962 mm
0.25 mm OD Undersize, Grind to .....	68.737 to 68.763 mm
Maximum Service Limit .....	68.712 mm
0.50 mm OD Undersize, Grind to .....	68.487 to 68.513 mm
Maximum Service Limit .....	68.462 mm
0.75 mm OD Undersize, Grind to .....	68.237 to 68.263 mm
Maximum Service Limit .....	68.212 mm
1.00 mm OD Undersize, Grind to .....	67.987 to 68.013 mm
Maximum Service Limit .....	67.962 mm
Connecting Rod Journal Maximum Taper .....	0.013 mm
Journals Out of Round Maximum .....	0.050 mm
Undersize Main Bearing Liners For Service .....	0.25, 0.50, 0.75 and 1.00 mm
Main Bearing Oil Clearance .....	0.041 to 0.119 mm
Maximum Service Limit .....	0.140 mm
Main Bearing Journal	
OD, Standard .....	82.987 to 83.013 mm
Maximum Service Limit .....	82.962 mm
0.25 mm OD Undersize, Grind to .....	82.737 to 82.763 mm
Maximum Service Limit .....	82.712 mm
0.50 mm OD Undersize, Grind to .....	82.487 to 82.513 mm
Maximum Service Limit .....	82.462 mm
0.75 mm OD Undersize, Grind to .....	82.237 to 82.263 mm
Maximum Service Limit .....	82.212 mm
1.00 mm OD Undersize, Grind to .....	81.987 to 82.013 mm
Maximum Service Limit .....	81.962 mm
Main Bearing Journal Bore ID No Liners .....	87.982 to 88.018 mm
Maximum Service Limit .....	88.031 mm
Main Journal Width:	
1st, 2nd, 3rd, 5th and 6th .....	37.424 to 37.576 mm
4th .....	37.475 to 37.525 mm
Connecting Rod Journals Width .....	38.950 to 39.050 mm

## Camshaft

Type .....	Hardened Iron
Bushing (Front Only) .....	1, Replaceable
Bushing Lubrication:	
Front Bushing .....	Pressure Lubricated
Intermediate .....	Pressure Lubricated
Rear .....	Pressure Lubricated
Oil Clearance .....	0.076 to 0.152 mm
ID of No. 1 Bushing (Installed) .....	54.107 to 54.133 mm
Maximum Service Limit .....	54.146 mm
ID of No. 1 Oversize (57.36 to 57.40 mm OD) Service Bushing .....	54.107 to 54.133 mm
Maximum Service Limit .....	54.146 mm
ID of No. 2, 3, 4, 5 and 6 Service Bushing .....	54.107 to 54.133 mm
Maximum Service Limit .....	54.146 mm
Width of No. 1 Bushing .....	25.15 to 25.65 mm
Width of No. 2, 3, 4, 5 and 6 Service Bushing .....	17.75 to 18.25 mm
Camshaft Bushing Journal OD .....	53.987 to 54.013 mm
Minimum Serviceable Limit .....	53.962 mm
Camshaft Bore Diameter in Block	
No. 1 Bushing .....	57.222 to 57.258 mm
No. 1 Oversize Bushing, Machine to .....	57.722 to 57.758 mm
No. 2, 3, 4, 5 and 6 Less Bushings .....	54.107 to 54.133 mm
No. 2, 3, 4, 5 and 6 Oversize for Bushings, Machine to .....	57.222 to 57.258 mm
Camshaft Thrust Thickness .....	9.42 to 9.58 mm
Minimum Service Limit .....	9.34 mm
Camshaft Thrust Clearance .....	0.130 to 0.340 mm
Maximum Service Limit .....	0.470 mm

## Turbocharger

Horizontal Travel of Turbine Shaft .....	0.10 to 0.16 mm
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## Gear Train

Backlash:	
Crankshaft Gear to Camshaft Gear .....	0.08 to 0.33 mm
Crankshaft Gear to Idler Gear .....	0.08 to 0.33 mm
Camshaft to Fuel Pump Gear .....	0.08 to 0.33 mm
Idler Gear to Oil Pump .....	0.08 to 0.33 mm
Camshaft to Auxiliary .....	0.08 to 0.33 mm
Maximum Service Limit (All Gears) .....	0.45 mm

## Rocker Arm Assembly

OD of Shaft .....	18.963 to 18.975 mm
Minimum Service Limit .....	18.938 mm
ID of Arm Bore .....	19.000 to 19.026 mm
Maximum Service Limit .....	19.051 mm
Lubrication .....	Pressure From Oil Gallery

**Intake Valve**

Tappet Clearance (Cold) .....	0.254 mm
Face Angle .....	29 Degrees
Face Run-Out .....	0.038 mm
Valve Head Edge Thickness, Minimum .....	1.50 mm
Length .....	128.84 to 129.46 mm
OD of Stem .....	7.960 to 7.980 mm
Minimum Service Limit .....	7.940 mm
OD of Head .....	44.870 to 45.130 mm
Seat Angle .....	30 Degrees
Seat Contact Width .....	1.32 to 1.92 mm
Seat Run-Out .....	0.10 mm
Insert Height .....	6.84 to 6.96 mm
OD of Insert .....	47.063 to 47.089 mm
ID of Insert .....	Tapered
Valve Recession Below Head Surface .....	0.99 to 1.52 mm
Maximum Service Limit .....	1.52 mm
ID of Valve Guide Bore .....	8.019 to 8.039 mm
Maximum Service Limit .....	8.089 mm

**Exhaust Valve**

Tappet Clearance (Cold) .....	0.508 mm
Face Angle .....	44 Degrees
Face Run-Out .....	0.038 mm
Valve Head Edge Thickness, Minimum .....	1.50 mm
OD of Head .....	41.870 to 42.130 mm
OD of Stem .....	7.960 to 7.980 mm
Minimum Service Limit .....	7.940 mm
Length .....	128.74 to 129.36 mm
Insert Seat Angle .....	45 Degrees
Seat Contact Width .....	1.47 to 2.07 mm
Seat Run-Out .....	0.10 mm
Insert Height .....	6.65 to 6.77 mm
OD of Insert .....	43.713 to 43.739 mm
ID of Insert .....	Tapered
Valve Recession Below Head Surface .....	0.99 to 1.52 mm
Maximum Service Limit .....	1.52 mm
ID of Valve Guide Bore .....	8.019 to 8.039 mm
Maximum Service Limit .....	8.089 mm

**Valve Springs**

Free Length .....	55.63 mm
Total Coils .....	7.25
Wire Diameter .....	4.830 to 4.930 mm
Compressed to 38.53 mm .....	(Valve Open) 785 to 839 N
Maximum Service Limit .....	765 N
Compressed to 49.25 mm .....	(Valve Closed) 285 to 321 N
Minimum Service Limit .....	270 N

## SPECIAL TORQUES

	U.S. Value	Metric Value
Aftercooler Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Air Crossover Elbow to Intake Aftercooler .....	18 lb ft	24 Nm (2.4 kgm)
Alternator Bracket Bolts (Lower) .....	18 lb ft	24 Nm (2.4 kgm)
Alternator Bracket Bolts (Upper) .....	18 lb ft	24 Nm (2.4 kgm)
Alternator Retaining Bolt .....	18 lb ft	24 Nm (2.4 kgm)
Belt Tensioner Bracket Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Belt Tensioner Retaining Bolt .....	32 lb ft	43 Nm (4.3 kgm)
Camshaft Retaining Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Connecting Rod Bolts .....	74 lb ft	100 Nm
(Lubricate Threads With Engine Oil)		(10.0 kgm)
Exhaust Manifold Bolts .....	32 lb ft	43 Nm (4.3 kgm)
Fan Pulley Bracket Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Fan Pulley Bolts (Grade 8.8) .....	18 lb ft	24 Nm (2.4 kgm)
Fan Pulley Bolts (Grade 10.9) .....	25 lb ft	34 Nm (3.4 kgm)
Flywheel Housing Bolts .....	45 lb ft	60 Nm (6.0 kgm)
Flywheel Retaining Bolts .....	101 lb ft	137 Nm (13.7 kgm)
Flywheel Housing Cover Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Fuel Filter Inlet Bolt .....	24 lb ft	32 Nm (3.2 kgm)
Fuel Air Removal Bolt .....	4 lb ft	6 Nm (0.6 kgm)
Fuel Filter Inlet Nut .....	24 lb ft	32 Nm (3.2 kgm)
Fuel Line Fitting (High Pressure) .....	18 lb ft	24 Nm (2.4 kgm)
Fuel Line Fitting (Low Pressure) .....	18 lb ft	24 Nm (2.4 kgm)
Fuel Pump Plug with Bronze Washer .....	17 lb ft	23 Nm (2.3 kgm)
Front Cover Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Front Housing Bolts .....	18 lb ft	24 Nm (2.4 kgm)

**SPECIAL TORQUES (CONT'D)**

	U.S. Value	Metric Value
Crankshaft Dampener Pulley .....	101 lb ft	137 Nm (13.7 kgm)
Cylinder Head Bolts .....	93 lb ft	126 Nm (12.6 kgm)
Injection Pump Drive Gear Nut .....	48 lb ft	65 Nm (6.5 kgm)
Injection Pump Lock Bolt .....	22 lb ft	30 Nm (3.0 kgm)
Injection Pump Retaining Nuts .....	18 lb ft	24 Nm (2.4 kgm)
Injection Pump Bracket Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Injector Leak off Bolt .....	11 lb ft	15 Nm (1.5 kgm)
Injector Retaining Nut .....	44 lb ft	60 Nm (6.0 kgm)
Intake Manifold Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Intake Manifold Plug .....	92 lb ft	125 Nm (12.5 kgm)
Engine Lift Bracket Bolts (Rear) .....	57 lb ft	77 Nm (7.7 kgm)
Main Bearing Bolts .....	129 lb ft	175 Nm (17.5 kgm)
(Lubricate The Threads With Engine Oil)		
Oil Fill Tube Bolts .....	32 lb ft	43 Nm (4.3 kgm)
Oil Pan Drain Plug .....	55 lb ft	75 Nm (7.5 kgm)
Oil Pan Heater Plug .....	90 lb ft	122 Nm (12.2 kgm)
Oil Pan Retaining Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Oil Pump Retaining Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Oil Inlet Tube Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Oil Inlet Tube Brace .....	18 lb ft	24 Nm (2.4 kgm)
Oil Filter Housing Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Rear Seal Retaining Bolts .....	7 lb ft	9 Nm (0.9 kgm)
Rocker Arm Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Starter Retaining Bolts .....	32 lb ft	43 Nm (4.3 kgm)

**SPECIAL TORQUES (CONT'D)**

	U.S. Value	Metric Value
Tachometer Drive Retaining Bolts .....	2 lb ft	3 Nm (0.3 kgm)
Lifter Cover Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Thermostat Housing Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Timing Pin Retaining Bolts .....	4 lb ft	5 Nm (0.5 kgm)
Fuel Shutoff Solenoid .....	10 lb ft	15 Nm (1.5 kgm)
Turbocharger Mounting Bolts .....	24 lb ft	32 Nm (3.2 kgm)
Turbocharger Drain Tube Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Turbocharger Oil Supply (Both Ends) .....	13 lb ft	17 Nm (1.7 kgm)
Turbine Housing Bolts .....	96 lb inch	11 Nm (1.1 kgm)
Center Housing to Back Plate Bolts .....	48 lb inch	6 Nm (0.6 kgm)
Compressor Housing Bolts .....	48 lb inch	6 Nm (0.6 kgm)
Compressor Lock Nut .....	120 lb inch	14 Nm (1.4 kgm)
Thrust Bearing Screws (Torx Head) .....	36 lb inch	5 Nm (0.5 kgm)
Water Pump Mounting Bolts .....	18 lb ft	24 Nm (2.4 kgm)
Coolant Inlet Bolts .....	32 lb ft	43 Nm (4.3 kgm)
Valve Cover Bolts .....	18 lb ft	24 Nm (2.4 kgm)

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