

Product: 1976 Case 480C Loader Backhoe Service Repair Workshop Manual

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Service Manual Introduction

Safety Rules



This Safety Alert Symbol Indicates Important Safety Messages In This Manual. When You See This Symbol, Carefully Read The Message That Follows and Be Alert To The Possibility Of Personal Injury Or Death.

1-1



WARNING: Read operator's manual to familiarize yourself with control lever functions.

35-1



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: Whenever the loader bucket must be raised to aid in servicing, block the bucket in place with lift cylinder stops or a suitable safety stand.

40-11



WARNING: Operate controls from the operator's seat only.

35-7



WARNING: When performing checks and tests on the equipment hydraulic system or steering system, DO NOT deviate from the written procedure.

40-13



WARNING: Whenever cycling the loader or backhoe to bleed air from circuits or to check operation, be sure area is clear of fellow workers.

40-12



WARNING: After installing tire on rim (wheel), place wheel in a safety cage before inflating tires. If proper equipment is not available, have a tire repair shop do the work. 40-5



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



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 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. 47-16



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 off the floor. Always block machine in place with suitable safety stands. 40-7



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



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

General

This service manual has been prepared with the latest service information available. Trouble shooting, removal, disassembly, inspection and installation procedures coupled with complete specifications and tightening references can be found in most sections.

Continued on next page

If this manual covers more than one machine, or different models of component parts (alternator, engine, gear box, control valves, etc.), the procedures will apply to all unless otherwise noted.

Illustrations

Where possible, illustrations are placed as close as possible to the accompanying text and should be used as part of the text.

Serial and Model Numbers

When requesting repair or replacement parts it may be necessary to furnish the parts department with one or both numbers. Serial and model numbers will be

The SAE number is a standard for engine oils. For example, SAE 10W-30 is a single grade oil. Engine oils are classified by SAE numbers. SAE 10W-30 is a single grade oil.

The API classification is a standard for engine oils. Only oils meeting the API classification should be used. These oils are classified by API numbers. Both the API and SAE numbers must be followed when selecting oil.

Gear Lubricant and Gear Lubricant and Gear Lubricant are specified in Section 1000.

Some sections will have exploded views without accompanying text due to the simplicity of the procedure. This service manual is one of the most important tools available to the service technician. It is an invaluable aid in properly performing any phase of service.

The terms right-hand and left-hand as used in this manual indicate the right and left sides of the machine as viewed from the operator's seat for proper operation of the machine or attachment.

The information contained in this manual is current at the time of printing.

Table of Contents

The preceding pages contain a Table of Contents which list the Series number and title, and the sections contained in each series. The individual sections, where required, will have a Table of Contents on the second page of that section.

Page Numbers

All page numbers consist of two sets of digits separated by a dash, such as 4002-9. The digits preceding the dash identify the section. The digits following the dash represent the consecutive page number within that section. Page numbers will be found at the upper right or left of each page.

Text

If this manual covers more than one machine, or different models of component parts (planetary axles, gear boxes, control valves, etc.) the procedures will apply to all unless otherwise noted.

Illustrations

Where possible, illustrations are placed as close as possible to the accompanying text and should be used as part of the text.

Serial and Model Numbers

When requisitioning repair or replacement parts it may be necessary to furnish the parts department with one or both numbers. Serial and model numbers will be

found in the following locations.

Machine - Plate fastened to left front cab or canopy mounting bracket. Also stamped on top of chassis behind left-hand hydraulic reservoir.

Engine - Right-hand side of block below starter.

Component parts - plate attached to part or number stamped in part.

Torque References

Essentially two grades of fasteners (bolts, nuts and screws) are used on Case machinery. They are grade 5 and grade 8. Refer to Section 1051 for torque specifications and means of identification.

The specifications in Section 1051 are standard torque values and should be used on all fasteners during assembly and installation unless special torque values are noted in a particular section.

Classification of Lubricants

Oils, lubricants, and grease are classified and graded according to standards recommended by the Society of Automotive Engineers (SAE), the American Petroleum Institute (API), and the National Lubricating Grease Institute (NLGI).

Engine Oil

The SAE number indicates the viscosity of engine oils, for example, SAE 30, a single grade oil. Engine oils are also identified by dual numbers, SAE 10W30, a multigrade oil.

The API classification (MS DS SD CA) defines oil performance in terms of engine usage. Only oils specified in Section 1050 should be used. These oils contain sufficient chemical additives to provide maximum engine protection. Both the SAE grade and API designation must be found on the container.

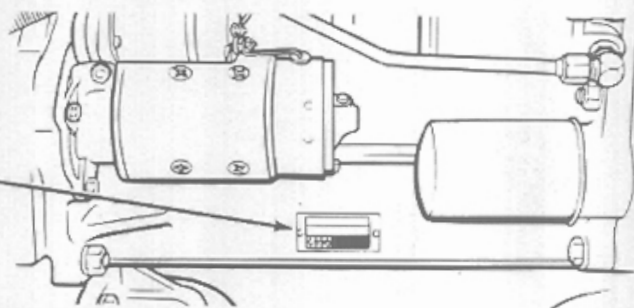
Gear Lubricant and Grease

Gear lubricant and grease must be that specified in Section 1050.

Section 1010

GENERAL ENGINE SPECIFICATIONS 480C TRACTORS

THE MODEL AND ENGINE SERIAL NUMBER IS STAMPED ON A PLATE, LOCATED ON THE RIGHT SIDE OF THE ENGINE, BELOW THE CRANKING MOTOR.



General

DIESEL ENGINES

Type	Case Open Chamber, 4 Cylinder, 4 Stroke Cycle, Valve-in-Head
Firing Order	1-3-4-2
Bore	3-13/16 Inches
Stroke	4-1/8 Inches
Piston Displacement	188 Cubic Inches
Compression Ratio	16-1/2 to 1
No Load Governed Speed	2000 to 2040 RPM
Rated Engine Speed	1900 RPM
Engine Idling Speed	625 to 675 RPM
*Valve Tappet Clearance (Exhaust)	(Hot and Cold) .014 Inch
(Intake)	(Hot and Cold) .012 Inch
*Hot Settings Are Made After the Engine Has Operated At Thermostat Controlled Temperature For At Least Fifteen Minutes.	

Piston and Connecting Rods

Rings per Piston	4
Number of Compression Rings	2
Number of Oil Rings	2
Type Pins	Full Floating Types
Type Bearing	Replaceable Precision, Steel Back, Copper-Lead or Aluminum Alloy Liners

Main Bearings

Number of Bearings	5
Type Bearings	Replaceable Precision, Steel Back, Copper-Lead or Aluminum Alloy Liners

Engine Lubricating System

Crankcase Capacity (Without Filter)	4
(With Filter Change)	5
Oil Pressure	50 to 70 Pounds with Engine Warm and Operating at Rated Engine Speed
Type System	Pressure and Spray Circulation
Oil Pump	Gear Type
Oil Filter	Full Flow Spin-on Type

Fuel System

Fuel Injection Pump	Roosa-Master
Pump Timing	8 Degrees Before Top Dead Center
Fuel Injectors	Pencil Type (Opening Pressure 2800 PSI)
Fuel Transfer Pump	Vane Type, Integral Part of Injection Pump
Governor	Variable Speed, Fly-Weight Centrifugal Type, Integral Part of Injection Pump
Fuel Filters	Full Flow Spin on Type

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Section 1027

DETAILED SPECIFICATIONS

188 Diesel Engines

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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 Pil Pump 8

 Cylinder Head 8

 Intake Valve 8

 Exhaust Valve 9

 Intake Valve Guides 9

 Exhaust Valve Guides 9

 Valve Spring 9

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INCH to MILLIMETER CONVERSION

mm	inch	mm	inch	mm	inch
10.4	0.41	125.0	5.00	254.0	10.00
12.7	0.50	127.0	5.00	254.0	10.00
15.9	0.63	152.4	6.00	304.8	12.00
19.0	0.75	177.8	7.00	354.3	14.00
22.1	0.87	203.2	8.00	404.7	16.00
25.4	1.00	228.6	9.00	457.2	18.00
28.5	1.13	254.0	10.00	508.0	20.00
31.8	1.25	279.4	11.00	558.5	22.00
35.0	1.38	304.8	12.00	609.6	24.00
38.1	1.50	330.2	13.00	660.1	26.00
41.3	1.63	355.6	14.00	711.2	28.00
44.5	1.75	381.0	15.00	762.0	30.00
47.6	1.87	406.4	16.00	812.5	32.00
50.8	2.00	431.8	17.00	863.0	34.00
53.9	2.13	457.2	18.00	913.5	36.00
57.1	2.25	482.6	19.00	964.0	38.00
60.3	2.38	508.0	20.00	1014.5	40.00
63.5	2.50	533.4	21.00	1065.0	42.00
66.7	2.63	558.8	22.00	1115.5	44.00
69.9	2.75	584.2	23.00	1166.0	46.00
73.0	2.87	609.6	24.00	1216.5	48.00
76.2	3.00	635.0	25.00	1267.0	50.00
79.4	3.13	660.4	26.00	1317.5	52.00
82.5	3.25	685.8	27.00	1368.0	54.00
85.7	3.38	711.2	28.00	1418.5	56.00
88.9	3.50	736.6	29.00	1469.0	58.00
92.1	3.63	762.0	30.00	1519.5	60.00
95.3	3.75	787.4	31.00	1570.0	62.00
98.4	3.87	812.8	32.00	1620.5	64.00
101.6	4.00	838.2	33.00	1671.0	66.00
104.8	4.13	863.6	34.00	1721.5	68.00
107.9	4.25	889.0	35.00	1772.0	70.00
111.1	4.38	914.4	36.00	1822.5	72.00
114.3	4.50	939.8	37.00	1873.0	74.00
117.5	4.63	965.2	38.00	1923.5	76.00
120.6	4.75	990.6	39.00	1974.0	78.00
123.8	4.87	1016.0	40.00	2024.5	80.00
127.0	5.00	1041.4	41.00	2075.0	82.00
130.2	5.13	1066.8	42.00	2125.5	84.00
133.4	5.25	1092.2	43.00	2176.0	86.00
136.5	5.38	1117.6	44.00	2226.5	88.00
139.7	5.50	1143.0	45.00	2277.0	90.00
142.9	5.63	1168.4	46.00	2327.5	92.00
146.0	5.75	1193.8	47.00	2378.0	94.00
149.2	5.87	1219.2	48.00	2428.5	96.00
152.4	6.00	1244.6	49.00	2479.0	98.00
155.6	6.13	1270.0	50.00	2529.5	100.00



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RUN-IN-INSTRUCTIONS

Engine Lubrication

When the engine rebuild is complete, fill the engine crankcase with Case HDM oil and install new engine oil filter. **NOTE:** If Case HDM oil is not used, use only a Series 3 DS or CD Service Classification oil that has the proper viscosity rating for prevailing air temperature. Refer to vehicle Operator's Manual.

After the first 20 hours of operation, change the engine oil while the engine is hot and replace the engine oil filter. **DO NOT DRAIN OIL UNTIL THE ENGINE HAS BEEN OPERATED 20 HOURS.**

Change the engine oil and filter at the recommended intervals thereafter as outlined in the Operator's Manual.

Break-In Procedure for Rebuilt Engines (With a Dynamometer)

The following procedure must be implemented when using a PTO dynamometer to break-in the engine. The dynamometer will insure control of the engine load at each speed and will eliminate over stressing new parts during break-in.

During the break-in, continually check the oil pressure, coolant level, and coolant temperature.

STEP	TIME	ENGINE SPEED	DYNAMOMETER SCALE LOAD*
1	**10 Minutes	1000 RPM	None
2	**10 Minutes	1800 RPM	None
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	Retorque the cylinder head bolts using the procedure described in Section 2015 of this service manual.		

*Based upon normal dynamometer scale load at rated speed for the particular vehicle model. Reduce this scale load as indicated.

**The most ideal break-in procedure would be to constantly vary the throttle between 750 to 1000 RPM for the first 10 minutes and from 1000 RPM to 1800 RPM for the next 10 minutes. The purpose of this changing RPM is to vary the lubrication and coolant flow.

***30 minutes at 3/4 load is a minimum amount of time the engine should be run. It is recommended that whenever possible the engine (especially turbocharged diesels) should 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.

Break-In Procedure for Rebuilt Engines (Without a Dynamometer)

STEP	TIME	ENGINE SPEED	LOAD
1	*10 Minutes	1000 RPM	None
2	*10 Minutes	1800 RPM	None
3	30 Minutes	2/3 Rated RPM	Light Load
4	1 Hour	Full RPM (not over 2000 RPM)	80 to 90%
5	Retorque the cylinder head bolts using the procedure described in Section 2015 of this service manual.		

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

Run-In Procedure (Agricultural 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 shifting to a lower gear. The engine must not be "lugged" below its Rated Engine RPM during the 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 prolonged converter or hydraulic stall. Engine must not be "lugged" below its Rated Engine RPM (Do not exceed 10 seconds of stall).

Run-In Procedure (Power Units)

For the first 1/2 hour, operate engine at 2/3 rated RPM with a light load or no load. For the next (1) hour, run engine at 80 to 90% load at rated RPM (but not over 2000 RPM). Then full load and rated RPM as required in application.

ST	TIME	ENGINE SPEED
1	10 Minutes	1000 RPM
2	10 Minutes	1200 RPM
3	10 Minutes	1400 RPM
4	10 Minutes	1600 RPM
5	10 Minutes	1800 RPM
6	10 Minutes	2000 RPM
7	10 Minutes	2200 RPM
8	10 Minutes	2400 RPM
9	10 Minutes	2600 RPM
10	10 Minutes	2800 RPM
11	10 Minutes	3000 RPM
12	10 Minutes	3200 RPM
13	10 Minutes	3400 RPM
14	10 Minutes	3600 RPM
15	10 Minutes	3800 RPM
16	10 Minutes	4000 RPM
17	10 Minutes	4200 RPM
18	10 Minutes	4400 RPM
19	10 Minutes	4600 RPM
20	10 Minutes	4800 RPM
21	10 Minutes	5000 RPM
22	10 Minutes	5200 RPM
23	10 Minutes	5400 RPM
24	10 Minutes	5600 RPM
25	10 Minutes	5800 RPM
26	10 Minutes	6000 RPM
27	10 Minutes	6200 RPM
28	10 Minutes	6400 RPM
29	10 Minutes	6600 RPM
30	10 Minutes	6800 RPM
31	10 Minutes	7000 RPM
32	10 Minutes	7200 RPM
33	10 Minutes	7400 RPM
34	10 Minutes	7600 RPM
35	10 Minutes	7800 RPM
36	10 Minutes	8000 RPM
37	10 Minutes	8200 RPM
38	10 Minutes	8400 RPM
39	10 Minutes	8600 RPM
40	10 Minutes	8800 RPM
41	10 Minutes	9000 RPM
42	10 Minutes	9200 RPM
43	10 Minutes	9400 RPM
44	10 Minutes	9600 RPM
45	10 Minutes	9800 RPM
46	10 Minutes	10000 RPM
47	10 Minutes	10200 RPM
48	10 Minutes	10400 RPM
49	10 Minutes	10600 RPM
50	10 Minutes	10800 RPM
51	10 Minutes	11000 RPM
52	10 Minutes	11200 RPM
53	10 Minutes	11400 RPM
54	10 Minutes	11600 RPM
55	10 Minutes	11800 RPM
56	10 Minutes	12000 RPM
57	10 Minutes	12200 RPM
58	10 Minutes	12400 RPM
59	10 Minutes	12600 RPM
60	10 Minutes	12800 RPM
61	10 Minutes	13000 RPM
62	10 Minutes	13200 RPM
63	10 Minutes	13400 RPM
64	10 Minutes	13600 RPM
65	10 Minutes	13800 RPM
66	10 Minutes	14000 RPM
67	10 Minutes	14200 RPM
68	10 Minutes	14400 RPM
69	10 Minutes	14600 RPM
70	10 Minutes	14800 RPM
71	10 Minutes	15000 RPM
72	10 Minutes	15200 RPM
73	10 Minutes	15400 RPM
74	10 Minutes	15600 RPM
75	10 Minutes	15800 RPM
76	10 Minutes	16000 RPM
77	10 Minutes	16200 RPM
78	10 Minutes	16400 RPM
79	10 Minutes	16600 RPM
80	10 Minutes	16800 RPM
81	10 Minutes	17000 RPM
82	10 Minutes	17200 RPM
83	10 Minutes	17400 RPM
84	10 Minutes	17600 RPM
85	10 Minutes	17800 RPM
86	10 Minutes	18000 RPM
87	10 Minutes	18200 RPM
88	10 Minutes	18400 RPM
89	10 Minutes	18600 RPM
90	10 Minutes	18800 RPM
91	10 Minutes	19000 RPM
92	10 Minutes	19200 RPM
93	10 Minutes	19400 RPM
94	10 Minutes	19600 RPM
95	10 Minutes	19800 RPM
96	10 Minutes	20000 RPM
97	10 Minutes	20200 RPM
98	10 Minutes	20400 RPM
99	10 Minutes	20600 RPM
100	10 Minutes	20800 RPM
101	10 Minutes	21000 RPM
102	10 Minutes	21200 RPM
103	10 Minutes	21400 RPM
104	10 Minutes	21600 RPM
105	10 Minutes	21800 RPM
106	10 Minutes	22000 RPM
107	10 Minutes	22200 RPM
108	10 Minutes	22400 RPM
109	10 Minutes	22600 RPM
110	10 Minutes	22800 RPM
111	10 Minutes	23000 RPM
112	10 Minutes	23200 RPM
113	10 Minutes	23400 RPM
114	10 Minutes	23600 RPM
115	10 Minutes	23800 RPM
116	10 Minutes	24000 RPM
117	10 Minutes	24200 RPM
118	10 Minutes	24400 RPM
119	10 Minutes	24600 RPM
120	10 Minutes	24800 RPM
121	10 Minutes	25000 RPM
122	10 Minutes	25200 RPM
123	10 Minutes	25400 RPM
124	10 Minutes	25600 RPM
125	10 Minutes	25800 RPM
126	10 Minutes	26000 RPM
127	10 Minutes	26200 RPM
128	10 Minutes	26400 RPM
129	10 Minutes	26600 RPM
130	10 Minutes	26800 RPM
131	10 Minutes	27000 RPM
132	10 Minutes	27200 RPM
133	10 Minutes	27400 RPM
134	10 Minutes	27600 RPM
135	10 Minutes	27800 RPM
136	10 Minutes	28000 RPM
137	10 Minutes	28200 RPM
138	10 Minutes	28400 RPM
139	10 Minutes	28600 RPM
140	10 Minutes	28800 RPM
141	10 Minutes	29000 RPM
142	10 Minutes	29200 RPM
143	10 Minutes	29400 RPM
144	10 Minutes	29600 RPM
145	10 Minutes	29800 RPM
146	10 Minutes	30000 RPM
147	10 Minutes	30200 RPM
148	10 Minutes	30400 RPM
149	10 Minutes	30600 RPM
150	10 Minutes	30800 RPM
151	10 Minutes	31000 RPM
152	10 Minutes	31200 RPM
153	10 Minutes	31400 RPM
154	10 Minutes	31600 RPM
155	10 Minutes	31800 RPM
156	10 Minutes	32000 RPM
157	10 Minutes	32200 RPM
158	10 Minutes	32400 RPM
159	10 Minutes	32600 RPM
160	10 Minutes	32800 RPM
161	10 Minutes	33000 RPM
162	10 Minutes	33200 RPM
163	10 Minutes	33400 RPM
164	10 Minutes	33600 RPM
165	10 Minutes	33800 RPM
166	10 Minutes	34000 RPM
167	10 Minutes	34200 RPM
168	10 Minutes	34400 RPM
169	10 Minutes	34600 RPM
170	10 Minutes	34800 RPM
171	10 Minutes	35000 RPM
172	10 Minutes	35200 RPM
173	10 Minutes	35400 RPM
174	10 Minutes	35600 RPM
175	10 Minutes	35800 RPM
176	10 Minutes	36000 RPM
177	10 Minutes	36200 RPM
178	10 Minutes	36400 RPM
179	10 Minutes	36600 RPM
180	10 Minutes	36800 RPM
181	10 Minutes	37000 RPM
182	10 Minutes	37200 RPM
183	10 Minutes	37400 RPM
184	10 Minutes	37600 RPM
185	10 Minutes	37800 RPM
186	10 Minutes	38000 RPM
187	10 Minutes	38200 RPM
188	10 Minutes	38400 RPM
189	10 Minutes	38600 RPM
190	10 Minutes	38800 RPM
191	10 Minutes	39000 RPM
192	10 Minutes	39200 RPM
193	10 Minutes	39400 RPM
194	10 Minutes	39600 RPM
195	10 Minutes	39800 RPM
196	10 Minutes	40000 RPM
197	10 Minutes	40200 RPM
198	10 Minutes	40400 RPM
199	10 Minutes	40600 RPM
200	10 Minutes	40800 RPM
201	10 Minutes	41000 RPM
202	10 Minutes	41200 RPM
203	10 Minutes	41400 RPM
204	10 Minutes	41600 RPM
205	10 Minutes	41800 RPM
206	10 Minutes	42000 RPM
207	10 Minutes	42200 RPM
208	10 Minutes	42400 RPM
209	10 Minutes	42600 RPM
210	10 Minutes	42800 RPM
211	10 Minutes	43000 RPM
212	10 Minutes	43200 RPM
213	10 Minutes	43400 RPM
214	10 Minutes	43600 RPM
215	10 Minutes	43800 RPM
216	10 Minutes	44000 RPM
217	10 Minutes	44200 RPM
218	10 Minutes	44400 RPM
219	10 Minutes	44600 RPM
220	10 Minutes	44800 RPM
221	10 Minutes	45000 RPM
222	10 Minutes	45200 RPM
223	10 Minutes	45400 RPM
224	10 Minutes	45600 RPM
225	10 Minutes	45800 RPM
226	10 Minutes	46000 RPM
227	10 Minutes	46200 RPM
228	10 Minutes	46400 RPM
229	10 Minutes	46600 RPM
230	10 Minutes	46800 RPM
231	10 Minutes	47000 RPM
232	10 Minutes	47200 RPM
233	10 Minutes	47400 RPM
234	10 Minutes	47600 RPM
235	10 Minutes	47800 RPM
236	10 Minutes	48000 RPM
237	10 Minutes	48200 RPM
238	10 Minutes	48400 RPM
239	10 Minutes	48600 RPM
240	10 Minutes	48800 RPM
241	10 Minutes	49000 RPM
242	10 Minutes	49200 RPM
243	10 Minutes	49400 RPM
244	10 Minutes	49600 RPM
245	10 Minutes	49800 RPM
246	10 Minutes	50000 RPM
247	10 Minutes	50200 RPM
248	10 Minutes	50400 RPM
249	10 Minutes	50600 RPM
250	10 Minutes	50800 RPM
251	10 Minutes	51000 RPM
252	10 Minutes	51200 RPM
253	10 Minutes	51400 RPM
254	10 Minutes	51600 RPM
255	10 Minutes	51800 RPM
256	10 Minutes	52000 RPM
257	10 Minutes	52200 RPM
258	10 Minutes	52400 RPM
259	10 Minutes	52600 RPM
260	10 Minutes	52800 RPM
261	10 Minutes	53000 RPM
262	10 Minutes	53200 RPM
263	10 Minutes	53400 RPM
264	10 Minutes	53600 RPM
265	10 Minutes	53800 RPM
266	10 Minutes	54000 RPM
267	10 Minutes	54200 RPM
268	10 Minutes	54400 RPM
269	10 Minutes	54600 RPM
270	10 Minutes	54800 RPM
271	10 Minutes	55000 RPM
272	10 Minutes	55200 RPM
273	10 Minutes	55400 RPM
274	10 Minutes	55600 RPM
275	10 Minutes	55800 RPM
276	10 Minutes	56000 RPM
277	10 Minutes	56200 RPM
278	10 Minutes	56400 RPM
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282	10 Minutes	57200 RPM
283	10 Minutes	57400 RPM
284	10 Minutes	57600 RPM
285	10 Minutes	57800 RPM
286	10 Minutes	58000 RPM
287	10 Minutes	58200 RPM
288	10 Minutes	58400 RPM
289	10 Minutes	58600 RPM
290	10 Minutes	58800 RPM
291	10 Minutes	59000 RPM
292	10 Minutes	59200 RPM
293	10 Minutes	59400 RPM
294	10 Minutes	59600 RPM
295	10 Minutes	59800 RPM
296	10 Minutes	60000 RPM
297	10 Minutes	60200 RPM
298	10 Minutes	60400 RPM
299	10 Minutes	60600 RPM
300	10 Minutes	60800 RPM
301	10 Minutes	61000 RPM
302	10 Minutes	61200 RPM
303	10 Minutes	61400 RPM
304	10 Minutes	61600 RPM
305	10 Minutes	61800 RPM
306	10 Minutes	62000 RPM
307	10 Minutes	62200 RPM
308	10 Minutes	62400 RPM
309	10 Minutes	62600 RPM
310	10 Minutes	62800 RPM
311	10 Minutes	63000 RPM
312	10 Minutes	63200 RPM
313	10 Minutes	63400 RPM
314	10 Minutes	63600 RPM
315	10 Minutes	63800 RPM
316	10 Minutes	64000 RPM
317	10 Minutes	64200 RPM
318	10 Minutes	64400 RPM
319	10 Minutes	64600 RPM
320	10 Minutes	64800 RPM
321	10 Minutes	65000 RPM
322	10 Minutes	65200 RPM
323	10 Minutes	65400 RPM
324	10 Minutes	65600 RPM
325	10 Minutes	65800 RPM
326	10 Minutes	66000 RPM
327	10 Minutes	66200 RPM
328	10 Minutes	66400 RPM
329	10 Minutes	66600 RPM
330	10 Minutes	66800 RPM
331	10 Minutes	67000 RPM
332	10 Minutes	67200 RPM
333	10 Minutes	67400 RPM
334	10 Minutes	67600 RPM
335	10 Minutes	67800 RPM
336	10 Minutes	68000 RPM
337	10 Minutes	68200 RPM
338	10 Minutes	68400 RPM
339	10 Minutes	68600 RPM
340	10 Minutes	68800 RPM
341	10 Minutes	69000 RPM
342	10 Minutes	69200 RPM
343	10 Minutes	69400 RPM
344	10 Minutes	69600 RPM
345	10 Minutes	69800 RPM
346	10 Minutes	70000 RPM
347	10 Minutes	70200 RPM
348	10 Minutes	70400 RPM
349	10 Minutes	70600 RPM
350	10 Minutes	70800 RPM
351	10 Minutes	71000 RPM
352	10 Minutes	71200 RPM
353	10 Minutes	71400 RPM
354	10 Minutes	71600 RPM
355	10 Minutes	71800 RPM
356	10 Minutes	72000 RPM
357	10 Minutes	72200 RPM
358	10 Minutes	72400 RPM
359	10 Minutes	72600 RPM
360	10 Minutes	72800 RPM
361	10 Minutes	73000 RPM
362	10 Minutes	73200 RPM
363	10 Minutes	73400 RPM
364	10 Minutes	73600 RPM
365	10 Minutes	73800 RPM
366	10 Minutes	74000 RPM
367	10 Minutes	74200 RPM
368	10 Minutes	74400 RPM
369	10 Minutes	74600 RPM
370	10 Minutes	74800 RPM
371	10 Minutes	75000 RPM
372	10 Minutes	75200 RPM
373	10 Minutes	75400 RPM
374	10 Minutes	75600 RPM
375	10 Minutes	75800 RPM
376	10 Minutes	76000 RPM
377	10 Minutes	76200 RPM
378	10 Minutes	76400 RPM
379	1	

DETAILED ENGINE SPECIFICATIONS

Cylinder Sleeves

	U.S. Value	Metric Value
Type	Replaceable Wet	
Material	Cast Iron	
I.D. of sleeve	3.8125 to 3.8115"	96.838 to 96.812mm
Maximum Serviceable Limit	3.8165"	96.939mm
Sleeve out-of-round (installed in block)	.001" max.	.025mm
Maximum Serviceable Limit	.004"	.102mm
Taper (installed in block)	.001"	.025mm
Maximum Serviceable Limit	.004"	.102mm
Clearance to bottom of piston skirt, 90° to piston pin ..	.0035 to .0055"	.090 to .140mm
Maximum Serviceable Limit	.0100"	.254mm
Sleeve Protrusion above cylinder block (Max.)	.005"	.127mm

Piston

Type	Cam ground	
Material	Aluminum Alloy	
O.D. at bottom of skirt, 90° to piston pin	3.807 to 3.808"	96.698 to 96.723mm
Minimum Serviceable Limit	3.806"	96.672mm
I.D. of piston pin bore including wear	1.2500 to 1.2508"	31.750 to 31.770mm
Width of 2nd ring groove	.097 to .098"	2.464 to 2.489mm
Maximum Serviceable Limit	.100"	2.540mm
Width of 3rd ring groove	.1885 to .1895"	4.788 to 4.813mm
Maximum Serviceable Limit	.1915"	4.864mm

Piston Rings

No. 1 Compression	Chrome Grooved Keystone	
End gap in 3.8125 I.D. (96.838mm I.D.) sleeve	.015 to .025"	.381 to .635mm
Maximum Serviceable Limit	.035"	.889mm
No. 2 Compression	Rectangular Grooved Back	
End gap in 3.8125 I.D. (96.838mm I.D.) sleeve	.015 to .025"	.381 to .635mm
Maximum Serviceable Limit	.035"	.889mm
Side Clearance	.0035 to .0055"	.090 to .140mm
Maximum Serviceable Limit	.008"	.203mm

Piston Rings (Cont'd)

U.S. Value

Metric Value

No. 3 Oil Control Ring	Three Piece	
End gap in 3.8125 I.D. (.96.838mm I.D.) sleeve	.015 to .055"	.381 to 1.397mm
Maximum Serviceable Limit	.065"	1.651mm
Side clearance	.000 to .008"	.000 to .203mm
Maximum Serviceable Limit	.010"	.254mm

Piston Pin

Type	Full Floating	
O.D. of pin	1.2495 to 1.2498"	31.737 to 31.745mm
Fit in piston	.0002 to .0010"	.005 to .025mm
Fit in rod bushing	.0004 to .0015"	.010 to .038mm

Connecting Rod

Bushing	Replaceable Bronze	
Bushing I.D. installed (ream to size)	1.2502 to 1.2504"	31.755 to 31.760mm
Maximum Serviceable Limit	1.2510"	31.775mm
Bearing liners	Replaceable	
Rod width at crank end	1.3035 to 1.3055"	33.109 to 33.160mm
Journal I.D. without bearing liners	2.1870 to 2.1875"	55.550 to 55.563mm
Bearing oil clearance	.0010 to .0040"	.025 to .102mm
Undersize bearings for service	.002,.010,.020,.030"	.051,.254,.508,.762mm
Side clearance	.005 to .011"	.127 to .279mm

Crankshaft

Type	Hardened Steel Balanced	
Main bearing liners	Replaceable	
End play, center main bearing cap	.001 to .015"	.025 to .381mm
Center main bearing thrust surface thickness	.1025 to .1045"	2.603 to 2.654mm
Connecting rod journal std. O.D.	2.0605 to 2.0615"	52.337 to 52.362mm
.002" (.051mm) O.D. undersize, grind to	2.0585 to 2.0595"	52.286 to 52.311mm
.010" (.254mm) O.D. undersize, grind to	2.0505 to 2.0515"	52.083 to 52.108mm
.020" (.508mm) O.D. undersize, grind to	2.0405 to 2.0415"	51.289 to 51.854mm
.030" (.762mm) O.D. undersize, grind to	2.0305 to 2.0315"	51.575 to 51.600mm
Connecting rod journal maximum taper	.001"	.025mm
Journals out-of-round	.0005"	.013mm
Undersize main bearing liners for service	.002,.010,.020,.030"	.051,.254,.508,.762mm
Main bearing oil clearance	.0012 to .0042"	.031 to .107mm

Crankshaft (Cont'd)

	U.S. Value	Metric Value
Main bearing journal std. O.D.	2.8730 to 2.8740"	72.974 to 73.000mm
.002" (.051mm) O.D. undersize, grind to	2.8710 to 2.8720"	72.923 to 72.949mm
.010" (.254mm) O.D. undersize, grind to	2.8630 to 2.8640"	72.720 to 72.746mm
.020" (.508mm) O.D. undersize, grind to	2.8530 to 2.8540"	72.466 to 72.492mm
.030" (.762mm) O.D. undersize, grind to	2.8430 to 2.8440"	72.212 to 72.238mm
Main bearing journal bore I.D. without liners	3.066 to 3.067"	77.876 to 77.902mm
Main journal width between cheeks:		
2nd and 4th	1.185 to 1.189"	30.099 to 30.201mm
3rd	1.3740 to 1.3770"	34.900 to 34.976mm
5th	1.745 to 1.755"	44.32 to 44.58mm
Connecting rod journals width between cheeks	1.3105 to 1.3145"	33.287 to 33.388mm

Camshaft

Type	Parabolic	
Bushings	5, Replaceable	
Bushing Lubrication:		
Front bushing	Pressure lubricated from oil pump	
Intermediate bushing	Gravity flow lubricated	
Rear bushing	Pressure lubricated with rear oil metering.	
Oil clearance	.002 to .007"	.051 to .178mm
I.D. of bushing installed	1.752 to 1.753"	44.501 to 44.526mm
Maximum Serviceable Limit	1.755"	44.577mm
Bushing width:		
1st (front)	1.213 to 1.223"	30.810 to 31.064mm
2nd, 3rd and 4th	.490 to .500"	12.446 to 12.700mm
5th (rear)	1.213 to 1.223"	30.810 to 31.064mm
O.D. of each bearing surface	1.749 to 1.750"	44.425 to 44.450mm
Minimum Serviceable Limit	1.748"	44.399mm
Thrust washer thickness	.147 to .149"	3.734 to 3.785mm
Minimum Serviceable Limit	Maintain end clearance	
Camshaft end play	Taken up by thrust washer	
Camshaft end clearance	.003 to .007"	.076 to .178mm

Valve Push Rod Lifters

Material	Hardened Steel	
Type	Mushroom	
O.D. of lifter stem	.5605 to .5610"	14.237 to 14.249mm
I.D. of block bore, including wear	.5625 to .5650"	14.287 to 14.351mm

Gear Train

U.S.Value

Metric Value

Backlash:

Crankshaft gear to camshaft gear	.0002 to .006"	.005 to .152mm
Camshaft gear to idler gear	.0004 to .006"	.010 to .152mm
Idler gear to fuel pump gear	.0005 to .007"	.013 to .178mm
Crankshaft gear to oil pump gear	.002 to .008"	.051 to .203mm
Crankshaft gear to fuel pump gear	.0005 to .019"	.013 to .483mm
O.D. of idler gear shaft	1.3745 to 1.3755"	34.912 to 34.938mm
Minimum Serviceable Limit	1.3740"	34.900mm
I.D. of idler gear with bushing	1.376 to 1.377"	34.950 to 34.976mm
Maximum Serviceable Limit	1.377"	34.976mm
Idler gear thrust washer shims	.005,.006,.007,.009"	.127,.152,.178,.229mm
Idler gear end play	.003"	.076mm

Oil Pump

Positive displacement pump	Gear Type	Type
Backlash, pump gear to crankshaft gear	.002 to .008"	.051 to .203mm
Drive gear to pump body maximum clearance	.0035 to .010"	.089 to .254mm
Pump gears to body radial maximum clearance	.002 to .008"	.051 to .203mm
Pump gears to pump cover maximum clearance	.0015 to .008"	.038 to .203mm
Oil pressure	50 to 75 PSI	344.7 to 482.6 kPa
Relief valve spring:		
Free length	2.125"	53.975mm
Compressed 1.44" (36.58mm)	18 to 19 lbs.	8.16 to 8.62 kg

Cylinder Head

Warpage (Max.)	.006"	.152mm
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Intake Valve

Tappet clearance (COLD and HOT)	.012"	.305mm
Face angle	44°	44°
Face run-out (max.)	.002"	.051mm
Length	6.339 to 6.364"	161.011 to 161.646mm
O.D. of stem	.3409 to .3419"	8.659 to 8.684mm
Minimum Serviceable Limit	.3399"	8.634mm
O.D. of head	1.599 to 1.609"	40.615 to 40.869mm
Seat angle	45°	45°
Seat contact width	.0704" to .1057"	1.788 to 2.685mm
Seat run-out (max.)	.002"	.051mm

Exhaust Valve

	U.S. Value	Metric Value
Tappet clearance (COLD and HOT)	.014"	.356mm
Face angle	44°	44°
Face run-out (max.)	.002"	.051mm
O.D. of head	1.398 to 1.408"	35.509 to 35.763mm
O.D. of stem	.3399 to .3409"	8.634 to 8.659mm
Minimum Serviceable Limit	.3389"	8.608mm
Length	6.340 to 6.364"	161.036 to 161.646mm
Insert seat angle	45°	45°
Seat contact width	.0608 to .0962"	1.544 to 2.443mm
Seat run-out (max.)	.002"	.051mm
Insert height	.2475 to .2525"	6.286 to 6.413mm
O.D. of insert	1.4495 to 1.4505"	36.817 to 36.843mm
I.D. of insert	1.245 to 1.255"	31.623 to 31.877mm

Intake Valve Guides

Length	3.250"	82.550mm
O.D.	.6565 to .6575"	16.675 to 16.701mm
I.D. (installed and reamed)	.3429 to .3439"	8.710 to 8.735mm
Maximum Serviceable Limit	.3449"	8.761mm
Protrusion above cylinder head	.875"	22.225mm
Valve stem clearance in guide	.001 to .003"	.025 to .076mm
Maximum Serviceable Limit	.004"	.102mm

Exhaust Valve Guides

Length	3.125"	79.375mm
O.D.	.6565 to .6575"	16.675 to 16.701mm
I.D. (installed and reamed)	.3429 to .3439"	8.710 to 8.735mm
Maximum Serviceable Limit	.3449"	8.761mm
Protrusion above cylinder head	.875"	22.225mm
Valve stem clearance in guide	.002 to .004"	.051 to .102mm
Maximum Serviceable Limit	.005"	.127mm

Valve Spring

Free length	2.375"	60.325mm
Total coils	8.25	
Wire diameter	.162"	4.115mm
I.D.	.958 to .978"	24.333 to 24.841mm
Compressed to 1.521" (38.63mm) (valve open)	110 to 118 lbs.	49.90 to 53.52 kg
Compressed to 1.875" (47.63mm) (valve closed)	53 to 59 lbs.	24.04 to 26.76 kg

Rocker Arm Assembly

U.S. Value

Metric Value

O.D. of shaft	.622 to .623"	15.799 to 15.824mm
I.D. of arm bore	.624 to .626"	15.850 to 15.900mm
Shaft spring:		
Free length	2.5"	63.500mm
Compressed to 1.75" (44.45mm)	7.5 to 8.5 lbs.	3.40 to 3.86 kg
Lubrication	Engine oil, camshaft metering	
Shaft oil holes	Toward valve side of engine. Shaft cannot be rotated.	

SPECIAL TORQUES

Engine

	U.S. Value	Metric Value
Camshaft nut	80 to 90 ft. lbs.	109 to 122 Nm
Camshaft thrust plate mounting bolt	17 to 20 ft. lbs.	23 to 27 Nm
Connecting rod nuts	45 to 50 ft. lbs.	61 to 68 Nm
Crankshaft nut	125 to 135 ft. lbs.	169 to 183 Nm
Crankshaft pulley bolt	54 to 64 ft. lbs.	73 to 87 Nm
Cylinder head studs w/flange nuts (1/2")	90 to 100 ft. lbs.	122 to 136 Nm
Cylinder head cover stud nuts (3/8")	4 to 6 ft. lbs.	5 to 8 Nm
Cylinder head bolts (Gr. 8, 12 pt. hd.)	105 to 115 ft. lbs.	142 to 156 Nm
Cylinder head stud nuts (1/2")	95 to 105 ft. lbs.	129 to 142 Nm
Engine oil filter	Install until gasket contacts filter head, then hand tighten 1/2 turn. Loosen filter approximately 1 full turn and retighten until gasket contact is made, then hand tighten an additional 1/2 to 3/4 turn.	
Fan mounting bolts	35 to 42 ft. lbs.	48 to 57 Nm
Fuel pump drive gear nut	40 to 50 ft. lbs.	54 to 68 Nm
Flywheel to crankshaft bolt	65 to 70 ft. lbs.	88 to 95 Nm
Idle gear journal mounting bolts	35 to 42 ft. lbs.	48 to 57 Nm
Intake manifold (Aluminum) stud nuts	30 to 35 ft. lbs.	41 to 48 Nm
Intake and Exhaust Manifold stud nuts	25 to 30 ft. lbs.	34 to 41 Nm
Main bearing cap bolts	90 to 100 ft. lbs.	122 to 136 Nm
Oil pan capscrews (stamped steel)	10 to 12 ft. lbs.	14 to 16 Nm
Oil pan capscrews (cast iron)	24 to 28 ft. lbs.	33 to 38 Nm
Oil pan to seal retainer	15 to 20 ft. lbs.	20 to 27 Nm
Oil pan drain plug	29 to 31 ft. lbs.	39 to 42 Nm
Oil pump cover capscrews	6 to 8 ft. lbs.	8 to 11 Nm
Oil seal retainer bolts (Grade 8)	12 to 15 ft. lbs.	16 to 20 Nm
Oil pump suction tube nut	95 to 105 ft. lbs.	129 to 142 Nm
Rocker arm bracket bolts	25 to 30 ft. lbs.	34 to 41 Nm
Timing gear housing bolts	25 to 30 ft. lbs.	34 to 41 Nm
Water pump mounting bolts	25 to 30 ft. lbs.	34 to 41 Nm
Water pump body-to-cyl. mounting bolts	35 to 42 ft. lbs.	48 to 57 Nm

GENERAL TORQUE SPECIFICATION TABLE (Revised 2-74)
USE THE FOLLOWING TORQUES WHEN SPECIAL TORQUES ARE NOT GIVEN

NOTE: These values apply to fasteners as received from supplier, dry, or when lubricated with normal engine oil. They do not apply if special graphited or moly-disulphide greases or other extreme pressure lubricants are used. This applies to both UNF and UNC threads.

SAE Grade No.		2				5				8 *			
Bolt head identification marks as per grade NOTE: Manufacturing Marks Will Vary						  				  			
		Torque				Torque				Torque			
Bolt Size		Foot Pounds		Newton-Meters		Foot Pounds		Newton-Meters		Foot Pounds		Newton-Meters	
Inches	Millimeters	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/4	6.35	5	6	6.8	8.13	9	11	12.2	14.9	12	15	16.3	20.3
5/16	7.94	10	12	13.6	16.3	17	20.5	23.1	27.8	24	29	32.5	39.3
3/8	9.53	20	23	27.1	31.2	35	42	47.5	57.0	45	54	61.0	73.2
7/16	11.11	30	35	40.7	47.4	54	64	73.2	86.8	70	84	94.9	113.9
1/2	12.70	45	52	61.0	70.5	80	96	108.5	130.2	110	132	149.2	179.0
9/16	14.29	65	75	88.1	101.6	110	132	149.2	179.0	160	192	217.0	260.4
5/8	15.88	95	105	128.7	142.3	150	180	203.4	244.1	220	264	298.3	358.0
3/4	19.05	150	185	203.3	250.7	270	324	366.1	439.3	380	456	515.3	618.3
7/8	22.23	160	200	216.8	271.0	400	480	542.4	650.9	600	720	813.6	976.3
1	25.40	250	300	338.8	406.5	580	696	786.5	943.8	900	1080	1220.4	1464.5
1-1/8	25.58					800	880	1084.8	1193.3	1280	1440	1735.7	1952.6
1-1/4	31.75					1120	1240	1518.7	1681.4	1820	2000	2467.9	2712.0
1-3/8	34.93					1460	1680	1979.8	2278.1	2380	2720	3227.3	3688.3
1-1/2	38.10					1940	2200	2630.6	2983.2	3160	3560	4285.0	4827.4

* Thick nuts must be used with Grade 8 bolts

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.

MAINTENANCE AND LUBRICATION

Section 1050

MAINTENANCE AND LUBRICATION

FLUIDS AND LUBRICANTS

COMPONENTS	CAPACITY		SPECIFICATIONS
	U.S.	Metric	
Fuel tank	22 gallons	83 litres	Refer to Operator's Manual.
Engine crankcase Without filter change	6 quarts	5.7 litres	Case HDM oil Engine oil, class CD, Above 32° F (0° C) SAE 30 10°-50° F (-12°-10° C) . . . SAE 20W Below 32° F (0° C) SAE 10W
With filter change	7 quarts	6.6 litres	
Hydraulic system (approx.) Loader/backhoe Loader only Loader/three point hitch Three point hitch only Reservoir refill	23 gallons 15 gallons 19 gallons 14 gallons 11.5 gallons	87 litres 57 litres 72 litres 53 litres 43 litres	Case TCH Fluid Alternate oil Engine oil, SD or CA Above 32° F (0° C) SAE 10W Below 32° F (0° C) SAE 5W Type C-2 transmission/hydraulic fluid such as Tenneco Hytrans Fluid.
Power steering system Reservoir refill	3 quarts 1 quart	2.8 litres 0.9 litre	Case TCH Fluid.
Mechanical shuttle	2 quarts	1.9 litres	Case TCH Fluid.
Transaxle	20 quarts	19 litres	Case FDL gear lubricant or lubri- cant meeting API-GL-4, specification Above 0° F (-18° C) SAE 90 Below 0° F (-18° C) SAE 80
Grease fittings	As required		No. 2 moly disulfide grease.
Front wheel bearings	As required		No. 2 wheel bearing grease.
Cooling system	21 quarts	19.8 litres	Mix ethylene glycol type antifreeze and water for lowest anticipated temperature.
Battery	As required		Add colorless, odorless drinking water.
Brake master cylinders	As required		DOT 3 brake fluid.

MAINTENANCE CHART

NOTE: This chart is based on maximum service intervals. If operating in severe working conditions, service more often.

INTERVAL	SERVICE	INSTRUCTIONS
Run-in period. Every two hours until stable	Torque front and rear wheel bolts to 115-130 foot-pounds (157-176 N m). Torque transaxle mounting bolts to 250-300 foot-pounds (339-407 N m). Torque swing cylinder trunnion plate mounting bolts to 520-640 foot-pounds (732-867 N m). Torque drive shaft cap screws to 20-24 foot-pounds (27-32 N m).	
Run-in period after first 20 hours	Change engine oil and filter. Change hydraulic oil filter. Check fan belt tension.	Section 4002 Section 8007
Every 10 hours of operation or daily, whichever occurs first	Grease loader pivot points. Grease backhoe pivot points. Grease extendable dipper, if so equipped. Grease three point hitch, if so equipped. Grease front axle pivot. Grease front axle king pins. Grease shuttle control bellcrank. Check engine oil level. Check hydraulic oil level. Check radiator coolant level. Clean air cleaner dust cup. Check the machine and the ground under it for signs of leaks. Check injection pump sediment bowl for water. If bowl has water, drain fuel tank, first stage fuel filter and sediment bowl.	Section 2051

INTERVAL	SERVICE	INSTRUCTIONS
Every 100 hours of operation	Change engine oil.	NOTE: This chart is based on maximum service conditions. Service more often. Run-in period Every 100 hours Daily - 1 mile Section 6229 Section 8005
	Grease rear axle bearings.	
	Grease seat post.	
	Grease brake pedals and clutch shaft.	
Every 200 hours of operation	Grease brake pedals and clutch shaft on mechanical shuttle machines.	Run-in period Every 200 hours Daily - 1 mile Section 2051
	Check tire condition and pressure.	
	Check battery fluid level.	
	Check transaxle oil level.	
Every 500 hours of operation	Check mechanical shuttle oil level.	Run-in period Every 500 hours Daily - 1 mile Section 2555 Section 8007
	Check power steering oil level.	
	Clean spark arresting muffler if so equipped.	
Every 1000 hours of operation or once a year, whichever occurs first	Change engine oil filter.	Section 4002 Section 5005
	Check fan belt tension.	
	Grease universal joints.	
	Lubricate hydraulic pump shaft.	
Every 1000 hours of operation or once a year, whichever occurs first	Replace fuel filters.	Section 3010 Section 5021 Section 9061 Section 4002 Section 4002
	Check brake master cylinder fluid level.	
	Repack front wheel bearings.	
	Inspect Roll-Over Protection Structure.	
Every 1000 hours of operation or once a year, whichever occurs first	Change hydraulic oil filter.	Section 4002 Section 4002
	Clean hydraulic reservoir breather.	

INTERVAL	SERVICE	INSTRUCTIONS
Every 2000 hours of operation or once a year, whichever occurs first	Drain, flush and refill cooling system.	Section 2050
As required	After a wheel has been removed and installed, check bolt torque every two hours until stable. Service air filter element whenever restriction warning light remains on with engine running at full throttle. Change hydraulic oil filter whenever restriction warning light remains on.	Section 2051 Section 4002

U.S. AND METRIC TORQUE SPECIFICATIONS
Grade 5 Bolts, Nuts and Studs (Dry Thread)

Section 1051

TORQUE SPECIFICATIONS

Thread size	FT-Lbs	N m	Thread size	FT-Lbs	N m
1/4"-20 NC	8-10	7-13	1 1/8"-12 NC	88-118	88-118
1/4"-28 NF	10-15	13-20	1 1/8"-12 NF	88-118	88-118
5/16"-18 NC	15-20	20-27	1 1/4"-7 NC	100-130	135-183
5/16"-24 NF	18-20	20-27	1 1/4"-7 NF	110-130	149-176
3/8"-16 NC	25-35	34-47	1 1/2"-6 NC	155-185	183-223
3/8"-24 NF	30-40	41-54	1 1/2"-6 NF	160-200	216-271
7/16"-14 NC	45-55	61-74			
7/16"-20 NF	50-60	68-81			
1 1/2"-12 NC	65-85	88-118			
1 1/2"-12 NF	60-100	82-118			
9/16"-12 NC	100-120	135-183			
9/16"-18 NF	110-130	149-176			
5/8"-11 NC	155-185	183-223			
5/8"-18 NF	160-200	216-271			

Grade 8 Bolts, Nuts and Studs (Dry Thread)

Thread size	FT-Lbs	N m	Thread size	FT-Lbs	N m
1/4"-20 NC	10-15	13-20	3/4"-10 NC	135-185	183-223
1/4"-28 NF	15-20	20-27	3/4"-10 NF	140-175	190-230
5/16"-18 NC	20-30	27-40	1 1/8"-7 NC	160-200	216-271
5/16"-24 NF	25-30	34-40	1 1/8"-7 NF	165-205	223-277
3/8"-16 NC	40-50	54-67	1 1/4"-7 NC	175-215	238-292
3/8"-24 NF	45-55	61-74	1 1/4"-7 NF	180-220	245-300
7/16"-14 NC	60-80	82-103	1 1/2"-6 NC	200-240	271-325
7/16"-20 NF	70-90	95-123	1 1/2"-6 NF	205-245	277-331
1 1/2"-12 NC	100-120	135-183			
1 1/2"-12 NF	110-130	149-176			
9/8"-12 NC	135-185	183-223			
9/8"-18 NF	155-190	210-267			
5/8"-18 NC	200-240	271-325			
5/8"-18 NF	210-267	283-350			

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U.S. AND METRIC TORQUE SPECIFICATIONS**Grade 5 Bolts, Nuts and Studs (Dry Threads)**

Thread size	Ft-lbs	N m		Thread size	Ft-lbs	N m
1/4"-20 NC	5-10	7-13		3/4"-10 NC	235-285	319-386
1/4"-28 NF	10-15	13-20		3/4"-16 NF	270-330	366-447
5/16"-18 NC	15-20	20-27		7/8"-9 NC	360-440	488-597
5/16"-24 NF	15-20	20-27		7/8"-14 NF	395-490	536-664
3/8"-16 NC	25-35	34-47		1"-8 NC	520-640	705-867
3/8"-24 NF	30-40	41-54		1"-12 NF	575-705	780-955
7/16"-14 NC	45-55	61-74		1-1/8"-7 NC	720-820	976-1111
7/16"-20 NF	50-60	68-81		1-1/8"-12 NF	790-970	1071-1315
1/2"-13 NC	65-85	88-115		1-1/4"-7 NC	1010-1240	1370-1681
1/2"-20 NF	80-100	109-135		1-1/4"-12 NF	1115-1365	1512-1850
9/16"-12 NC	100-120	135-163		1-3/8"-6 NC	1315-1610	1783-2182
9/16"-18 NF	110-130	149-176		1-3/8"-12 NF	1510-1850	2047-2508
5/8"-11 NC	135-165	183-223		1-1/2"-6 NC	1745-2135	2366-2894
5/8"-18 NF	160-200	216-271		1-1/2"-12 NF	1880-2420	2549-3281

Grade 8 Bolts, Nuts and Studs (Dry Threads)

Thread size	Ft-lbs	N m		Thread size	Ft-lbs	N m
1/4"-20 NC	10-15	13-20		3/4"-10 NC	340-420	461-569
1/4"-28 NF	15-20	20-27		3/4"-16 NF	380-460	515-623
5/16"-18 NC	20-30	27-40		7/8"-9 NC	540-660	732-894
5/16"-24 NF	25-30	34-40		7/8"-14 NF	595-725	807-982
3/8"-16 NC	40-50	54-67		1"-8 NC	810-990	1098-1342
3/8"-24 NF	45-55	61-74		1"-12 NF	900-1100	1220-1491
7/16"-14 NC	60-80	82-102		1-1/8"-7 NC	1150-1400	1559-1898
7/16"-20 NF	70-90	95-122		1-1/8"-12 NF	1295-1585	1756-2148
1/2"-13 NC	100-120	136-162		1-1/4"-7 NC	1640-2000	2224-2711
1/2"-20 NF	110-130	149-176		1-1/4"-12 NF	1800-2200	2440-2982
9/16"-12 NC	135-165	183-223		1-3/8"-6 NC	2140-2620	2901-3552
9/16"-18 NF	155-190	210-257		1-3/8"-12 NF	2450-3000	3322-4067
5/8"-11 NC	200-240	271-325		1-1/2"-6 NC	2845-3475	3857-4711
5/8"-18 NF	215-265	292-359		1-1/2"-12 NF	3200-3900	4339-4880

U.S. AND METRIC TORQUE SPECIFICATIONS**Hydraulic Fittings (Steel)**

Dash Size	Tube O.D. Hose I.D.	Thread Size	37° Flare Torque		Straight Thread O-ring Torque	
			Ft-lbs	N m	Ft-lbs	N m
4	1/4"	7/16"-20	6-12	8-16	12-19	16-25
5	5/16"	1/2"-20	8-16	11-21	16-25	22-33
6	3/8"	9/16"-18	10-25	14-33	25-40	34-54
8	1/2"	3/4"-16	15-42	20-56	42-67	57-90
10	5/8"	7/8"-14	25-58	34-78	58-92	79-124
12	3/4"	1-1/16"-12	40-80	54-108	80-128	108-174
14	7/8"	1-3/16"-12	60-100	81-135	100-160	136-216
16	1"	1-5/16"-12	75-117	102-158	117-187	159-253
20	1-1/4"	1-5/8"-12	125-165	169-223	165-264	224-357
24	1-1/2"	1-7/8"-12	210-250	285-338	250-400	339-542

Split Flange Mounting Bolts (Grade 5, Dry Threads)

Flange Size	Thread Size	Torque	
		Ft-lbs	N m
1/2"	5/16"-18 NC	15-20	20-25
3/4"	3/8"-16 NC	20-25	26-33
1"	3/8"-16 NC	20-25	26-33
1-1/4"	7/16"-14 NC	35-45	47-61
1-1/2"	1/2"-13 NC	45-55	61-74
2"	1/2"-13 NC	55-65	74-88
2-1/2"	1/2"-13 NC	80-90	104-122
3"	5/8"-11 NC	140-150	190-203

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U.S. AND METRIC TORQUE SPECIFICATIONS Hydraulic Fittings (Steel)

Dash Size	Tube O.D. / Hose I.D.	Thread Size	37° Flare Torque Ft-lbs / N m	Light Torque Ft-lbs / N m
4	1 1/4"	1 1/8"-20	8-12	2-3
6	1 3/8"	1 1/2"-20	8-16	3-5
8	1 7/8"	2 1/8"-18	10-25	4-6
10	2 1/2"	2 1/4"-16	18-42	6-9
12	3 1/8"	2 3/8"-14	28-58	9-14
14	3 1/2"	2 1/2"-12	40-80	12-18
16	4"	2 3/4"-12	60-100	18-25
18	4 1/2"	3"-12	75-117	22-35
20	5"	3 1/8"-12	100-155	35-55
24	5 1/2"	3 1/2"-12	135-188	55-85
30	6 1/2"	4"-12	210-250	95-135

Split Flange Mounting Bolts (Grade 5, L)

Flange Size	Thread Size	Torque
1 1/2"	1 1/8"-18 NC	15-20
2"	1 1/2"-16 NC	20-25
2 1/2"	2"-16 NC	20-25
3"	2 1/8"-14 NC	28-45
3 1/2"	2 3/8"-12 NC	48-85
4"	2 1/2"-12 NC	55-85
4 1/2"	2 3/4"-12 NC	80-90
5"	3"-11 NC	140-155

NOISE PROTECTION

Section 1052

NOISE CONTROL

1.1 Case provides noise abatement kits that may be factory or field installed. Each kit is made of an acoustical foam material and a noise control muffler. The material must be kept clean and intact. Also the muffler must be of the proper type and size and be installed working order to protect the proper level of noise protection.

Cleaning

1.2 If the muffler becomes contaminated with dirt, hose down with water. Soak glass parts that have become contaminated with oil or grease. Squeeze out the excess with a clean cloth.

1.3 If the muffler is saturated with oil or grease and does not clean up, replace the muffler with a new one.

Replacement



When replacing padding make sure the metal surfaces are clean of all oil, grease, excessive dirt and traces of old material. It is very important that the new piece cover the same area as the old one.

Use a hand name contact cement according to manufacturer's instructions to hold padding in place.

Checking Noise Protection

The level of some cities, states or provinces may require that your machine be checked and certified for a maximum noise level. Be sure to check with local author-

ities to determine what noise level is required. Listed below are the steps to be performed to insure proper noise protection.

1.1 Check that all metal fasteners are tight. Check that all metal fasteners are tight.

1.2 Check that all metal fasteners are tight. Check that all metal fasteners are tight.

1.3 Check noise level. Check noise level.

1.4 Check that the engine speed is correct. Check that the engine speed is correct.

1.5 Check the muffler for resonance. Check the muffler for resonance.

1.6 Check muffler for excessive noise. Check muffler for excessive noise.

NOTE: For your information, see the SAE J1182 sound levels and the SAE Handbook.

NOISE PROTECTION

J I Case provides noise abatement kits that may be factory or field installed. Each kit is made up of an acoustical foam material and a noise control muffler. The material must be kept clean and intact. Also the muffler must be of the proper type and size, and be in good working order to maintain the proper level of noise protection.

Cleaning

If the padding becomes contaminated with surface dust or dirt, hose down with water. Steam clean parts that have become contaminated with oil or grease. Squeeze out the excess water.

If the padding is saturated with oil or grease and does not clean up, replace the contaminated part.

Replacement



WARNING: Be sure the area has good ventilation before applying the adhesive. 39-10

When installing padding make sure the metal surfaces are clean of all oil, grease, excessive rust and traces of old material. It is very important that the new piece cover the same area as the old one.

Use a brand name contact cement according to manufacturer's instructions to hold padding in place.

Checking Noise Protection

The laws of some cities, states or provinces may require that your machine be checked and certified for a maximum noise level. Be sure to check with local authori-

ties to determine what the requirements are.

Listed below are checks that must be performed to insure continuing noise protection.

1. Check that all exterior parts and sheet metal fasteners are tight. All rattles close to the operator's area must be eliminated.
2. Check that all sealing and barrier materials are whole and intact. A small hole can admit a large amount of noise.
3. Check noise isolators such as engine mounts, rubber shock mounts, hydraulic tube isolators, etc. Replace if defective.
4. Check that the full throttle - no load engine speed is checked with an accurate tachometer. The engine speed must be within the limits as listed in Section 1010.
5. Check the full range of engine speed for resonance (loud, undampened vibration). To check, increase the engine speed from low idle to full throttle slowly. If excessive resonance is found, eliminate the vibration of the suspected part.
6. Check muffler for deterioration. Check for excessive engine noise out of the muffler. If either condition exists, replace muffler with muffler listed in the parts catalog.

NOTE: For your general information, see the SAE recommended practice on sound levels and measurements. Refer to SAE J 919a, J87 and J88 in the SAE Handbook.

Section 2001

ENGINE DIAGNOSIS

188 and 207 Diesel Engines

GENERAL INFORMATION

Before making any repairs or adjustments on an engine, a mechanic or technician must properly diagnose the trouble.

Locating the trouble and repairing it is only part of the job, a technician must find and eliminate the cause of the trouble as well. Too many repairs are made with no thought to removing the causes that made the repair necessary.

For any engine to start or perform properly, three main requirements must be present:

1. FUEL
2. COMPRESSION
3. COMBUSTION

When any of these requirements are not present or limited by some mechanical reason, the engine will not start and will fail to operate properly throughout the power range.

FUEL. Fuel system problems can be present anywhere from the fuel tank, through the filters and injection pump as well as the injectors. Correct injection pump timing is important in the overall fuel system performance.

COMPRESSION. Compression on an engine is related to the "breathing function". Proper compression is affected by the air cleaner condition, muffler restriction, valve condition and operation including proper valve adjustment, cylinder head gaskets, condition of sleeves, rings, pistons, camshaft, and camshaft timing.

COMBUSTION. Combustion is the result of adequate compression to develop enough heat in the air charge on the compression stroke to fire the fuel being injected into the engine cylinders. Proper spray pattern and atomization of the fuel by the injector is very important. Timing the fuel injection pump to the engine to a precise degree BTDC is a vital requirement for proper combustion.

The engine diagnosis contained in the following pages covers many trouble symptoms, the causes, and what will be necessary to repair or eliminate the problem. Under each symptom are listed the most common and reoccurring problems progressing to the not so common problems. Locate your problem symptom in the diagnosis chart and refer to the pages listed for the probable causes and remedies.