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* Schematic Set Sections

THIS TABLE OF CONTENTS REPLACES LEP 8-88992

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* Schematic Set Sections

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Sectional Index

SECTION NO.

Section

1002

SPECIFICATIONS

For 688 Crawler Excavators

DON 7-32351 REPLACES DON 7-32350

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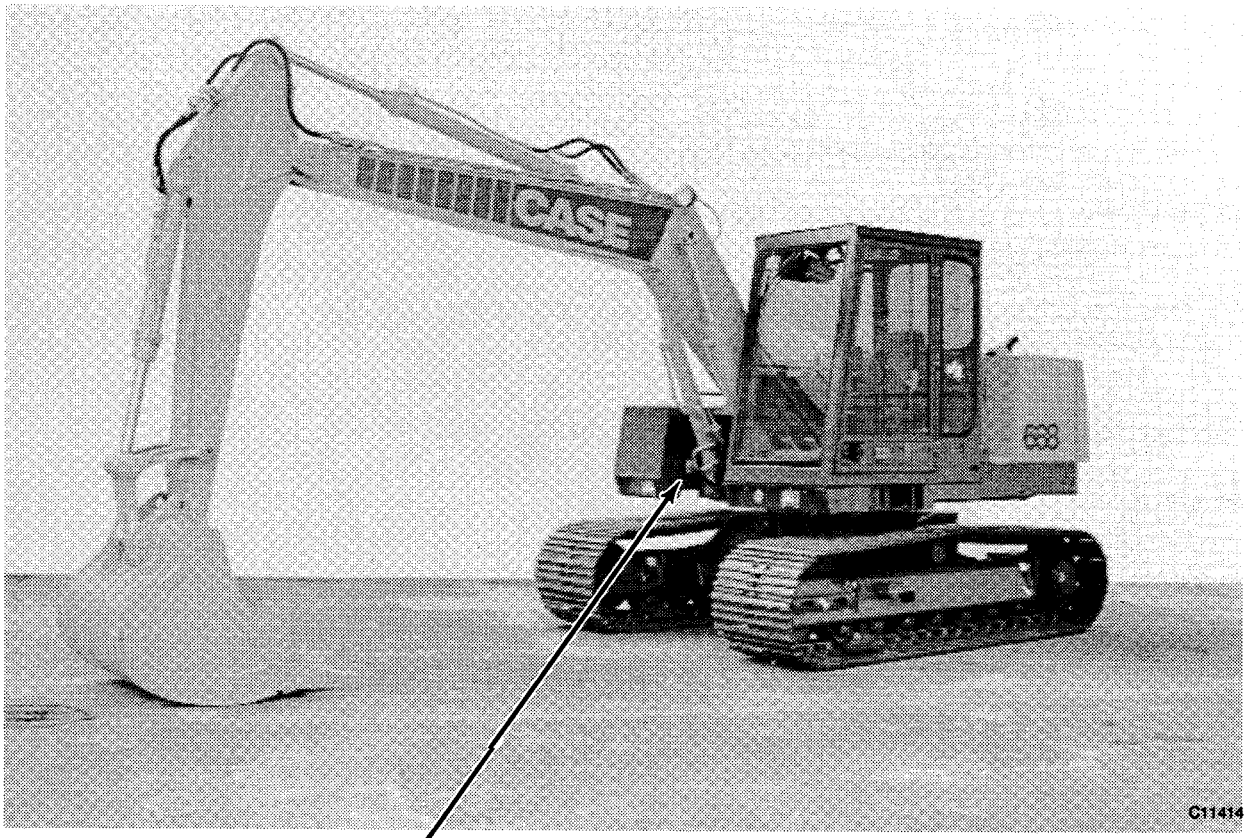
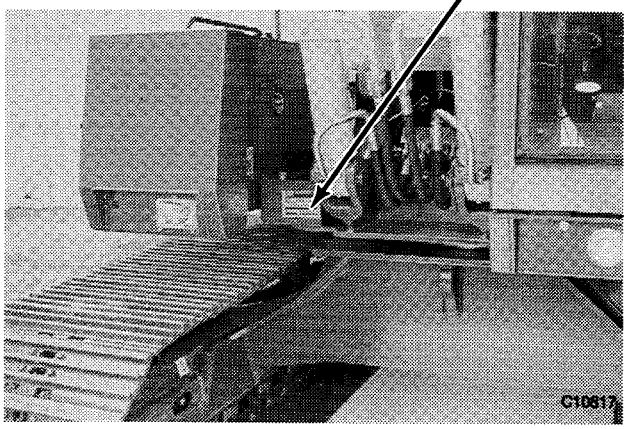
MODEL AND PIN NUMBERS

When ordering parts or when requesting information or assistance, always give the identification numbers of your machine.
Write the model and PIN numbers of your machine on the lines below.





Machine Model Number _____

Machine PIN Number _____

Engine Serial Number _____

High Pressure Pump Serial Number _____

Low Pressure Pump Serial Number _____

_____

_____

Final Drive Serial Number:

Right Hand Side _____

Left Hand Side _____

_____

_____

GENERAL SPECIFICATIONS

Capacities

Engine Oil Capacity (with filter change)	10.5 litres	2.77 US gallons
Engine Cooling System (with cab heater)	14 litres	3.7 US gallons
Fuel Tank	247 litres	65 US gallons
Hydraulic Oil Tank Capacity	100 litres	26.3 US gallons
Total Hydraulic System Capacity	155 litres	40.9 US gallons
Final Drive Transmission Capacity (each side)	1.5 litres	1.6 US quarts
Swing Reduction Gear Capacity	3.5 litres	3.7 US quarts
Track Front Idlers	0.25 litres	0.26 US quarts
Track Lower Rollers	0.26 litres	0.28 US quarts

NOTE: *These capacities are only a guide to the quantities. Always use the dipstick, sight gauge or level plug to make sure that fluid levels are correct.*

Drawbar Pull

Drawbar Pull	101080 N	22725 lb

Drive Speed

Drive Speed	3.5 kph	2.17 mph

Electrical System

Type of System ..... 24 volts, negative ground

Alternator
- Manufacturer ..... Bosch
- Output ..... 28 volts at 45 amperes
- Resistance of rotor winding ..... 9.0 ohms
- Resistance of stator winding ..... 0.22 ohms
- Minimum brush length ..... 14 mm (0.55 inch)

Batteries
- Number of batteries required 2
- Voltage of each battery ..... 12 volts
- Reserve capacity ..... 160 minutes
- Cold cranking capacity at -17°C (0°F) ..... 800 amperes
- Load for capacity (load) test ..... 400 amperes

Starter Motor
- Manufacturer ..... Bosch
- No load test at 27°C (80°F)
  - volts ..... 23 volts
  - current draw ..... 85 amperes maximum
  - armature speed ..... 7000 rpm minimum
- Brush length ..... 8.5 mm (0.3125 inch) minimum
- Armature run-out ..... 0.03 mm (0.001 inch) maximum
- Commutator diameter ..... 42.5 mm (1.74 inch) minimum
- Armature end play ..... 0.05 to 0.4 mm (0.002 to 0.15 inch)

Hydraulic System

Low Pressure Pump
Comprises one body with a fixed flow for the servo-steering hydraulic circuits,

Maximum flow at 2000 rpm:	24 l/min	6.3 US gpm
Operating pressure	28 Bar	406 psi

Flow Setting Times

Boom Up	3.3 to 3.5seconds
Dipper In	4.7 to 4.9 seconds
Bucket In	3.3 to 3.5 seconds

Flow Setting Valve Rates (cylinder large chamber):

Boom raising	148 to 155 l/min	36.7 to 38.4 US gpm
Boom lowering	28 to 45 l/min	6.9 to 11.1 US gpm
Bucket opening	75 to 100 l/min	18.6 to 24.8 US gpm
Bucket closing	95 to 105 l/min	23.5 to 26 US gpm
Dipper extension	110 to 125 l/min	27.2 to 31 US gpm
Dipper retraction	122 to 130 l/min	30.2 to 32.2 US gpm
Right-hand travel in forward drive	88 to 95 l/min	23.2 to 25 US gpm
Left-hand travel in forward drive	88 to 95 l/min	23.2 to 25 US gpm
Right and left-hand travel in forward drive	176 to 190 l/min	46.5 to 50.1 US gpm
Offset backhoe	25 to 35 l/min	6.6 to 9.2 US gpm

Hydraulic Oil Test Temperature	50°C	120°F

Pressure Settings

Attachment Flow Cut-off Valve (LS1)	360 to 370 Bar	5221 to 5366 psi
Attachment Valve Bank Main Relief Valve	435 to 445 Bar	6309 to 6454 psi
Regulator		
Torque Regulator Valve, 97 l/min (25.6 US gpm) engine speed 2020 rpm at a pressure of	275 Bar	3988 psi
Load Sensing Valve (LS)	18 to 20 bar	261 to 290 psi
Travel Flow Cut-off Valve (LS2)	405 to 415 Bar	5874 to 6019 psi

Circuit Relief Valves:

Boom : raising	380 to 405 Bar	5511 to 5874 psi
Boom : lowering	400 to 435 Bar	5801 to 6309 psi
Bucket : opening, closing	380 to 405 Bar	5511 to 5874 psi
Dipper : extension, retracting	380 to 405 Bar	5511 to 5874 psi
Swing : right, left	320 to 330 Bar	4641 to 4786 psi
Travel : forward drive, reverse drive	420 to 435 Bar	6091 to 6309 psi
Boom and Dipper Anti-Drift Valve	390 to 410 Bar	5656 to 5946 psi
Boom and Dipper Safety Valve	390 to 410 Bar	5656 to 5946 psi
Low Flow (Clamshell Swing)	130 to 150 Bar	1885 to 2175 psi
Offset boom	180 to 200 Bar	2610 to 2900 psi

Counter Rotation Valve		
Reduction Pressure (A2)	19 to 20 Bar	275 to 290 psi
Selector Sequence Pressure (A3)	14 to 15 Bar	203 to 217 psi
Thermostat Controlled Valve		
Starts to Close	40°C	104°F
Fully Closed	50°C	122°F
Track Speed		
7 Revolutions		60 seconds

Tracks, Rollers and Idlers

Track Tension	260 to 280 mm	10.2 to 11.1 inch
Maximum Pin and Bushing Wear Over Four Links	703 mm	27.7 inch
Maximum Link Wear (ITRAC Link)	86.6 mm	3.41 inch
Maximum Track Shoe Wear	12 mm	0.47 inch
Maximum Spacer Wear	46.5 mm	1.83 inch
Maximum Idler Wear	35 mm	1.37 inch
Minimum Diameter on Track Roller	137 mm	5.39 inch

Weights

Operating Weight	13200 kg	29040 lb
Counterweight	2900 kg	6395 lb
Turntable Bearing	135 kg	300 lb
Attachments		
4.30 (169 inch) Boom with Dipper Cylinder	830 kg	18261 lb
210 cm (83 inch) Dipper with Links and Bucket Cylinder	485 kg	1067 lb
235 cm (106 inch) Dipper with Links and Bucket Cylinder	505 kg	1113 lb
Buckets		
60 cm (24 inch) Bucket	360 kg	790 lb
75 cm (30 inch) Bucket	405 kg	890 lb
85 cm (34 inch) Bucket	430 kg	945 lb
95 cm (37 inch) Bucket	460 kg	1010 lb
105 cm (42 inch) Bucket	495 kg	1090 lb
120 cm (47 inch) Bucket	515 kg	1133 lb
Cylinders		
Boom Cylinder (each)	95 kg	209 lb
Dipper Cylinder	107 kg	235 lb
Bucket Cylinder	85 kg	187 lb

RUN-IN INSTRUCTIONS

Engine Lubrication

Fill the engine crankcase with CD service classification oil that has the correct viscosity rating for the ambient air temperature. Refer to Engine Lubrication on page 8. 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.

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 Engine (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

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 Cooling System

Coolant Solution ..... Ethylene Glycol

IMPORTANT: *When using ethylene glycol coolant solutions, always have a minimum of 50% ethylene glycol coolant in the system. Do not put more than 50% ethylene glycol in the cooling system unless the ambient air temperature will be less than -36°C (-34°F). More than 50% decreases heat transfer and will cause the engine surface temperture to be higher than normal.*

Thermostat ..... Starts to open at 82°C (180°F)
Fully open at 94°C (201°F)
Radiator Cap ..... 1.03 Bar (15 psi)

Engine Lubrication

Engine Oil Type

Case IH No. 1 engine oil is recommended for use in the Case engine. Case IH engine oil will lubricate the engine under all operating conditions. If Case IH No.1 Multi-Viscosity engine oil is not available, Case IH No. 1 Single Grade engine oil can be used.

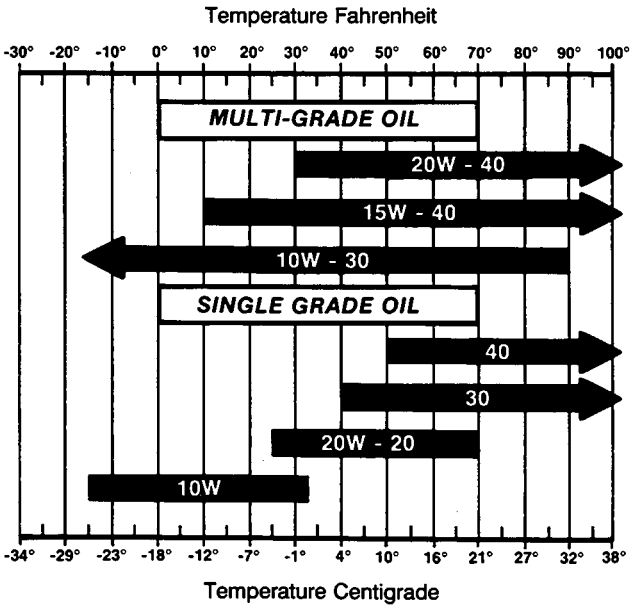
If Case IH No. 1 Multi-Viscosity or Single Grade engine oil is not available, use only oil meeting API engine oil service category CD.

See the chart below for recommended viscosity at ambient air temperature ranges.

NOTE: *DO NOT put performance additives or other oil additive products into the engine crankcase.*

Engine Lubrication Oil Viscosity

AMBIENT AIR TEMPERATURE RANGES



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GENERAL ENGINE SPECIFICATIONS

General

Make and Model	JI Case, 4T-390	
Type	4 cylinder, turbocharged 4 stroke cycle	
Horsepower	92 at 2000 rpm	68.6 kw at 2000 rpm
Firing Order	1, 3, 4, 2	
Bore and Stroke	102 mm x 102 mm	
Piston Displacement	3920 cm^3	
Compression Ratio	17 to 1	
Valve Tappet Clearance		
Exhaust (Cold)	0.508 mm	
Intake (Cold)	0.254 mm	
Engine Speeds		
No Load Governed Speed	2080 to 2200 rpm	
Rated Engine Speed	2040 to 2070rpm	
Engine Idle Speed	850 to 900 rpm	

Pistons 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 of Bearings	Steel Back Leaded Bronze

Main Bearings

Number of Bearings	5
Type of Bearings	Replaceable

Engine Lubricating System

Type of System	Pressure and Spray Lubrication	
Oil Pressure (when engine warm and operating at rated speed)	2.07 to 3.45 Bar	30 to 50 psi
Oil Pump	Rotor Type	
Oil Filter	Full Flow Turn-on Type	
Oil Capacity		
(with filter change)	15.4 litres	16 US quarts
(without filter change)	14.4 litres	15 US quarts

Fuel System

Fuel Injection Pump		Bosch
Pump Timing		Top Dead Center
Fuel Injectors		Bosch 17 mm
Opening Pressure (New)	231 to 253 Bar	3350 to 3670 psi
Opening Pressure (Used)	221 to 250 Bar	3200 to 3625 psi
Maximum Pressure Difference	10.34 Bar	150 psi
Number of Orifices		4
Spray Orifice Size		0.29 mm
Governor		Variable Speed, Part of the Injection Pump
First Stage Fuel Filter		Turn-on Type
Second Stage Fuel Filter		Turn-on Type
Lift Pump	0.34 to 0.48 Bar	5 to 7 psi

DETAILED ENGINE SPECIFICATIONS

Cylinder Block

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
0.5 mm Oversize Piston	
Machine Cylinder Bore to	102.40 to 102.44 mm
1.00 mm Oversize Piston	
Machine Cylinder Bore to	103.00 to 103.04 mm

Service Cylinder Sleeves

Type	Dry, Can Be Replaced
Material	Cast Iron
Machine Cylinder Block Bore to	104.500 to 104.515 mm
Installation	Press Fit
Machine Sleeve Bore to	102.00 to 102.04 mm

Pistons

Type	Cam Ground
Material	Aluminium alloy
OD at 12 mm From the Bottom, 90 Degrees From Piston Pin	
Standard Size Piston	101.873 to 101.887 mm
Minimum Service Limit	101.823 mm
0.5 Oversize Piston	102.373 to 102.387 mm
Minimum Service Limit	102.323 mm
1.00 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 Pins

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

Piston Rings

No. 1 Compression (4T-390)	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

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 Rods

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	0.041 to 0.119 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 (57.24 mm OD) Service Bushing	54.089 to 54.139 mm
Maximum Service Limit	54.146 mm
ID of No. 2, 3, 4 and 5 Service Bushing	54.089 to 54.139 mm
Maximum Service Limit	54.146 mm
Width of No. 1 Bushing	25.15 to 25.65 mm
Width of No. 2, 3, 4 and 5 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 and 5 Less Bushings	54.089 to 54.139 mm
No. 2, 3, 4 and 5 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

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 Valves

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 Valves

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

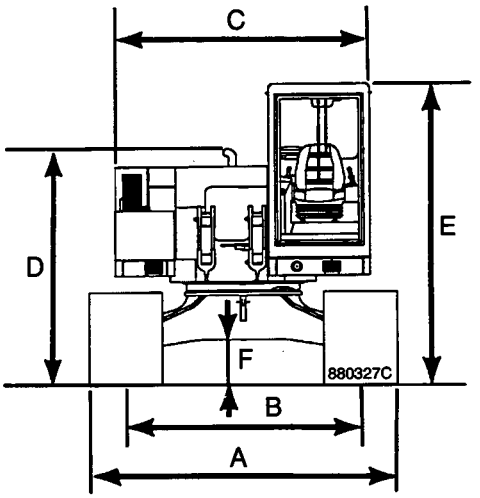
SPECIAL TORQUES

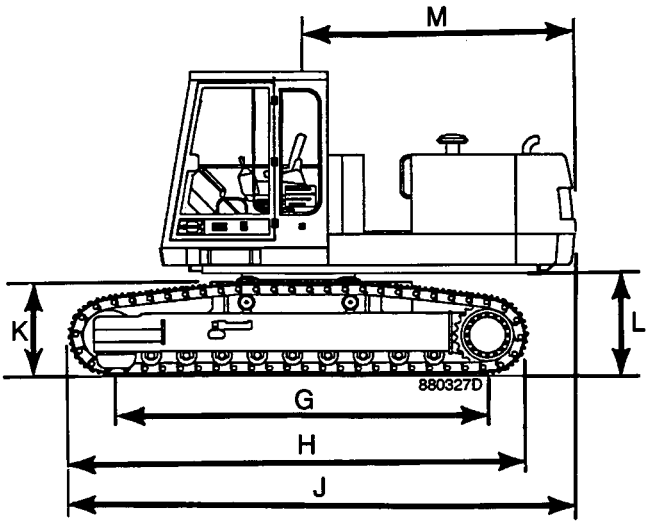
Alternator Bracket Bolts (Lower)	24 Nm	18 lb ft
Alternator Bracket Bolts (Upper)	24 Nm	18 lb ft
Alternator Retaining Bolt	24 Nm	18 lb ft
Belt Tensioner Bracket Bolts	24 Nm	18 lb ft
Belt Tensioner Retaining Bolt	43 Nm	32 lb ft
Camshaft Retaining Bolts	24 Nm	18 lb ft
Center Housing to Back Plate Bolts	6 Nm	4.5 lb ft
Connecting Rod Bolts (Lubricate Threads with Engine Oil)	100 Nm	74 lb ft
Coolant Inlet Bolts	43 Nm	32 lb ft
Crankshaft Dampener Pulley	137 Nm	101 lb ft
Cylinder Head Bolts	126 Nm	93 lb ft
Engine Lift Bracket Bolts (Rear)	77Nm	57 lb ft
Exhaust Manifold Bolts	43 Nm	32 lb ft
Fan Pulley Bracket Bolts	24 Nm	18 lb ft
Fan Pulley Bolts (Grade 8.8)	24 Nm	18 lb ft
Fan Pulley Bolts (Grade 10.9)	34 Nm	25 lb ft
Flywheel Housing Bolts	60 Nm	45 lb ft
Flywheel Housing Cover Bolts	24 Nm	18 lb ft
Flywheel Retaining Bolts	137 Nm	101 lb ft
Front Cover Bolts	24 Nm	18 lb ft
Front Housing Bolts	24 Nm	18 lb ft
Fuel Air Removal Bolt	6 Nm	4.5 lb ft
Fuel Filter Inlet Bolt	32 Nm	24 lb ft
Fuel Filter Inlet Nut	32 Nm	24 lb ft
Fuel Line Fitting (High Pressure)	24 Nm	18 lb ft
Fuel Line Fitting (Low Pressure)	24 Nm	18 lb ft
Fuel Pump Plug with Bronze Washer	23 Nm	17 lb ft
Fuel Shutoff Solenoid	15 Nm	11 lb ft

Injection Pump Drive Gear Nut	65 Nm	48 lb ft
Injection Pump Lock Bolt	30 Nm	22 lb ft
Injection Pump Retaining Nuts	24 Nm	18 lb ft
Injection Pump Bracket Bolts	24 Nm	18 lb ft
Injector Leak off Bolt	15 Nm	11 lb ft
Injector Retaining Nut	60 Nm	45 lb ft
Intake Manifold Bolts	24 Nm	18 lb ft
Intake Manifold Plug	125 Nm	92 lb ft
Lifter Cover Bolts	24 Nm	18 lb ft
Main Bearing Bolts (Lubricate Threads with Engine Oil)	175 Nm	129 lb ft
Oil Fill Tube Bolts	43 Nm	32 lb ft
Oil Filter Housing Bolts	24 Nm	18 lb ft
Oil Inlet Tube Bolts	24 Nm	18 lb ft
Oil Inlet Tube Brace	24 Nm	18 lb ft
Oil Pan Drain Plug	75 Nm	55 lb ft
Oil Pan Heater Plug	122 Nm	90 lb ft
Oil Pan Retaining Bolts	24 Nm	18 lb ft
Oil Pump Retaining bolts	24 Nm	18 lb ft
Rear Seal Retaining Bolts	9 Nm	7 lb ft
Rocker Arm Bolts	24 Nm	18 lb ft
Starter Retaining Bolts	43 Nm	32 lb ft
Tachometer Drive Retaining Bolts	3 Nm	2 lb ft
Thermostat Housing Bolts	24 Nm	18 lb ft
Thrust Bearing Screws (Torx Head)	5 Nm	4 lb ft
Timing Pin Retaining Bolts	5 Nm	4 lb ft
Turbine Housing Bolts	11 Nm	8.5 lb ft
Turbocharger Drain Tube Bolts	24 Nm	18 lb ft
Turbocharger Mounting Bolts	32 Nm	24 lb ft
Turbocharger Oil Supply (Both Ends)	17 Nm	13 lb ft

Valve Cover Bolts	24 Nm	18 lb ft
Water Pump Mounting Bolts	24 Nm	18 lb ft

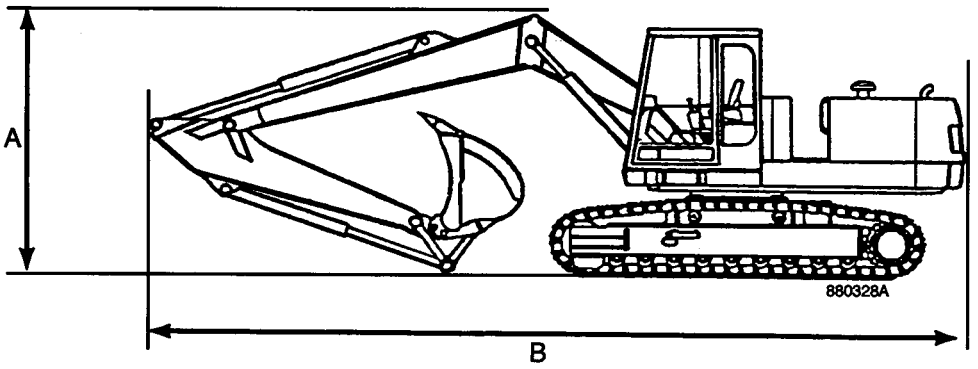
GENERAL DIMENSIONS





A	2.57 m	8 ft 5 inch
B	1.96 m	6 ft 4 inch
C	2.44 m	8 ft 0 inch
D	2.35 m	7 ft 9 inch
E	2.89 m	9 ft 6 inch
F	432 mm	1 ft 5 inch
G	2.76 m	9 ft 1 inch
H	3.55 m	11 ft 8 inch
J	3.82 m	12 ft 6 inch
K	787 mm	2 ft 7 inch
L	1.03 m	2 ft 11 inch
M	2.05 m	6 ft 9 inch

TRANSPORT DIMENSIONS



	2.10 m (6 ft 10 inch) Dipper	2.65 m (8 ft 8 inch) Dipper
A	2.89 m (9 ft 6 inch)	2.89 m (9 ft 6 inch)
B	7.7 m (25 ft 3 inch)	7.55 m (24 ft 9 inch)

Section

2000

ENGINE REMOVAL AND INSTALLATION

2000

For 688 Crawler Excavators

J I Case

Don 8-89000

Printed in England
December 1989

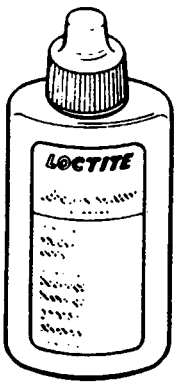
TABLE OF CONTENTS

WARNING: *This safety symbol is used in this manual to indicate important safety messages. When you see this symbol, read the message carefully. It is shown where possible injury or death can be caused.*

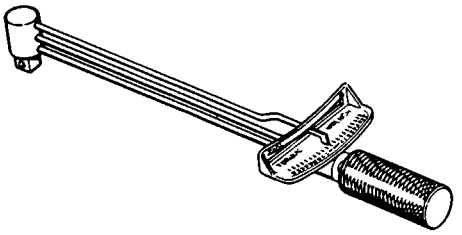
SPECIAL TORQUES

Engine Mounting Bolts	217 to 271 Nm	160 to 200 lb ft
Fan Mounting Bolts	43 Nm	32 lb ft
Hydraulic Pump Mounting Bolts	44 Nm	32.5 lb ft
Shock-Absorber Centering-Mount Bolts	220 Nm	162 lb ft

SPECIAL TOOLS



1. LOCTITE 638
CASE PART NUMBER P1003572

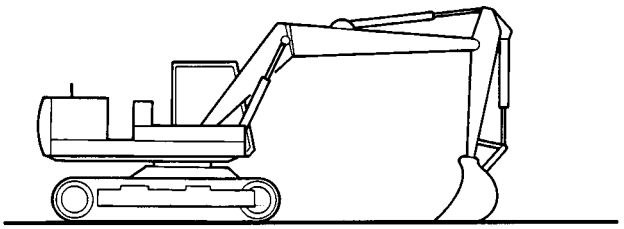


2. TORQUE WRENCH (Nm or lb ft)

Removal

WARNING: *When the machine is operating, the engine systems and the hydraulic pump systems heat up to a high temperature. To avoid the possibility of being burnt by hot metal or scalded by hot oil or water, allow the machine to cool before starting any maintenance work.*

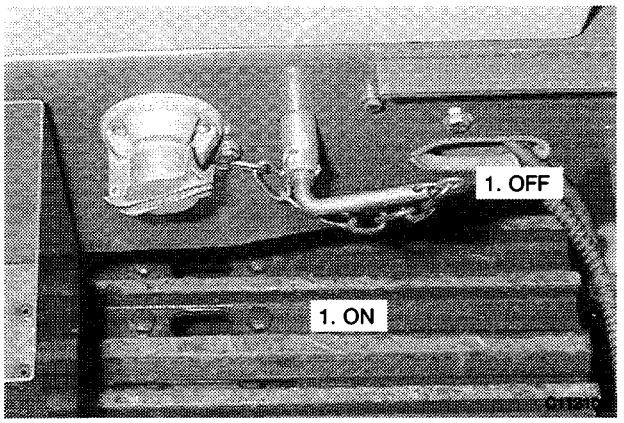
STEP 1



EA2836

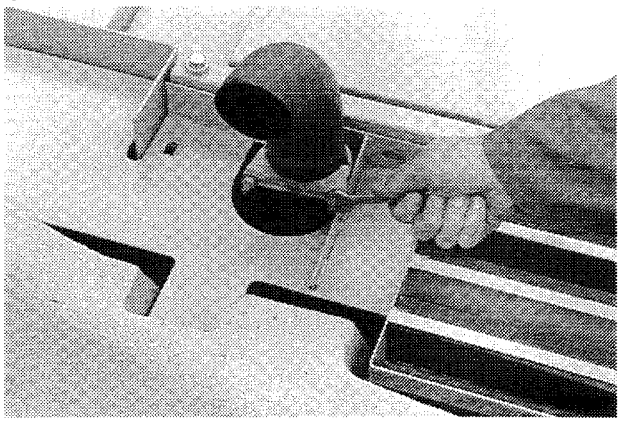
Put the machine on level ground. Lower the attachment to the ground. Stop the engine and allow the systems to cool.

STEP 2



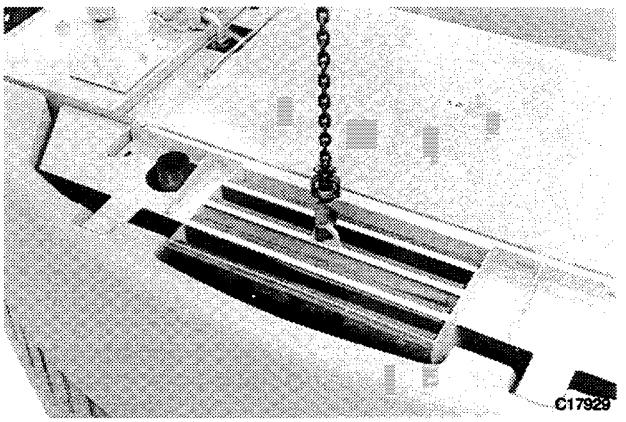
Turn the master disconnect switch, located under the right-hand side of the walkway, to the OFF position and remove the key.

STEP 3



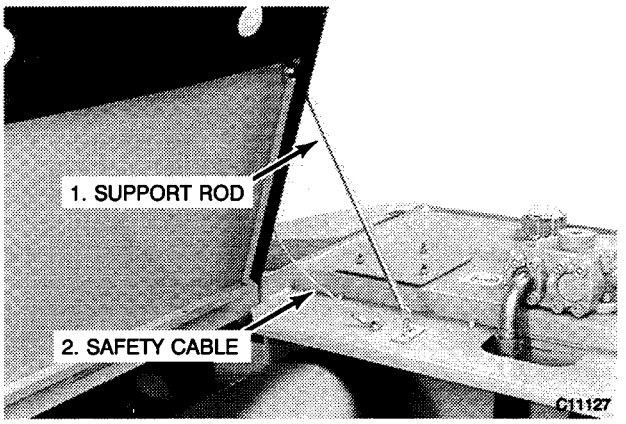
Loosen the nuts on the exhaust muffler extension tube. Remove the exhaust muffler extension tube.

STEP 4



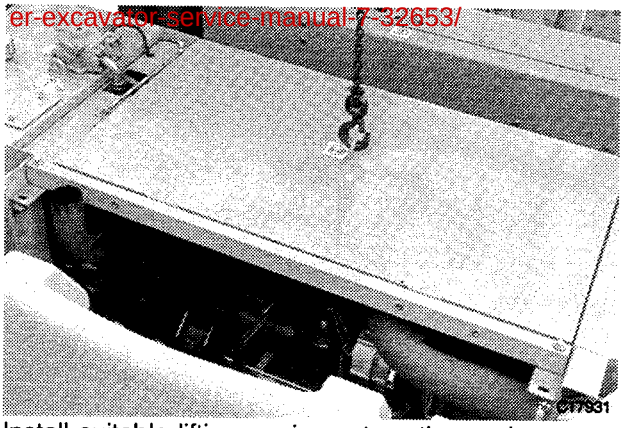
Install suitable lifting equipment onto the engine insulator. Remove the engine insulator mounting bolts and spacers and remove the engine insulator.

STEP 5



Raise the engine upper access cover and install the support rod. Remove the engine front cover. Remove the safety cable retaining bolt, spacers and nut. Lower the engine upper access cover.

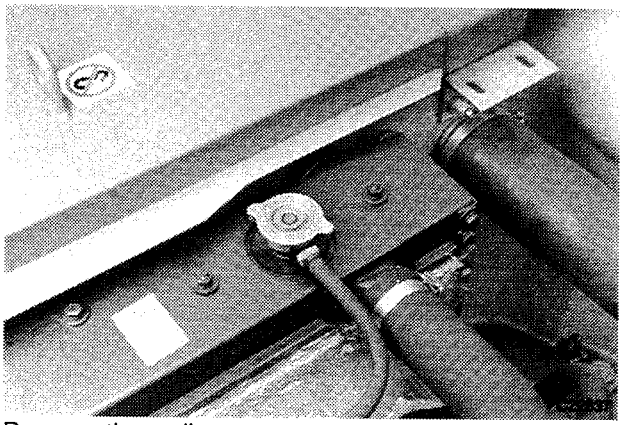
STEP 6



Install suitable lifting equipment on the engine upper access cover. Remove the retaining bolts, spacers and nuts and remove the engine upper access cover.

> WARNING: *Hot engine coolant can spray out of the radiator when the radiator cap is removed. To remove the radiator cap, allow the engine cooling system to cool. Turn the radiator cap to the first notch and wait until the pressure is released. Then remove the radiator cap.*

STEP 7

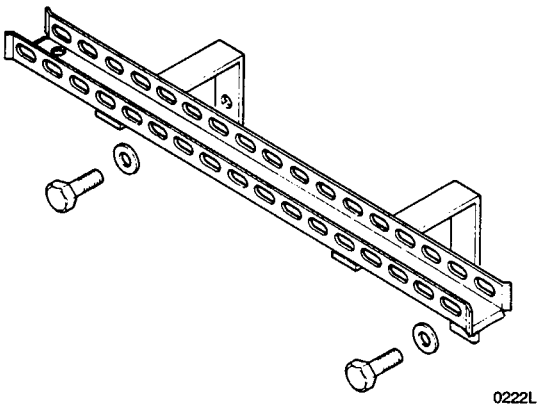


Remove the radiator cap.

STEP 8

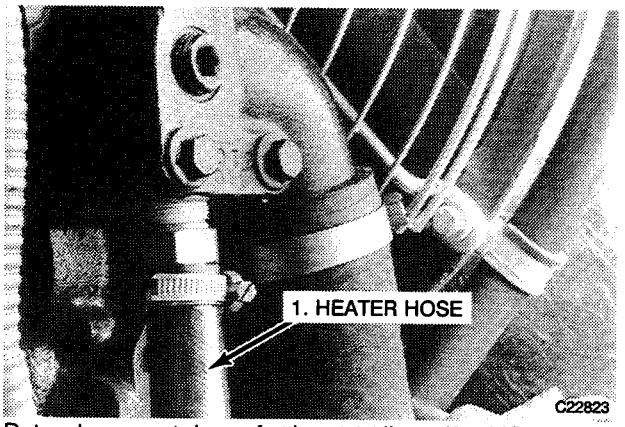
Remove the access panels under the engine and under the hydraulic oil tank.

STEP 9



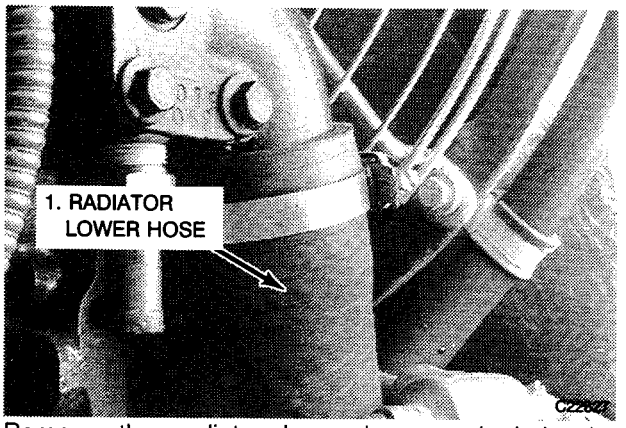
Remove the mounting bolts and spacers and remove the wiring harness carrier from the rear of the engine.

STEP 10



Put a clean container of at least 14 litres (3.7 US gallons) under the engine. Remove the heater hose from the engine and drain engine coolant into the container.

STEP 11



Remove the radiator lower hose and drain the remaining engine coolant into the container.