

480 SERIES B TRACTOR

Product: Case 480 Series B Backhoe Loader Service Repair Manual 9-72255
 Full Download: <https://www.arepairmanual.com/download/case-480-series-b-backhoe-loader-service-repair-manual-9-72255/>

TABLE OF CONTENTS

SERIES/SECTION	SECTION NO.	FORM NO.
10 SERIES - GENERAL		
General Specifications	11	9-80941
Detailed Specifications	1020	9-80732
Lubrication of Loader, Backhoe, and Three Point Hitch	13	9-72255
Lubrication	13	9-80911
20 SERIES - ENGINES		
Cylinder Head and Valves	2014	9-80473
Cylinder Head, Valve Train and Camshaft	2015	9-78835
Engine Block Assembly	2024	9-77005
Crankshaft, Main Bearings, Flywheel and Oil Seal Replacement	2035	9-78865
Cooling System	2055	9-78815
Cylinder Head and Valves	22	9-80511
Engine Block Assemblies	23	9-80431
Air Cleaner, Restriction Indicator and Pre-Screen	24	9-80531
30 SERIES - FUEL SYSTEM		
Fuel System and Filters	31	9-80551
Roosa Master Fuel Injection Pumps	3022	9-80422
Roosa Master Fuel Injectors	33	9-80411
Model TSX Series Carburetor	35	9-80581
40 SERIES - HYDRAULICS		
Hydraulic Diagrams, Troubleshooting	42	9-72255
Power Steering Oil Filter	42	9-80991
Equipment Pump	43	9-72085
D58538 Equipment Pump	43	9-72255
3 Point Hitch Cylinders	44	9-80821
Loader Control Valve	44a	9-72255
Backhoe Control Valve	44b	9-72255
Three Point Hitch Control Valve	44d	9-72085
Backhoe Control Valve	44e	9-75485
Cylinder Removal and Installation	45	9-72255
Loader Cylinders	45	9-72085
Backhoe Cylinders	46	9-80961
Hydra-Guide Hydraulics Guidance System	47	9-72085
Boom Lockout System	49	9-72255
Boom Lock, D56102 Lockout Valve Sn 5224733 and After	49	9-72255
50 SERIES - STEERING		
Power Steering Pump and Hand Pump	52	9-80611
Steering Control Valve	53	9-80671
Steering Cylinders and Adjustment	54	9-80621
Steering Axle and Wheel Bearings	55	9-80631
60 SERIES - POWER TRAIN		
Four Speed Transmission and Final Drive	65	9-80641
Mechanical Shuttle	66	9-80771
Dual Range Assembly	67	9-80781
11 Inch Clutch	68	9-80792
Independent Power Take-Off	69	9-80811

SERIES	SECTION	SECTION NO.	FORM NO.
<p>Case 480 Series B Backhoe Loader Service Repair Manual 9-72255</p> <p>Full Download: https://www.arepairmanual.com/downloads/case-480-series-b-backhoe-loader-service-repair-manual-9-72255/</p>			
70	SERIES - BRAKES		
	Differential Brakes, Differential Lock and Parking Brake	74	9-80691
80	SERIES - ELECTRICAL		
	Wiring Diagram	81	9-80921
	Distributor Ignition system	83	9-74625
	Battery Servicing and Testing	85	9-74505
	Starting or Cranking Motors	86	9-74575
90	SERIES - MOUNTED EQUIPMENT		
	Loader	92	9-72255
	Splitting the 480-580 Series B Tractors Between the Torque Tube and Final Drive	92	9-80711
	Backhoe	93	9-72255
	Three-Point Hitch	97	9-72255
	Three Point Hitch Anti-Leakdown Kit	97	9-72255
100	SERIES - HOW IT WORKS		
	How it Works Hydrostatic Power Steering	151	9-80801

Sample of manual. Download All 735 pages at:

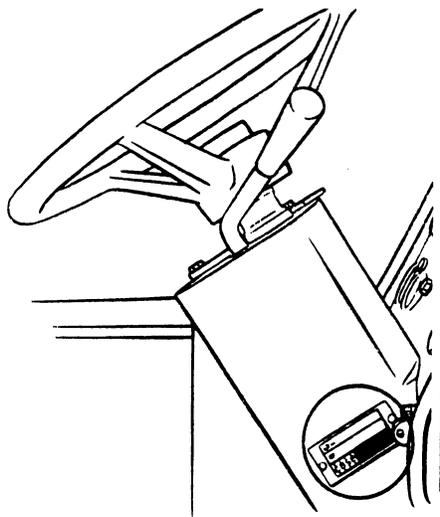
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Section

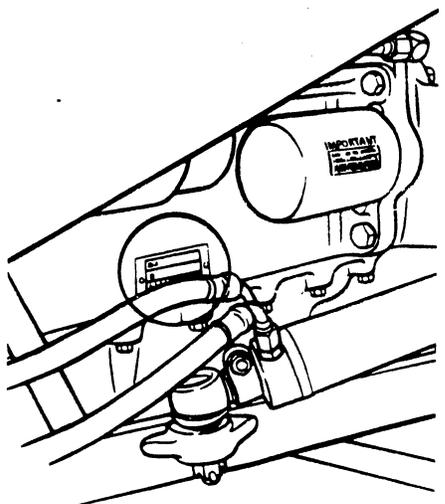
11

GENERAL SPECIFICATIONS 480 SERIES B TRACTORS

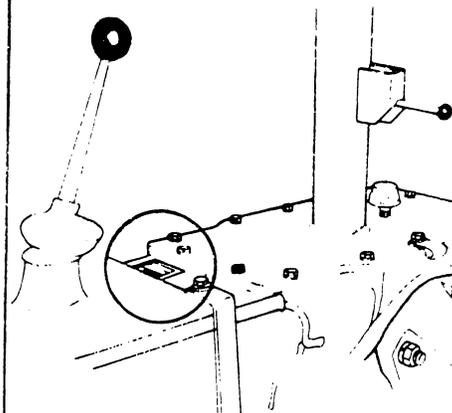
SERIAL NUMBERS



MODEL AND SERIAL NUMBER



ENGINE SERIAL NUMBER



TRANSMISSION SERIAL NUMBER

DIESEL ENGINE

General

Type	"Case" Open Chamber Combustion 4 Cylinder, 4 Stroke Cycle, Valve-in-Head.
Firing Order	1-3-4-2
Bore	3-13/16 Inches (96.8mm)
Stroke	4-1/8 Inches (104.8mm)
Piston Displacement	188 Cubic Inches (3 080.8cm ³)
Compression Ratio	17.5 to 1
Cylinder Sleeves	Removable Wet Type
No Load Governed Speed	1900 RPM
Rated Engine Speed	1750 RPM
Engine Idling Speed	600-650 RPM
*Valve Tappet Clearance (Exhaust)	(Hot and Cold) .014 Inch (0.356mm)
(Intake)	(Hot and Cold) .014 Inch (0.356mm)

*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	3
Number of Compression Rings	2
Number of Oil Rings	1
Type Pins	Full Floating Type
Type Bearing	Replaceable Precision, Steel Back, Copper-Lead Alloy Liners.

Main Bearings

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

Engine Lubricating System

Oil Pressure	50 to 70 Pounds (3.5 to 4.9 kg/cm ²) 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	4 Degrees Before Top Dead Center
Fuel Injectors	Pencil Type (Opening Pressure 2800 PSI).
Fuel Transfer Pump	Vane Type, Integral Part of Injection Pump.
Governor	Mechanical, Fly-Weight, Integral Part of Injection Pump
1st Stage Fuel Filter	Replaceable Type
2nd Stage Fuel Filter	Replaceable Type
Fuel Tank Water Trap and Drain	Located in Base of Fuel Tank
Fuel Tank Capacity	22 U.S. Gallons (83.31 liters)

SPARK IGNITION ENGINE

General

Type	4 Cylinder, 4 Stroke Cycle, Valve-in-Head
Firing Order	1-3-4-2
Bore	3-3/8 Inches (85.7mm)
Stroke	4-1/8 Inches (104.8mm)
Compression Ratio	7.1 to 1
Piston Displacement	148 Cubic Inches (2 425.3cm ³)
No Load Governed Speed	1960 RPM
Rated Engine Speed	1750 RPM
Engine Idling Speed	600 to 650 RPM
*Valve Tappet Clearance (Intake)	(Hot and Cold) .014 Inches (0.356mm)
(Exhaust)	(Cold) .020 Inches (0.508mm) (Hot) .014 Inches (0.356mm)

Exhaust Valve Rotators Positive Type
 *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	3
Number of Oil Rings	1
Type Pin	Full Floating Type
Type Bearings	Replaceable, Precision Steel Back, Copper Lead Alloy Liners.

Main Bearings

Number of Bearings	3
Type Bearings	Replaceable, Precision Steel Back, Copper Lead Alloy Liners.

Engine Lubricating System

Oil Pressure	24 to 32 Pounds (1.7 to 2.3 kg/cm ²) with Engine Warm and Operating at Rated Engine Speed
Type System	Pressure Spray Circulation
Oil Pump	Gear Type
Oil Filter	Full Flow, Spin on Type

Fuel System

Fuel Tank Capacity	22 U.S. Gallons (83.3 liters)
Carburetor	Marvel-Schebler (w/solenoid shut-off) 1-1/4 Inch SAE Flange (31.7mm)
Fuel Strainer	In Sediment Bowl Under Fuel Tank
Fuel Filter	Mounted on Fuel Strainer Head

Distributor Ignition

Contact Point Gap .....	.020 Inch
Dwell Angle	70°
Spark Plugs	Prestolite 18 8
Plug Gap .....	.025 Inch
Thread	12mm
Shank Length	1/2 Inch

Engine Timing

Static Timing	5° ATDC
Running Timing	25° BTDC at Rated Speed

GENERAL SPECIFICATIONS

Cooling System

Capacity (188D)	16-1/2 U.S. Quarts (15.6 liters)
(148G)	14 U.S. Quarts (13.3 liters)
Type of System	Pressurized Thermostat Controlled Impeller Type Pump.
Radiator	Heavy Duty Fin and Tube Type
Thermostat	Starts to Open at Approximately 177°F. Fully Open at 202°F.
Pressure Cap Required	4 PSI
When using a proper operating pressure cap, the engine temperature can safely rise to 230°F.	

Electrical System

Type of System - Diesel and Spark Ignition 12 Volt Negative Ground
 Batteries (Spark Ignition) (1) 12 Volt Battery
 (Diesel) (2) 6 Volt Batteries Connected in Series

Parking Brake

Type Hand Operated Ratchet Type, Operated from Operator's Seat.

Differential Brakes

Type Heavy Duty, Disc and Band Differential Brakes
 Brake Pedals Can Be Locked Together for Safe Road Travel or Operated Independently
 for Steering Assistance

Mechanical Shuttle - Four Speed

Clutch Type Foot Operated, Spring Loaded, Single Disc.
 Disc Size 11 Inch (279.4mm)
 Throwout Bearing Ball Thrust w/grease fitting
 Transmission 4 Speed Gear
 Dual Range Shuttle Mechanical Actuated Forward and
 Reverse Clutch
 P.T.O. Independent

Mechanical Shuttle - Dual Range

Clutch Type Foot Operated, Spring Loaded, Single Disc.
 Disc Size 11 Inch (279.4mm)
 Throwout Bearing Ball Thrust w/grease fitting
 Transmission 8 Speed Gear
 Shuttle 4 Speed Mechanical Actuated
 Forward and Reverse Clutch
 Dual Range 4 Speed Mechanical Operated
 Low and Direct Drive
 PTO Independent

Hydrostatic Power Steering

Relief Valve Pressure 1500 to 1700 PSI
 Pump Capacity at No Load Engine RPM 6.7 GPM (25.4 l/mn)
 Capacity of Reservoir 1 Quart (.95 liter)
 Capacity of System 2.5 Quarts (2.36 liters)
 Type of Oil Case TCH
 Hand Pump Type Gerotor Bi-Directional Driven
 By the Steering Wheel.
 Actuating Cylinders 2 Way Cylinders Are Integral
 Part of Steering System.

Belt Pulley

Method of Engagement PTO Control Lever
 Pulley Diameter 10.25 Inches (260.4mm)
 Pulley Face Width 6.5 Inches (165.1mm)
 Ratio Engine RPM to Belt Pulley RPM 1.53 to 1
 1 RPM of Belt Pulley 2.68 Feet (0.872m) Per Minute Belt Travel

TIRE AND WHEEL EQUIPMENT

Front

TIRE SIZE	RIM SIZE	TIRE PLY	THREAD TYPE	INTEGRAL	DEMOUNTABLE	RECOM PSI
6.50-16	5.50-16	4	I1	X		32 PSI (2.3 kg/cm ²)
6.50-16	5.50-16	6	I1	X		44 PSI (3.1 kg/cm ²)
7.50-16	5.50-16	10	I1	X		56 PSI (3.9 kg/cm ²)
			F.S.			
7.50-16	5.50-16	6	I1	X		40 PSI (2.8 kg/cm ²)
Rear						
13.6-24	W12-24	4	R1	X	X	14 PSI (1.0 kg/cm ²)
13.6-24	W12-24	6	R1	X	X	22 PSI (1.5 kg/cm ²)
14.9-24	W12-24	6	R1	X	X	20 PSI (1.4 kg/cm ²)
			R3			
			R4			
14.9-24	W12-24	8	R4	X	X	26 PSI (1.8 kg/cm ²)
16.9-24	W15L-24	6	R1	X		18 PSI (1.3 kg/cm ²)
			R3			
			R4			
16.9-28	W15L-28	6	R1		X	18 PSI (1.3 kg/cm ²)
			R4			
16.9-28	W15L-28	8	R4		X	24 PSI (1.7 kg/cm ²)
17.5-24	W15L-24	6	R4	X		16 PSI (1.1 kg/m ²)
17.5-24	W15L-24	8	R4	X		22 PSI (1.5 kg/m ²)

APPROXIMATE TRAVEL SPEEDS

With 14.9-24 Tires

MECHANICAL SHUTTLE (1750 RPM)

	DUAL RANGE		4 SPEED	
RANGE	FORWARD	REVERSE	FORWARD	REVERSE
LOW				
1	1.5 mph (2.4 km/h)	1.9 mph (3.1 km/h)		
2	3.0 mph (4.8 km/h)	3.7 mph (6.0 km/h)		
3	3.6 mph (5.8 km/h)	4.5 mph (7.2 km/h)		
4	10.5 mph (16.9 km/h)	13.1 mph (21.1 km/h)		
DIRECT				
1	2.5 mph (4.0 km/h)	3.1 mph (5.0 km/h)	2.5 mph (4.0 km/h)	3.1 mph (5.0 km/h)
2	4.8 mph (7.7 km/h)	6.0 mph (9.7 km/h)	4.8 mph (7.7 km/h)	6.0 mph (9.7 km/h)
3	5.9 mph (9.5 km/h)	7.3 mph (11.8 km/h)	5.9 mph (9.5 km/h)	7.3 mph (11.8 km/h)
4	16.9 mph (27.2 km/h)	21.1 mph (34.0 km/h)	16.9 mph (27.2 km/h)	21.1 mph (34.0 km/h)

NOTE Listed above are the approximate speeds obtained under full load conditions. Normal transport speeds are approximately 10% higher than those listed above.

FUEL SPECIFICATIONS



CAUTION NEVER FILL THE FUL TANK WHEN THE ENGINE IS RUNNING OR WHEN NEAR AN OPEN FLAME. DO NOT SMOKE WHEN WORKING NEAR FLAMMABLE FUELS.

GASOLINE

Case Gasoline Engines are designed to operate on Regular Grade gasoline having a minimum research method rating of 90.7 Octane. This will give full power and economy together with long engine life and low maintenance cost.

The average Octane Number Ratings for Regular Grade gasoline are:

Motor Research	86.2 Octane Number
Research Method	94.2 Octane Number

These two Octane Ratings are used to define the anti-knock quality of gasoline. It has become common practice in the Petroleum Industry to refer to only the Research Method Rating.

When only one Octane Rating is given for gasoline and the rating method is not specified, it can be assumed to be the Research Method rating.

DIESEL

Case diesel engines are designed to operate most efficiently when using a Number 2 Diesel Fuel. Most well known refiners and distributors market a good grade of Diesel Fuel and there should be no difficulty in obtaining it.

Do not confuse number 2 Diesel Fuel with Number 2 Furnace Oil, as this does not always meet the fuel specifications for diesel engines.

Specifications for a Suitable Number 2 Diesel Fuel

A.P.I. Gravity (Minimum) 30
Pour Point (Maximum) 10^o Fahrenheit belt ambient operating temperature.

DISTILLATION

90% Point 540^o-625^o Fahrenheit
End Point 675^o Fahrenheit

FLASH POINT (Minimum) 125^o Fahrenheit or legal

Kinematic Viscosity, centistokes @ 100^o Fahrenheit 2.0-4.3 Seconds*

Cetane No. (Minimum) 40 (45-55 for winter or high altitude use)
Water and Sediment Vol. (Maximum)05%
Ash, wt. (Maximum)01%
Sulphur wt. (Maximum)5%
Carbon Residue on 10% (Maximum)2%
Corrosion, Copper Strip,
3 hrs. @ 212^o Fahrenheit No. 3

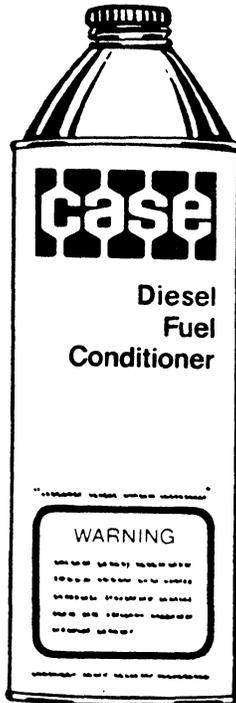
(*32-40 Saybolt Universal Seconds)

NOTE The use of Number 1 Diesel Fuel, which is a lighter fuel, may result in a loss of engine power and also increased fuel consumption because it has less heat content and a lower viscosity than Number 2 Diesel Fuel.

The life of the injection pump may also be affected because of the lack of lubricant in the lighter Number 1 Diesel Fuel.

FUEL CONDITIONER

Case Diesel Fuel Conditioner is recommended for use in all Case Diesel engine fuel system. Case Lubra - Gas Conditioner is recommended for use in all Case Gasoline engine fuel systems. These fuel conditioners should be used as directed on the container.



CASE DIESEL FUEL CONDITIONER

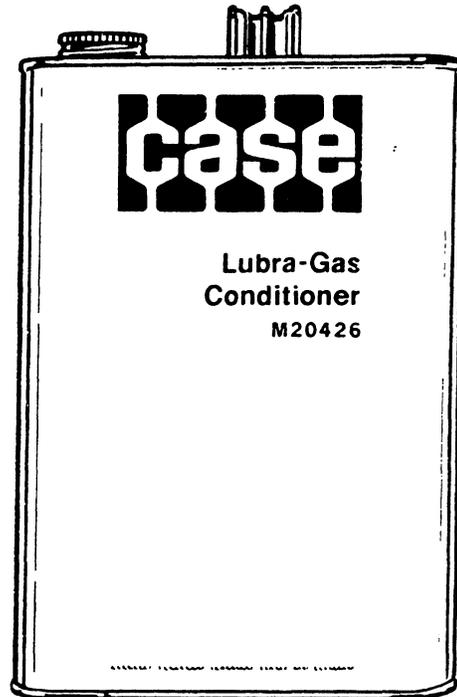
Prevents gummy deposits from forming in the fuel system.

Improved lubrication to the upper internal parts of the engine.

Eliminates fouling of injector nozzles, valves and manifolds.

Helps keep condensation suspended in the fuel, allowing it to be burned with the fuel.

Maintains a higher degree of fuel combustion and engine performance from fuel the engine burns.



CASE LUBRA-GAS CONDITIONER

Improved lubrication to upper internal parts of the engine.

Reduces cylinder and ring wear, improved compression, reduced corrosion of the internal engine parts.

Reduces crankcase oil dilution.

Helps keep condensation suspended in the fuel, allowing it to be burned with the fuel.

Maintains a higher engine performance from fuel the engine burns.

Section 1020

DETAILED SPECIFICATIONS 480 AND 580 SERIES B TRACTORS

TABLE OF CONTENTS

ENGINE BLOCK	2
CYLINDER HEAD AND VALVES	7
COOLING SYSTEM	10
ENGINE OIL FILTER	11
AIR CLEANER	11
FUEL SYSTEM	12
BRAKES	14
POWER TRAIN	15
STEERING	16
GENERAL TORQUE TABLE	17
SPECIAL TORQUES	17

Engine Block

NOTE: All dimensions are given in inches. Specifications apply to all engines unless noted.

	Maximum Limit Including Wear
CYLINDER SLEEVES	
I.D. of sleeve (159G)	3.5013 to 3.5028 ..... .005
(188D)	3.8115 to 3.8125 ..... .005
(188G)	3.8130 to 3.8145 ..... .005
(148G)	3.3745 to 3.3765 ..... .005
Sleeve out-of-round .....	.004
Clearance to bottom of piston skirt (188D) .....	.0035 to .0055
(188G) .....	.0025 to .0055
(159G) .....	.0015 to .0045
(148G) .....	.001 to .003
Taper .....	.001
PISTON	
Type	Cam Ground
Material	Aluminum Alloy
O.D. at bottom of skirt: 90° to piston pin (188G)	3.8090 to 3.8105
(188D)	3.8070 to 3.8080
(159G)	3.4983 to 3.4998
(148G)	3.373 to 3.3750
I.D. of piston pin bore (188D)	1.2500 to 1.2503 ..... .001
(188G, 159G) .....	.9992 to .9994 ..... .001
(148G) .....	.8592 to .8594 ..... .001
Width of 1st ring groove (188D)	Keystone Type
(188G, 159G, 148G) .....	.0965 to .0975
Width of 2nd ring groove (188D) .....	.097 to .098
(148G, 159G, 188G) .....	.0955 to .0965
Width of 3rd ring groove (188D) .....	.1885 to .1895
(188G, 159G, 148G) .....	.0955 to .0965
Width of 4th ring groove (188G, 159G, 148B) .....	.250 to .251
PISTON RINGS	
No. 1 Compression (188D)	Chrome Grooved Keystone
(188G, 159, 148G)	Chrome Tapered Face
Width (188D)	Not Measureable
(188G, 159G, 148G) .....	.0930 to .0935

Engine Block (Continued)Maximum Limit
Including Wear

PISTON RINGS (Continued)

End gap (188D)015 to .025
 (148G, 159G, 188G)010 to .020
 Side clearance (188D) Not Measureable
 (188G, 159G, 148G)0030 to .0045

No. 2 Compression (188G, 159G, 148G) Tapered Face

Width (188G, 159G, 148G)0930 to .0935
 (188D)0925 to .0935
 End gap (188D)015 to .025
 (148G, 159G, 188G)010 to .020
 Side clearance (188D)0035 to .0055
 (188G, 159G, 148G)0020 to .0035

No. 3 Compression (188G,159G,148G) Tapered Face

Width0930 to .0935
 End gap in 3.812 sleeve (188G, 159G, 148G)010 to .020
 Side clearance0020 to .0035

OIL RINGS

Width (188D)1825 to .1888
 (188G,159G,148G)2485 to .2490
 Side clearance (188D)000 to .007
 (188G,159G,148G)0010 to .0015
 End gap (188G, 159G, 148G)010 to .018
 Rail end gap (188D)015 to .055

Engine Block (Continued)Maximum Limit
Including Wear

PISTON PIN

Type	Full Floating
O.D. of pin (188D)	1.2497 to 1.2498
(188G, 159G) .....	.9991 to .9992
(148G) .....	.8592 to .8593
Fit in piston (188D) .....	.0002 to .0006
(188G, 159G) .....	.0000 to .0003
(148G) .....	.0000 to .0002
Fit in rod bushing (188D) .....	.0002 to .0006
(188G,159G,148G) .....	.0003 to .0006

CONNECTING ROD

Bushing	Replaceable Bronze	
Bushing I.D. installed (reamed to size)		
(188G,159G)9995 to .9997	.002
(188D)	1.2502 to 1.2504	.002
(148G)8596 to .8598	.002
Bushing out-of-round0015
Bearing Liners	Replaceable	
Bearing liner width	1.120 to 1.130	
Rod width at crank end	1.3035 to 1.3055	
Journal I.D. without bearing liners	2.1870 to 2.1875	
Bearing oil clearance0010 to .0035	.006
Undersize bearings for service .....	.002,.010,.020,.030
Side clearance .....	.005 to .011
Cap bolts	Self locking type	

CRANKSHAFT

Type	Balanced	
Main bearing liners	Replaceable	
End play, center main bearing cap001 to .006	.012
Center main bearing thrust surface thickness .....	.1025 to .1045
Connecting rod journal std. O.D.	2.0605 to 2.0615	
Grind to .010" O.D. undersize	2.0505 to 2.0515	
.020" O.D. undersize	2.0405 to 2.0415	
.030" O.D. undersize	2.0305 to 2.0315	

Engine Block (Continued)Maximum Limit
Including Wear

CRANKSHAFT (Continued)

Journals out-of-round .....	.001
Main bearing liner width 1st, (188D, 188G)	1.276 to 1.286
Main bearing liner width 1st, (159G, 148G)	1.870 to 1.880
Main bearing liner width 3rd (188D)	1.371 to 1.373
Main bearing liner width 2nd (188G)	1.371 to 1.373
Main bearing liner width 2nd and 4th (188D) .....	.950 to 1.000
Main bearing liner width 5th (188D), (188G 3rd.)	1.557 to 1.567
Undersize main bearing liners for service .....	.002,.010,.020,.030
Main bearing oil clearance .....	.0012 to .0042
Main bearing journal std. O.D. (188G, 188D)	2.8730 to 2.8740
(159G,148G)	2.6230 to 2.6240

Grind to:

.010" O.D. undersize, (188G, 188D)	2.8630 to 2.8640
.020" O.D. undersize, (188G, 188D)	2.8530 to 2.8540
.030" O.D. undersize, (188G, 188D)	2.8430 to 2.8440
.010" O.D. undersize, (159G, 148G)	2.6130 to 2.6140
.020" O.D. undersize, (159G, 148G)	2.6030 to 2.6040
.030" O.D. undersize, (159G, 148G)	2.5930 to 2.5940
Main journal bore I.D. w/o liners (188D, 188G)	3.066 to 3.067
(159G,148G)	2.816 to 2.817

Main journal width between cheeks:

2nd (159G, 148G)	1.499 to 1.502
2nd and 4th (188D)	1.185 to 1.189
2nd (188G)	1.3770 to 1.3740
3rd (188D)	1.3740 to 1.3770
3rd (159G, 148G, 188G)	1.745 to 1.755
5th (188D)	1.745 to 1.755

Connecting rod journal width between cheeks 1.3105 to 1.3145

CAMSHAFT

Type	Parabolic
Bushings (188D)	5, Replaceable
Bushings (188G)	4, Replaceable
Bushings (159G, 148G)	3, Replaceable
Oil Clearance .....	.002 to .005..... .007

Engine Block (Continued)

Maximum Limit
Including Wear

CAMSHAFT (Continued)

Bushing lubrication:

Front bushing Pressure lubricated
from oil pump.

Intermediate bushing Gravity flow lubricated

Rear bushing (188D Only) Pressure lubricated with
rear oil metering.

I.D. of bushing installed 1.752 to .1753

Bushing width:

1st (front) (159G,148G) 1.307 to 1.317

1st (front) (188D,188G) 1.213 to 1.223

2nd (159G,148G)713 to .723

2nd, 3rd & 4th (188D)490 to .500

2nd, & 3rd. (188G)490 to .500

3rd (rear) (148G, 159G) 1.177 to 1.197

4th (rear) (188G) 1.213 to 1.223

5th (rear) (188D) 1.213 to 1.223

O.D. of each bearing surface 1.749 to 1.750004

Thrust plate thickness149 to .147

Camshaft end play Taken up by thrust plate

Camshaft end clearance003 to .007

VALVE PUSH ROD LIFTERS

Type Mushroom

Body O.D. std.5605 to .5610

I.D. of block bore, std.5625 to .56350015

GEAR TRAIN

Backlash:

Crankshaft gear to camshaft gear0002 to .006

Camshaft gear to idler gear (Diesel)0004 to .006

Idler gear to fuel pump gear (Diesel)0005 to .007

Crankshaft gear to oil pump gear002 to .008

Crankshaft gear to fuel pump gear (Diesel) Maximum .019

Engine Block (Continued)

Maximum Limit
Including Wear

IDLER GEAR

O.D. of idler gear journal (Diesel)	1.3740 to 1.3755	.0005
I.D. of idler gear w/bushing (Diesel)	1.376 to 1.377	
Thrust washer shims (Diesel) .....	.005,.006,.007,.009	
Idler gear end play (Diesel) .....		.003

OIL PUMP FRONT MOUNTED

Positive displacement pump	Gear Type	
Pump gears to oil pump cover clearance .....	.0015 to .0055	
Pump gears radial clearance .....	.002 to .005	
Drive gear to body clearance (188G,159G,148G) .....	.003 to .006	
Drive gear to body clearance (188D) .....	.0035 to .0065	

Relief valve spring:

Wire thickness (188D) .....	.0625	
Maximum O.D. (188G,159G,148G) .....	.469	
Maximum O.D. (188D) .....	.4844	
Free length (188G,159G,148G)	2	
Free length (188D)	2-1/8	
Load at 1.38 inches (188G,159G,148G)	6-3/4 to 7-1/4 lbs.	
Load at 1.44 inches (188D)	18 to 19 lbs.	
Oil pressure (188G,159G,148G)	24 to 32 PSI	
Oil pressure (188D)	50 to 70 PSI	

Backlash, crankshaft drive gear and oil pump gear002 to .008

Cylinder Head and Valves

Diesel Engines

CYLINDER HEAD

Warpage006"
---------------	--	-------

EXHAUST VALVES

Tappet Clearance (Hot and Cold) .....	.014"	
Face Angle	44 ⁰	
Face Run-Out .....		.002"
O.D. of Head	1.398" to 1.408"	
O.D. of Stem .....	.3399" to .3409"	.002"
Length	6.340" to 6.364"	
Insert Seat Angle	45 ⁰	
Seat Face Width .....	.0608" to .0962"	
Seat Run-Out .....		.002"

Cylinder Head and Valves (Continued)

Maximum Limit
Including Wear

EXHAUST VALVES (Continued)

Insert Height .....	.2475" to .2525"
O.D. of Insert	1.4450" to 1.4505"
I.D. of Insert	1.245" to 1.255"

INTAKE VALVES

Tappet Clearance (Hot and Cold) .....	.014"
Face Angle	44°
Face Run-Out .....	.002"
O.D. of Head	1.599" to 1.609"
O.D. of Stem .....	.3409" to .3419"
Length	6.339" to 6.364"
Seat Angle	45°
Seat Run-Out .....	.002"
Seat Width .....	.0704" to .1057"

EXHAUST VALVE GUIDES

Length	3.125"
O.D. ....	.6565" to .6575"
I.D. (Installed and Reamed) .....	.3429" to .3439"
Valve Stem Clearance in Guide .....	.002" to .004"
Protrusion Above Cylinder Head .....	.875"

INTAKE VALVE GUIDES

Length	3.250"
O.D. ....	.6565" to .6575"
I.D. (Installed and Reamed) .....	.3429" to .3439"
Valve Stem Clearance in Guide .....	.001" to .003"
Protrusion Above Cylinder Head .....	.875"

VALVE SPRING

Free Length	2.375"
Total Coils	8.25
Wire Diameter .....	.162"
I.D. ....	.958" to .978"
Compressed to 1.521" (Valve Open)	110 to 118 lbs.
Compressed to 1.875" (Valve Closed)	53 to 59 lbs.

ROCKER ARM ASSEMBLY

O.D. of Shaft .....	.622" to .623"
I.D. of Arm Bore .....	.624" to .625"
Shaft Spring	
Free Length	2.5"
Wire Diameter .....	.072"
Compressed to 1.75"	7.5 to 8.5 lbs.
Lubrication	Engine oil, camshaft metering
Shaft Oil Holes	Toward valve side of engine, shaft cannot be rotated.

Cylinder Head and Valves (Continued)

Spark Ignition Engines

	Maximum Limit Including Wear
CYLINDER HEAD	
Warpage .....	.006"
SPARK PLUG	
Gap Setting (18mm) .....	.025"
EXHAUST VALVE	
Tappet Clearance (COLD) .....	.020"
(HOT) .....	.014"
Face Angle	44 ⁰
Face Run-out .....	.002"
Length (188 and 201)	5.824" to 5.844"
Length (148 and 159)	5.309" to 5.334"
O.D. of Head (188 and 201)	1.398" to 1.408"
O.D. of Head (148 and 159)	1.265" to 1.275"
O.D. of Stem .....	.3382" to .3390" .002"
Insert Seat Angle	45 ⁰
Seat Contact Width (188 and 201) .....	.072" to .085"
Seat Contact Width (148 and 159) .....	.090" to .100"
Seat Run-Out .....	.002"
Insert Height (188 and 201) .....	.2475" to .2525"
Insert Height (148 and 159) .....	.198" to .203"
O.D. of Insert (188 and 201)	1.4495" to 1.4505"
O.D. of Insert (148 and 159)	1.3765" to 1.3775"
I.D. of Insert (188 and 201)	1.245" to 1.255"
I.D. of Insert (148 and 159)	1.074" to 1.084"
INTAKE VALVE	
Tappet Clearance (HOT AND COLD) .....	.014"
Face Angle	29 ⁰
Face Run-Out .....	.002"
Length (188 and 201)	5.796" to 5.816"
Length (148 and 159)	5.275" to 5.300"
O.D. of Stem .....	.3406" to .3414"
O.D. of Head (188 and 201)	1.514" to 1.524"
O.D. of Head (148 and 159)	1.410" to 1.420"
Seat Angle	30 ⁰
Seat Run-out .....	.002"
Seat Contact Width (188 and 201) .....	.055" to .070"
Seat Contact Width (148 and 159) .....	.045" to .060"
EXHAUST VALVE GUIDE	
Length (188 and 201)	2.834"
Length (148 and 159)	2.438"
O.D. ....	.6565" to .6575"
I.D. (Installed and Reamed) .....	.3422" to .3432" .002"
Protrusion Above Cylinder Head (188 & 201)	1.000"
Protrusion Above Cylinder Head (148 & 159) .....	.844"

Cylinder Head and Valves (Continued)

	Maximum Limit Including Wear
INTAKE VALVE GUIDE	
Length (188)	3.125"
Length (148 and 159)	2.688"
O.D. ....	.6565" to .6575"
I.D. (Installed and Reamed) .....	.3422" to .3432" ..... .002"
Protrusion Above Cylinder Head	1.000"
 VALVE SPRING (Exhaust Valve)	
Free Length	2-3/16"
Total Coils	7-3/4
Wire Diameter .....	.162"
I.D. ....	.970" to .990"
Compressed to 1.332" (Valve Open)	110 to 118 lbs.
Compressed to 1.686" (Valve Closed)	53 to 59 lbs.
Color Code	Silver Stripe Full Length
 VALVE SPRING (Intake Valve)	
Free Length	2-3/8"
Total Coils	8-1/4
Wire Diameter .....	.162"
I.D. ....	.958" to .978"
Compressed to 1.521" (Valve Open)	110 to 118 lbs.
Compressed to 1.875" (Valve Closed)	53 to 59 lbs.
 ROCKER ARM ASSEMBLY	
O.D. of shaft .....	.622" to .623"
I.D. of Rocker Arm .....	.624" to .625"
(Installed and Reamed on 148 and 159)	
Shaft Spring (188 and 201):	
Free Length	2-1/2"
I.D.	11/16"
Wire Diameter .....	.072"
Compressed to 1-3/4"	7.5 to 8.5 lbs.
Shaft Spring (148 and 159):	
Free Length	1-3/16"
Total Coils	7
I.D.	11/16"
Wire Diameter .....	.072"
Compressed to 11/16"	7.5 to 8.5 lbs.
Lubrication	Engine oil, camshaft metering.
Shaft Oil Holes	Toward valve side of engine. Shaft cannot be rotated.

Cooling System

Type	Pressurized thermostat controlled by-pass forced circulation
Pump Type	Impeller Type - Sealed Pre-Lubricated Bearings.
Fan	Suction Type
Fan belt adjustment	60 Pound tension w/belt tension gauge or 1/2" deflection

Cooling System (Continued)

Cooling System Capacity (188D and 188G) 16-1/2 U.S. Qts.
 (148G and 159G) 14 U.S. Qts.
 Radiator cap 4 PSI
 Thermostat Start to open at approximately 177°F.
 Fully Open at 202°F.
 Cold weather coolant Reputable top brand "High Boiling Point" Anti-Freeze
 Radiator Heavy Duty Fin and Tube Type

Engine Oil Filter

Type Full Flow spin on type
 Capacity 1 U.S. Quart
 Filter replacement Every 200 hours

Air Cleaner

Dry type Replaceable Element
 Change Interval Every six washings or more often if required.
 Element service interval When the red signal appears in the clear plastic window of
 the restriction indicator.
 Dust cup check Whenever element is serviced.

PRE-SCREENER

Service Interval Whenever element is serviced.

RESTRICTION INDICATOR

Replacement When the red signal does not disappear
 after several resets or does not meet the
 specification given below.

CASE NO.	DONALDSON NO.	INCHES OF WATER	INCHES OF MERCURY
A59568	RBX00-2254	27.7" to 32.3"	2.04" to 2.37"

Fuel System

FUEL FILTERS (Spark Ignition Engine)

Fuel strainer servicing Every 200 Hours
 Fuel filter replacement Every 1000 Hours or earlier
 when loss of engine horsepower is indicated.

Fuel System (Continued)

FUEL FILTERS (Diesel Engine) (Starting W/Engine SN2718490)

- Filter replacement (Final and Primary) Every 500 hours or earlier when loss of engine horsepower is indicated.
- Final stage filter (Replaceable Cartridge) Full Flow spin on Type
- Primary stage filter (Replaceable Cartridge) Full Flow spin on Type

FUEL FILTERS (Diesel Engine) (Prior to Engine SN 2718490)

- Filter replacement (Final and Primary) Every 500 hours or earlier when loss of engine horsepower is indicated.
- Final stage filter (Replaceable Element) 30 Micron Filtration
- Primary stage filter (Replaceable Element) 2 to 5 Micron Filtration

Fuel filter element spring:

- No. of coils (active) 5-1/2
- Free length 1.120"
- Wire diameter060"
- I.D. of spring655" to .665"

FUEL TANK

- Capacity 22 U.S.Gallons
- Water trap Drain daily

FUEL INJECTION PUMP

- Type Roosa Master, Model DB
- Rotation Counter-clockwise
- Mounting Left hand side of engine
- Drive Gear driven at 1/2 engine speed
- Lubrication Self lubricated by fuel
- Governor Centrifugal type, variable speed, flyweight, integral part of pump

TIMING (Diesel Engines)

- Timing marks Located (as equipped) on crankshaft pulley w/pointer on timing gear cover or on flywheel w/pointer on flywheel housing.
- 1750 RPM Rated Engine Speed 4° BTDC
- 1850-1900 RPM Rated Engine Speed 8° BTDC
- 2000-2100 RPM Rated Engine Speed 8° BTDC
- 2200-2250 RPM Rated Engine Speed 8° BTDC

Fuel System (Continued)

FUEL INJECTOR

Type	Roosa Master-Pencil	
Opening pressure (New)(Part No. A37836)	2750 to 2850 PSI	
Opening pressure (New) (Part No. A51234)	3150 to 3250 PSI	
(Serviced) (Part No. A37836)	2550 to 2650 PSI	
(Serviced) (Part No. A51234)	2950 to 3050 PSI	
Maximum opening pressure difference between cylinders	100 PSI	
Valve lift	1/2 turn off valve seat or .009"	
Spray orifice size .....	.011"	
Sac hole size .....	.042"	
Sac hole length (Prior Engine SN2717963) .....	.195"	
Sac hole length (Starting W/Engine SN2717963) .....	.095"	
Number of orifices	4	
Orifice spray angle	160°	
Leakoff rate	3 to 10 drops in 30 seconds at 1500 PSI after first drop appears (serviced injector).	
Opening pressure control spring:		
Free length	A37836 .536"	A51234 .563"
No. of coils	7	7.5
Wire diameter .....	.056"	.058"
O.D. of spring .....	.272"	.276"
Compressed to (.435"-.457") (.435"-.478")	27 lbs.	29 lbs.

TIMING (Spark Ignition Engines)

Timing marks	Located (as equipped) on crankshaft pulley w/pointer on timing gear cover or on flywheel w/pointer on flywheel housing.	
Static Timing, 2100 RPM Rated Engine Speed	TDC	
Static Timing, 1900 RPM Rated Engine Speed	3° ATDC	
Static Timing, 1750 RPM Rated Engine Speed	5° ATDC	
Running Timing, 2100 RPM Rated Engine Speed	34° BTDC	
Running Timing, 1900 RPM Rated Engine Speed	30° BTDC	
Running Timing, 1750 RPM Rated Engine Speed	25° BTDC	

CARBURETOR (188G and 159G)

Type	Zenith Updraft, Single venturi with magnetic shut-off solenoid.	
Magnetic fuel shut-off solenoid	12 Volt	
Idle Speed adjustment	600 to 650 RPM	
Idle mixture adjustment	Approximately 1 turn open	
Load adjustment	Approximately 2 turns opens	
Float adjustment	1.156", without gasket	
Venturi (at narrow point) (188G) .....	.78"	
Venturi (at narrow point) (159G) .....	.74"	
Main jet (188G) .....	.049"	
Main jet (159G) .....	.037"	

Fuel System (Continued)

CARBURETOR (Continued)

Main discharge jet .....	.118"
Well vent jet (188G) .....	.039"
Well vent jet (159G) .....	.051"
Idling jet (188G) .....	.025"
Idling jet (159G) .....	.020"
Float valve seat (188G) .....	.069"
Float valve seat (159G) .....	.078"
Idle air bleed (188G) .....	.055"
Idle air bleed (159G) .....	.059"

Choke Lever spring:

Number of coils	18
Wire diameter .....	.031"
Free length	1.000"

Idle adjusting needle spring:

Number of coils	4-1/2
Wire diameter .....	.040"
Free length .....	.469"

CARBURETOR (148G)

Type	Marvel-Schebler Updraft, Single Venturi with shut-off solenoid.
Magnetic fuel shut-off solenoid	12 Volt
Idle Speed adjustment	600 to 650 RPM
Idle mixture adjustment	Approximately 1 turn open
Load adjustment	Approximately 2 turns open
Float adjustment	1/4" from gasket
Venturi (at narrowest point) .....	.782"
Power jet .....	.0635"
Main nozzle .....	.115"
Upper Vent hole .....	.0465"
Idling jet .....	.033"
Float valve seat .....	.070"
Idle feed hole .....	.040"

Choke Lever Spring:

Number of coils	5
Wire diameter .....	.0317"
I.D. ....	.281"

Idle Adjusting Needle Spring:

Number of coils	5
I.D. ....	.203"
Free length .....	.531"

Choke Valve Spring:

Number of coils	26 to 27
Wire diameter .....	.029"
Free length	1.062"

Throttle Lever Spring

Number of coils	4-1/2 to 5
I.D. ....	.165"
Free length .....	.281"

Brakes

Type	Heavy Duty, Disc and Band Differential Brakes
Type fluid	Case TCH
Free pedal	1-1/4" to 1-3/4"
Brake Pedal Return Spring:	
Free Length	4.625"
Wire Diameter .....	.135"
No. of Coils	22-1/4

Brakes (Continued)

Disc Spring:

Free Length	1.27"
Wire Diameter .....	.0857"
No. of Coils	10-1/4
Expand to 1.37"	22-1/2 to 27-1/2 lbs.

Retractor Spring:

Free Length .....	.66"
Wire Diameter .....	.060"
No. of Coils	5-3/4
Expand to .74"	9 to 11 lbs.

Power Train

SHUTTLE TRACTORS

Reverse idler gear bushing I.D. (burnished) .....	.862" to .863"
Countershaft bearing pre-load	4 to 12 in. lbs. required to rotate shaft.
Differential end play	No end play
Differential gear to countershaft pinion backlash .....	.005" to .009"
Axle shaft end play .....	.0001" to .001"
Countershaft end play (between 2nd and 3rd speed gear) .....	.001" to .006"
Gear shift fork rail interlock plug	O.D. .373" to .375" Length .566" to .574"
Main drive shaft end play .....	.002" to .005"
Differential center wheel to side wheel backlash (pinion gear) .....	.005" to .015"
Rear axle bearing preload	20 to 30 in. lbs. more than no load turning torque

Shifter Lever Support Spring:

Free Length	2"
Wire Diameter .....	.1416"
No. of Coils	Optional
Compress to 1-5/16"	35 to 50 lbs.

Range Detent Spring:

Free Length	Optional
Wire Diameter .....	.072"
No. of Coils	Optional
Compress to 13/16"	35 to 38 lbs.

Neutral Start Spring:

Free Length	1-9/16"
Wire Diameter .....	.056"
No. of Coils	11
Compress to 1.250"	19-1/2 lbs.

Power Train (Continued)

HYDROSTATIC TRACTORS

Forward-Reverse pedals free travel	1/4" to 1/2"
Pinion shaft bearing preload	4 to 12 in. lbs. rolling torque
Dump valve pad to lever clearance .....	.045"

Hydrostatic Power Steering

Type	Large Volume Pump, Gear Type, Continuous Running
Relief Valve Pressure	1500 to 1700 PSI
Pump Capacity at No Load Engine RPM	6.5 GPM
Capacity of Reservoir	1 Quart
Capacity of System	3 Quarts
Type of Fluid	Case TCH
Hand Pump Type	Gerotor Bi-Directional, Driven By the Engine
Actuating Cylinders	2 Way Cylinders, Are Integral Part of Steering System

STEERING HAND PUMP

Steering shaft to body clearance .....	.006" Max.
Rotor to stator clearance .....	.005" Max.

STEERING CONTROL VALVE

Centering Spring:

No. of Coils	6
Free Length .....	.860"
Wire Diameter .....	.080"
I.D. of Spring .....	.625"
Compressed to .824"	1.5-2.5 lbs.

STEERING AXLE

Front wheel toe-in	1/4"
Front pivot pin bushing, installed and removed I.D.	1.744" to 1.746"
Rear pivot pin bushing, installed and removed I.D. ....	.863" to .864"

GENERAL TORQUE SPECIFICATION TABLE (Revised 7-72)

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.		5				8 ★					
Bolt head identification marks as per grade NOTE: Manufacturing Marks Will Vary											
		Torque						Torque			
Bolt Size		Foot Pounds		Meter Kilograms		Foot Pounds		Meter Kilograms			
Inches	Millimeters	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
1/4	6.35	9	11	1.2	1.5	12	15	1.7	2.1		
5/16	7.94	17	20.5	2.4	2.8	24	29	2.3	4.0		
3/8	9.53	35	42	4.8	5.8	45	54	6.2	7.5		
7/16	11.11	54	64	7.5	8.9	70	84	9.7	11.6		
1/2	12.70	80	96	11.1	13.3	110	132	15.2	18.3		
9/16	14.29	110	132	15.2	18.3	160	192	22.1	26.6		
5/8	15.88	150	180	20.7	24.9	220	264	30.4	36.5		
3/4	19.05	270	324	37.3	44.8	380	456	52.6	63.1		
7/8	22.23	400	480	55.3	66.4	600	720	83.0	99.6		
1	25.40	580	696	80.2	96.3	900	1080	124.5	149.4		
1-1/8	25.58	800	880	110.6	121.7	1280	1440	177.0	199.2		
1-1/4	31.75	1120	1240	154.9	171.5	1820	2000	251.7	276.6		
1-3/8	34.93	1460	1680	201.9	232.3	2380	2720	329.2	376.2		
1-1/2	38.10	1940	2200	268.3	304.3	3160	3560	437.0	492.3		
						★ Thick nuts must be used with Grade 8 bolts					

Special Torques

ENGINE BLOCK

Camshaft nut	80 to 90 Ft. lbs.
Connecting rod nuts	45 to 55 Ft. lbs.
Crankshaft nut	125 to 135 Ft. lbs.
Flywheel to crankshaft bolt	65 to 70 Ft. lbs.
Main bearing cap bolts	90 to 100 Ft. lbs.
Oil pan capscrews (Stamped steel)	10 to 12 Ft. lbs.
Oil pan capscrews (Cast iron)	24 to 28 Ft. lbs.
Oil pan to seal retainer	15 to 20 Ft. lbs.
Oil pan drain plug w/nylon gasket	29 to 30 Ft. lbs.
Oil pump cover capscrews	6 to 8 Ft. lbs.
Oil seal retainer bolts (Grade 8 bolts)	12 to 15 Ft. lbs.
Fuel pump drive gear nut (Diesel)	40 to 50 Ft. lbs.
Timing gear housing (Aluminum Front Cover)	25 to 30 Ft. lbs.

Special Torques (Continued)

CYLINDER HEAD AND VALVES

Cylinder head flanged nuts	90 to 100 ft. lb
Cylinder head stud nuts w/hardened washers	95 to 105 ft. lb
Cylinder head grade 8 bolts	110 to 115 ft. lb
Intake and exhaust manifold stud nuts	25 to 30 ft. lb
Rocker arm bracket stud nuts and bolts	25 to 30 ft. lb
Valve cover stud nuts	5 to 8 ft. lb
Water pump stud nuts	20 to 25 ft. lb
Spark plugs	32 to 35 ft. lb

FUEL SYSTEM

Injector leak off tube nuts	35 to 45 in. lb
Fuel injector pressure adjusting screw locknut	70 to 75 in. lb
Fuel injector clamp capscrews	18 to 22 ft. lb
High pressure fuel line banjo connection screws	35 ft. lb
Fuel inlet filter assembly (Diesel)	20 ft. lb
Injection tube nuts	18 to 22 ft. lb

STEERING

Control Valve end cap retaining bolts	14 to 17 ft. lb
Hand pump body bolts	18 to 22 ft. lb
Power steering pump cover bolts	9 to 11 ft. lb
Relief valve locknut	18 to 20 ft. lb
Relief valve cartridge	10 to 12 ft. lb
Cylinder end plate retaining screws	5 to 7 ft. lb
Piston rod locknut	30 to 35 ft. lb

POWER TRAIN (Shuttle Tractors)

Front cover or dual range housing nuts	35 to 40 ft. lb
Axle housing bolts	150 to 180 ft. lb
Differential brake housing bolts	70 to 90 ft. lb
Countershaft locking bolts	35 to 40 ft. lb
Transmission case to torque tube bolts	80 to 132 ft. lb
Transmission case to torque tube stud nuts	110 to 132 ft. lb
Reverse idler gear stud nuts	130 to 145 ft. lb

POWER TRAIN (Hydrostatic Tractors)

Banjo fitting bolt on hydrostatic pump	14 to 16 ft. lb
Servo mounting bolts	18 to 21 ft. lb
Hydrostatic pump bracket to housing bolts	35 to 42 ft. lb
Hydrostatic pump mounting bolts	80 to 90 ft. lb
Hydrostatic motor mounting bolts	80 to 96 ft. lb