480 SERIES B TRACTOR
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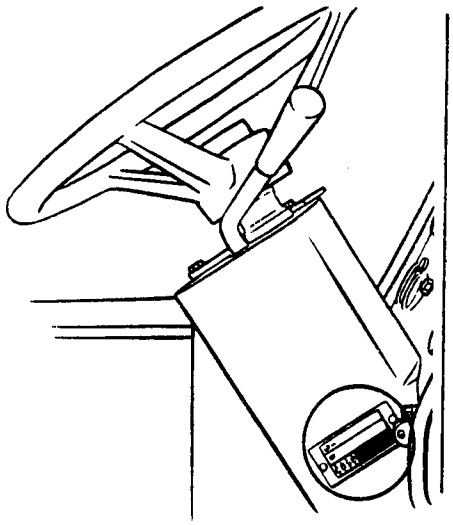
Section

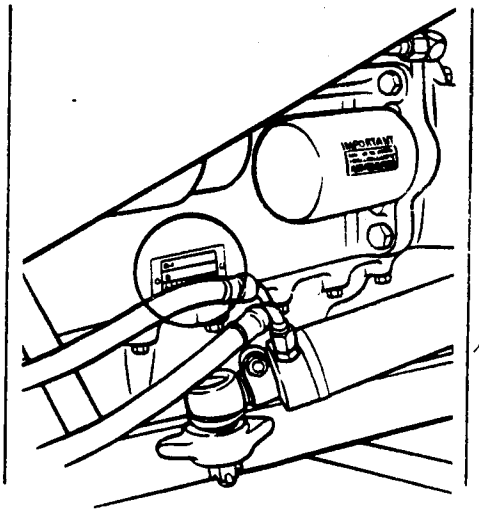
11

GENERAL SPECIFICATIONS
480 SERIES B TRACTORS

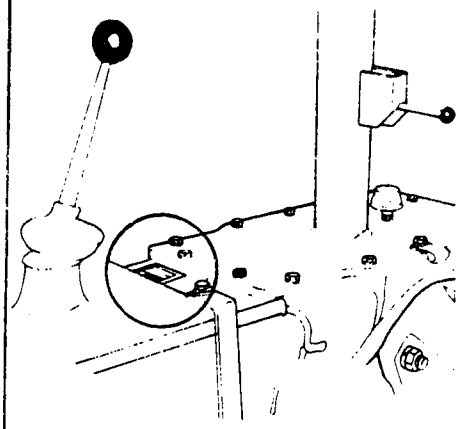
SERIAL NUMBERS



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.

Rac. Form 9-80941

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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.

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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 ..... 70^0
Spark Plugs ..... Prestolite 18 8
Plug Gap ..... .025 Inch
Thread 12mm
Shank Length ..... 1/2 Inch

Engine Timing

Static Timing ..... 5^0 ATDC
Running Timing ..... 25^0 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^{0}F. Fully Open at 202^{0}F.
Pressure Cap Required ..... 4 PSI
When using a proper operating pressure cap, the engine temperature can safely rise to 230^{0}F.

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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

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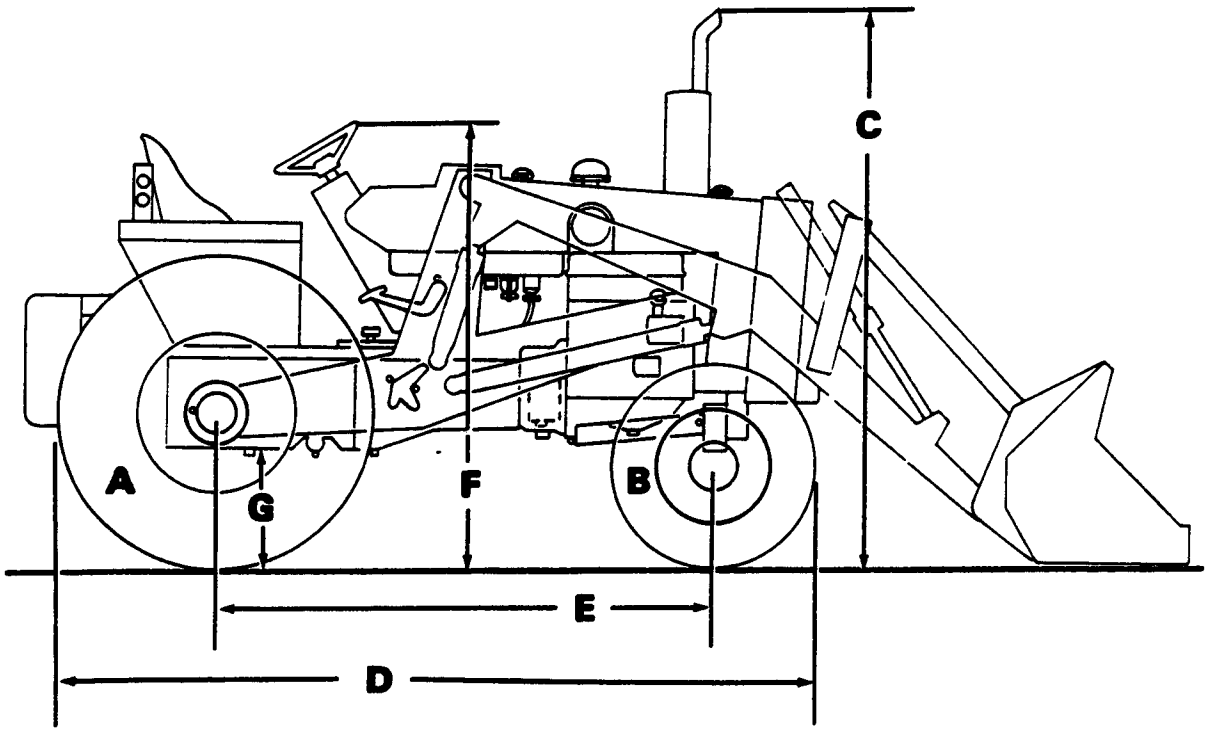
Power Take-Off

Type ..... Independent
Rotation ..... Clockwise
Spline Size .....540 RPM at 1750 RPM ..... 1-3/8" Dia. (34.9mm)

APPROXIMATE OVERALL MEASUREMENTS



	TIRE	WHEEL
A	13.6-24 R4	W12-24 INTEGRAL
B	7.50-16 PR	I1

C	D	E	F	G
91 INCHES (2 311mm)	118 INCHES (2 997mm)	78.4 INCHES (1 991mm)	60.5 INCHES (1 537mm)	13 INCHES (330mm)

Overall Width (W15L-24 Integral Rim) ..... 77 Inches (1 956mm)
Turning Radius W/Brakes ..... 125.2 Inches (3 170mm)
Turning Radius W/O Brakes ..... 133.2 Inches (3 383mm)
Front Wheel Toe-In ..... 1/4 Inch (6.35mm)
Front Wheel Tread (8L-16 Rim) ..... 57 Inches (1 448mm)
(5.50-16 Rim) ..... 54 Inches (1 372mm)
Rear Wheel Tread (W12-24 Integral Rim) ..... 62 Inches (1 575mm)
(W15L-24 Integral Rim) ..... 62 Inches (1 575mm)
(W12-24 Integral Rim, 1.81 offset) .... Dished Out Only - 66 Inches (1 676mm)
Rear Wheel Tread (W12-24 Demountable Rim) Wheel dished in and lugs inside - 60 Inches (1 524mm), Wheel dished out and lugs outside - 64 Inches (1 626mm), 72 Inches (1 829mm), 76 Inches (1 930mm).
Rear Wheel Tread (W15L-24 and W15L-28 Demountable Rim) Wheel dished out only and lugs outside 64 Inches (1 626mm), 68 Inches (1 727mm), 72 Inches (1 829mm), 76 Inches (1 930mm).

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TIRE AND WHEEL EQUIPMENT

Front

TIRE SIZE	RIM SIZE	TIRE PLY	THREAD TYPE	INTE GRAL	DEMOU NTABLE	RECOM PSI
6.50-16	5.50-16	4	I1	X		32 PSI (2.3 kg/cm²)
6.50-16	5.50-16	6	I1	X		44 PSI (3.1 kg/cm²)
7.50-16	5.50-16	10	I1 F.S.	X		56 PSI (3.9 kg/cm²)
7.50-16	5.50-16	6	I1	X		40 PSI (2.8 kg/cm²)

Rear

13.6-24	W12-24	4	R1	X	X	14 PSI (1.0 kg/cm²)
13.6-24	W12-24	6	R1	X	X	22 PSI (1.5 kg/cm²)
14.9-24	W12-24	6	R1 R3 R4	X	X	20 PSI (1.4 kg/cm²)
14.9-24	W12-24	8	R4	X	X	26 PSI (1.8 kg/cm²)
16.9-24	W15L-24	6	R1 R3 R4	X		18 PSI (1.3 kg/cm²)
16.9-28	W15L-28	6	R1 R4		X	18 PSI (1.3 kg/cm²)
16.9-28	W15L-28	8	R4		X	24 PSI (1.7 kg/cm²)
17.5-24	W15L-24	6	R4	X		16 PSI (1.1 kg/m²)
17.5-24	W15L-24	8	R4	X		22 PSI (1.5 kg/m²)

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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.

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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 practive 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.

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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° Fahrenheit belt ambient operating temperature.

DISTILLATION

90% Point ..... 540°-625° Fahrenheit
End Point ..... 675° Fahrenheit

FLASH POINT (Minimum) ..... 125° Fahrenheit or legal

Kinematic Viscosity, centistokes @ 100° 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° Fahrenheit ..... No. 3

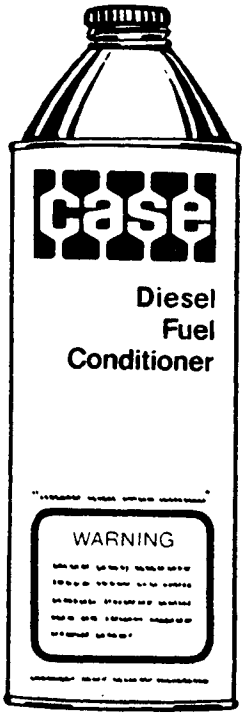
(*32-40 Saybolt Universal Seconds)

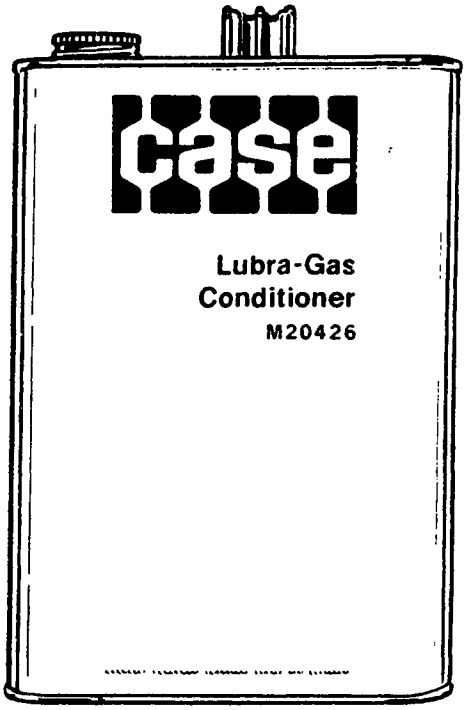
NOTE The use of Number 1 Diesel Fuel, which is a lighter fuel, may result in a loss of engine power and also increased fuel consumption because it has less heat content and a lower viscosity than Number 2 Diesel Fuel.

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

Rac. 9-80732

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CASE CORPORATION

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: 90^0 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)

PISTON RINGS (Continued)	Maximum Limit Including Wear
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
Width	.0930 to .0935
End gap in 3.812 sleeve (188G, 159G, 148G)	.010 to .020
Side clearance	.0020 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-round		.0015
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 clearance	.0010 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 cap	.001 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 1.750	.004
Thrust plate thickness	.149 to .147	
Camshaft end play	Taken up by thrust plate	
Camshaft end clearance	.003 to .007	
VALVE PUSH ROD LIFTERS		
Type	Mushroom	
Body O.D. std.	.5605 to .5610	
I.D. of block bore, std.	.5625 to .5635	.0015
GEAR TRAIN		
Backlash:		
Crankshaft gear to camshaft gear	.0002 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 gear	.002 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 gear	.002 to .008	

Cylinder Head and Valves

Diesel Engines

CYLINDER HEAD		
Warpage		.006″
EXHAUST VALVES		
Tappet Clearance (Hot and Cold)	.014″	
Face Angle	44°	
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°	
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"	.002"
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"	.001"
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"	.001"
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°	
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°	
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°	
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°	
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 (Installed and Reamed on 148 and 159)	.624″ to .625″	
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 diameter ..... .060″

I.D. of spring ..... .655″ 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 ..... 4^0 BTDC

1850-1900 RPM Rated Engine Speed ..... 8^0 BTDC

2000-2100 RPM Rated Engine Speed ..... 8^0 BTDC

2200-2250 RPM Rated Engine Speed ..... 8^0 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:	A37836	A51234
Free length	.536"	.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

TIRE AND WHEEL EQUIPMENT (480B)

Front

TIRE SIZE	RIM SIZE	TIRE PLY	THREAD TYPE	INTE GRAL	DEMOU NTABLE	RECOM PSI
6.50-16	5.50-16	4	I1	X		32 PSI (2.3 kg/cm²)
6.50-16	5.50-16	6	I1	X		44 PSI (3.1 kg/cm²)
7.50-16	5.50-16	10	I1 F.S.	X		56 PSI (3.9 kg/cm²)
7.50-16	5.50-16	6	I1	X		40 PSI (2.8 kg/cm²)
Rear						
13.6-24	W12-24	4	R1	X	X	14 PSI (1.0 kg/cm²)
13.6-24	W12-24	6	R1	X	X	22 PSI (1.5 kg/cm²)
14.9-24	W12-24	6	R1 R3 R4	X	X	20 PSI (1.4 kg/cm²)
14.9-24	W12-24	8	R4	X	X	26 PSI (1.8 kg/cm²)
16.9-24	W15L-24	6	R1 R3 R4	X		18 PSI (1.3 kg/cm²)
16.9-28	W15L-28	6	R1 R4		X	18 PSI (1.3 kg/cm²)
16.9-28	W15L-28	8	R4		X	24 PSI (1.7 kg/cm²)
17.5-24	W15L-24	6	R4	X		16 PSI (1.1 kg/m²)
17.5-24	W15L-24	8	R4	X		22 PSI (1.5 kg/m²)

TIRE AND WHEEL EQUIPMENT (580B)

Front

TIRE SIZE	RIM SIZE	TIRE PLY	TREAD TYPE	INTEGRAL	DEMOUNTABLE	RECOM PSI
7.50-16	5.50-16	10	I1 F.S.	X		56 PSI (3.9 kg/cm²)
11.00L-16	8L-16	8	I1	X		40 PSI (2.8 kg/cm²)
11.00L-16	8L-16	10	I1	X		48 PSI (3.4 kg/cm²)

Rear

12.4-24	W10-24	4	R1		X	16 PSI (1.1 kg/cm²)
14.9-24	W12-24	6	R1 R3 R4	X	X	20 PSI (1.4 kg/cm²)
14.9-24	W12-24	8	R4	X	X	26 PSI (1.8 kg/cm²)
16.9-24	W15L-24	6	R1, R3 & R4	X	X	18 PSI (1.3 kg/cm²)
16.9-24	W15L-24	8	R4	X		24 PSI (1.7 kg/cm²)
16.9-24	W15L-24	10	R4	X		28 PSI (1.9 kg/cm²)
16.9-28	W15L-28	6	R1 R4		X	18 PSI (1.3 kg/cm²)
16.9-28	W15L-28	8	R4		X	24 PSI (1.7 kg/cm²)
17.5-24	W15L-24	6	R4	X	X	16 PSI (1.1 kg/cm²)
17.5-24	W15L-24	8	R4	X	X	22 PSI (1.5 kg/cm²)
18.4-24	W15L-24	8	R4	X		20 PSI (1.4 kg/cm²)

SECTION 13

LUBRICATION OF LOADER, BACKHOE, AND THREE-POINT HITCH

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Lubricants

Grease Fittings

Above 32° F. (0° C.) . . . . . Multipurpose or No. 2 lithium-soap base grease

Below 32° F. (0° C.) . . . . . Multipurpose or No. 1 lithium-soap base grease

Loader Lubrication Points

The loader pivots should be lubricated every 10 hours. If the loader is used in severe or abnormal working conditions, reduce the time interval by one half.

1. Lift arm pivot (1 each side) 2
2. Lift cylinder closed end (1 each side) 2
3. Lift cylinder rod end pivot pin (1 each side) . . . 2
4. Tilt link upper pivot:
   - Single tilt cylinder 1
   - Dual tilt cylinders 2
5. Tilt link lower pivot (single tilt cylinder only) . . 1
6. Tilt cylinder trunnion:
   - Single tilt cylinder 1
   - Dual tilt cylinders 2
7. Tilt cylinder rod end pivot pin (dual tilt cylinders only, 1 each side) 2
8. Tilt arm pivot pin (1 each side) 2

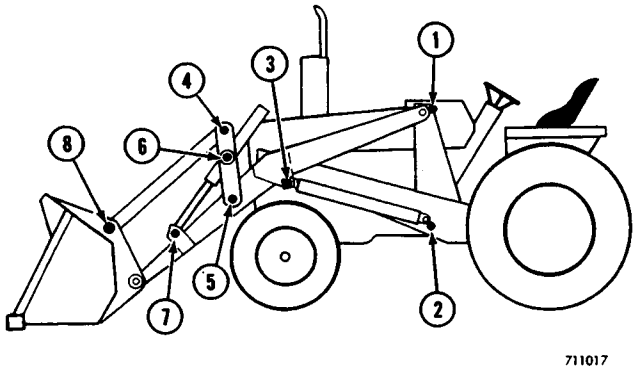

Figure 1 - Loader Lubrication Points

Three-Point Hitch Lubrication Points

The 3-point hitch pivot points should be lubricated every 10 hours. If the hitch is used in severe or abnormal working conditions, reduce the time interval by one half. Remove dirt from grease fittings before applying grease gun.

1. Lift cylinder . . . . . one each end
2. Lift arm . . . . . one
3. Tilt cylinder rod eye . . . . . one

Hydraulic Pump

Remove every 500 hours and lubricate coupling and driveshaft (Molykote G. part no. 058702 - 2 oz.) See Section 43, page 9.

Backhoe Lubrication Points

The backhoe pivot points should be lubricated every 10 hours. If the backhoe is used in severe or abnormal working conditions, reduce the time interval by one half.

1. Control lever pivots (standard controls only) . . 6
2. Stabilizer cylinder closed end (1 each side) . . . 2
3. Swing cylinder rod end (1 each side) 2
4. Swing cylinder trunnion (2 each side) 4
5. Boom swing pivot pins (1 each pin) 2
6. Boom lift pivots (1 each pivot) 2
7. Boom cylinder (1 each end) 2
8. Dipper cylinder rod end 1
9. Bucket cylinder (1 each end) 2
10. Bucket pivot 1

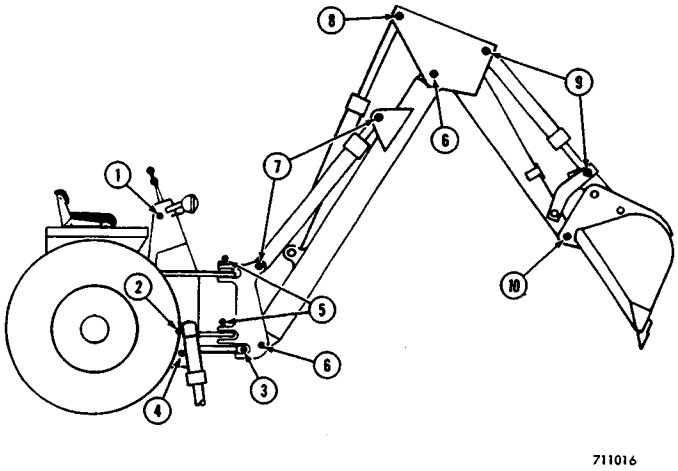

Figure 2 - Backhoe Lubrication Points

Dipper Extension Wear Strips

Lubricate the wear strips every 50 hours of operation or monthly.

1. The wear strips are lubricated with the same grease specified for the loader and backhoe. See Lubricants above.

2. Attach nozzle and fitting provided with tractor to a grease gun. See Figure 3.

3. Insert nozzle into each of the twelve 1/8" holes in the dipper arm and inject two strokes of grease in all twelve holes.

NOTE: On early production units with wear strips attached by screws or rivets, lubricate the wear strips by fully extending the dipper extension and applying a light coat of grease to each wear strip.

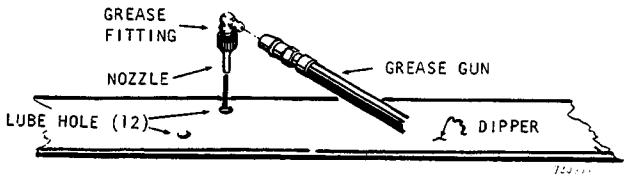

Figure 3

Section
13

LUBRICATION
480 SERIES B TRACTORS

Rac. Form 9-80911

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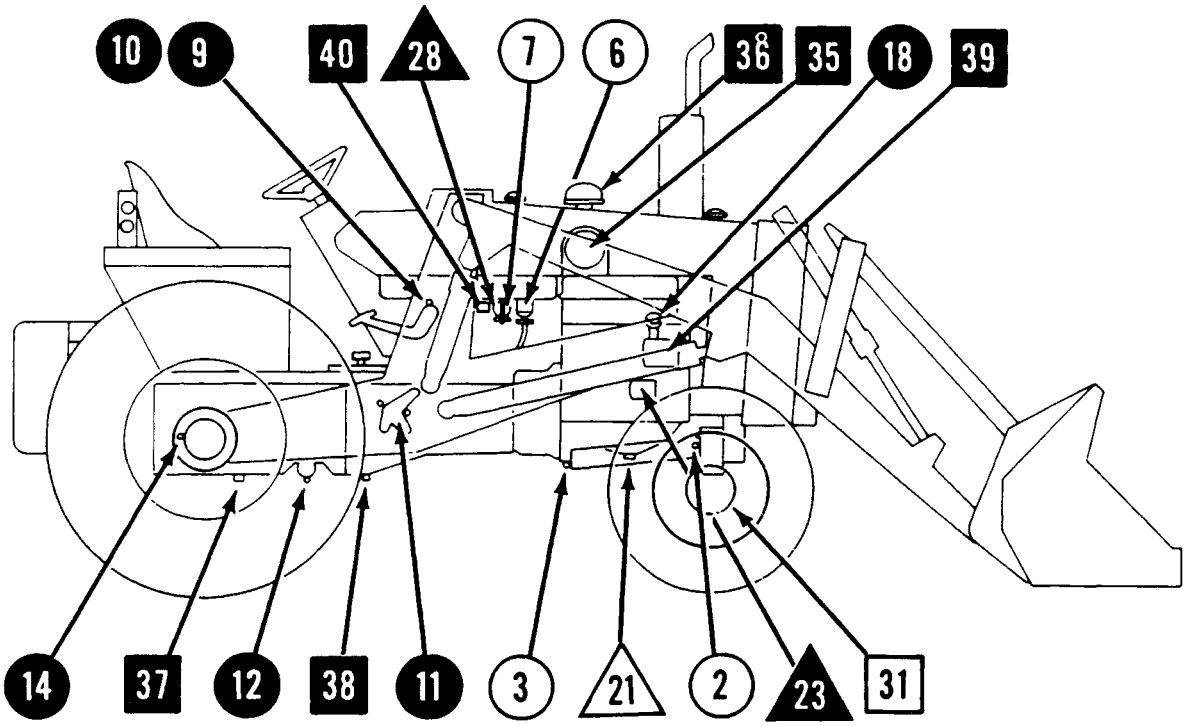
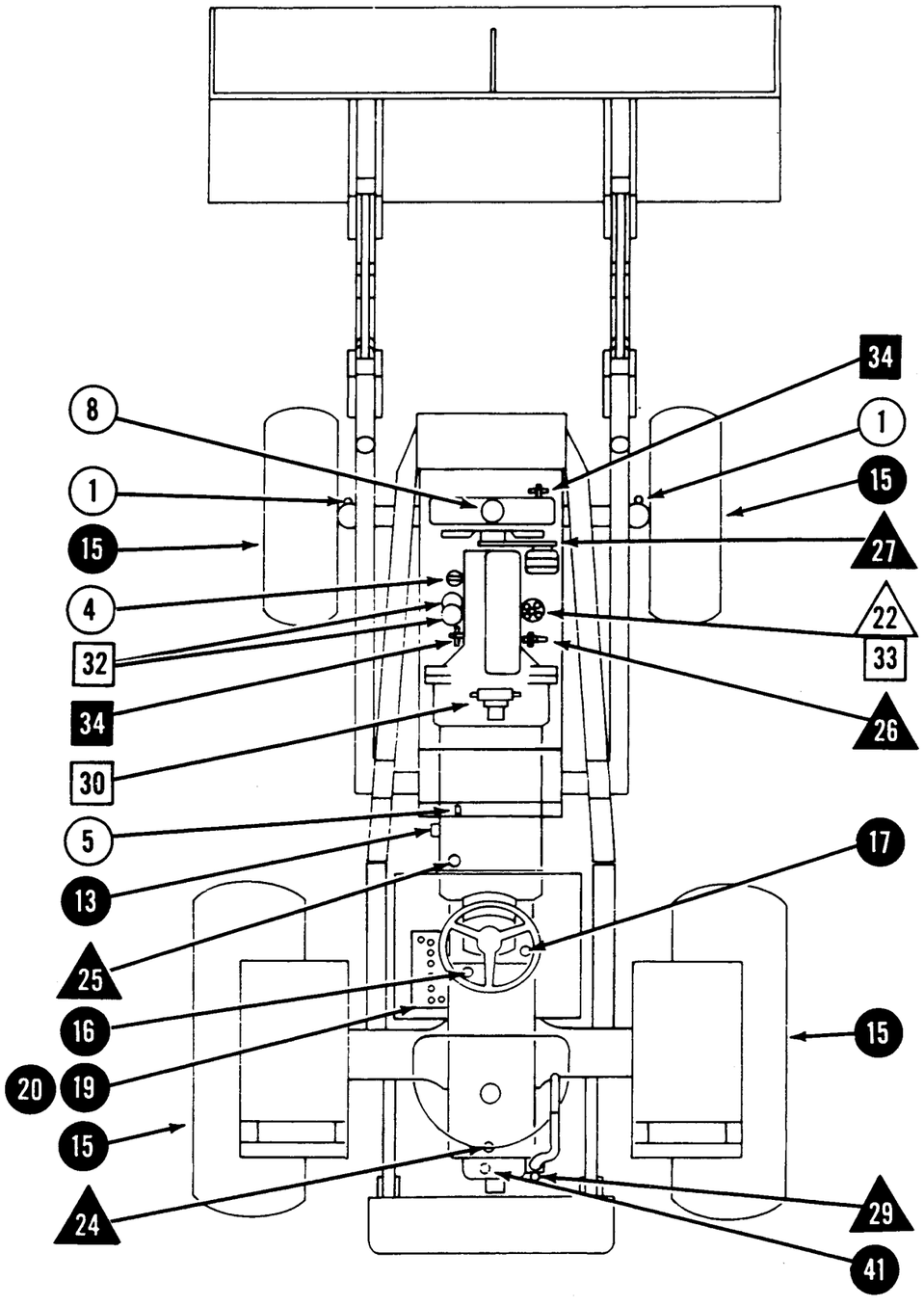


RECOMMENDED LUBRICANTS AND APPROXIMATE CAPACITIES GIVEN IN U.S. AND METRIC MEASURE

LUBRICATION POINTS	APPROXIMATE CAPACITIES	PREVAILING AIR TEMPERATURE RANGES				
Engine Crankcase W/O filter	4 Qts. (3.8 liters)	DIESEL ENGINES				
		32°F. (-0°C.) and Above		10°F. (-12°C.) to 50°F. (10°C.)		Use Only Below 32°F. (0°C.)
		SAE 30		SAE 20W		SAE 10W
Engine Crankcase W/Filter	5 Qts. (4.7 liters)	SPARK IGNITION ENGINES				
		40°F. (4.4°C.) and Above	32°F. (0°C.) to 90°F. (32.2°C.)	-10°F. (-23°C.) to 60°F. (15.5°C.)	Below -10°F. (-23°C.) to 60°F. (15.5°C.)	All Temp. Above -10°F. (-23°C.)
		SAE 30	SAE 20W	SAE 10W	SAE 5W-20	SAE 10W-30
Transmission and Differential Housing	17 Qts. (16.1 Liters)	Above 32°F. (0°C.)			Below 32°F. (0°C.)	
Belt Pulley	1 Pint (0.473 liter)	SAE 90 EP			SAE 80EP	
Torque Tube Reservoir	16 Qts. (15.1 liters)	USE CASE TCH OIL				
Steering System	3 Qts. (2.8 liters)					
Steering Reservoir	1 Qt. (0.946 liters)					
Fuel Tank	22 Gal. (83.3 liters)	Diesel - Use a Good Grade Number 2 Diesel Fuel Gasoline - Use Regular Grade w/Minimum 90.7 Octane (Research Method)				
Cooling System (188D) (148G)	16-1/2 Qts. (15.6 liters) 14 Qts. (13.2 liters)	Use a Top Brand High Boiling Point Anti-Freeze in Cold Weather				
All Pressure Fittings	As Many Strokes As Required	Use a Good No. 2 Lithium Gun Grease				



REF. NO.	SERVICE POINTS	NO. OF POINTS	GREASE	DRAIN	CHECK	CLEAN	CHANGE	OIL (Few Drops)	FREQUENCY
1	King Pins	2	▒						○ 10 HOURS OR DAILY
2	Front Axle Pivot	1	▒						
3	Radius Rod Pivot	1	▒						
4	Engine Oil Dipstick & Filler	1			▒				
5	Air Cleaner Restriction Indicator	1			▒				
6	Fuel Tank Water Trap (Diesel)	1		▒					
7	Fuel Tank Water Trap (Spark Ignition)	1			▒				
8	Radiator Coolant Level	1			▒				
9	Brake Pedals	2	▒						● 50 HOURS OR WEEKLY
10	Clutch Pedal	1	▒						
11	Brake Rod Bellcrank	2	▒						
12	Brake Cross Shaft	3	▒						
13	Clutch Pivot Shaft	1	▒						
14	Rear Axle Outer Bearings	2	▒						
15	Tire Pressure	4			▒				
16	Transmission Dipstick	1			▒				
17	Torque Tube Dipstick	1			▒				
18	Steering Reservoir Dipstick	1			▒				
19	Battery Level (Spark Ign.)	1			▒				
20	Battery Level (Diesel)	2			▒				
21	Engine Oil Drain	1		▒			▒		△ 100 HOURS
22	Distributor Tach. Drive (Spark Ign.)	1	▒						
23	Engine Oil Filter	1		▒			▒		▲ 200 HOURS
24	Transmission Breather	1				▒			
25	Torque Tube Breather	1				▒			
26	Spark Plugs (Spark Ign.)	4			▒	▒	▒		
27	Fan Belt	1			▒				
28	Fuel Strainer Screen	1		▒	▒	▒			
29	PTO Lever	1	▒						
30	Clutch Throwout Bearing	1	▒						□ 500 HOURS
31	Front Wheel Bearings	2	▒			▒	▒	▒	
32	Fuel Filters (Diesel)	2		▒		▒	▒		
33	Distributor Points	1			▒		▒		
34	Cooling System	2		▒			▒		■ 1000 HOURS OR YEARLY
35	Air Cleaner	1					▒	▒	
36	Air Cleaner Pre-Screener	1					▒		
37	Transmission Oil	1		▒				▒	
38	Torque Tube-Hydraulic Oil	1		▒				▒	
39	Power Steering Oil & Filter	1		▒				▒	
40	Fuel Filter (Spark Ign.)	1		▒				▒	
41	Independent PTO	1		▒				▒	

NOTE: For further service information, consult the applicable service manual section.

Section 2014

CYLINDER HEAD AND VALVES 188 DIESEL ENGINES

SPECIFICATIONS

		Maximum Limit Including Wear
CYLINDER HEAD		
Warpage		.006"
EXHAUST VALVES		
Tappet Clearance (Hot and Cold)	.014"	
Face Angle	44°	
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°	
Seat Face Width	.0608" to .0962"	
Seat Run-Out		.002"
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"	.002"
Length	6.339" to 6.364"	
Seat Angle	45°	
Seat Run-Out		.002"
Seat Width	.0704" to .1057"	

SPECIFICATIONS (Continued)

		Maximum Limit Including Wear
EXHAUST VALVE GUIDES		
Length	3.125″	
O.D.	.6565″ to .6575″	
I.D. (Installed and Reamed)	.3429″ to .3439″	.001″
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″	.001″
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.	

SPECIAL TORQUES

Cylinder Head Studs w/Flange Nuts	90 to 100 ft. lbs.
Intake and Exhaust Manifold Stud Nuts	25 to 30 ft. lbs.
Cylinder Head Valve Cover Stud Nuts	5 to 8 ft. lbs.
Rocker Arm Bracket Bolts	25 to 30 ft. lbs.

CHECKING COMPRESSION PRESSURE

1. Clean the engine thoroughly, preferably by steam cleaning.

2. Before cranking the engine make sure all operating controls are in neutral, brakes are set and the wheels are securely blocked.

3. There are two methods of checking compression pressure - the cranking method and the engine running method. **NOTE:** The engine must be at operating temperature for either method used.

A. CRANKING METHOD - Close the needle valve at the fuel tank. Disconnect all high pressure fuel lines and leak-off lines between injectors. Remove all of the injectors. Refer to the chart on Page 3.

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