780 CK LOADER BACKHOE TABLE OF CONTENTS

10 SERIES GENERAL

SECTION 13

MAINTENANCE AND LUBRICATION

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MAINTENANCE SCHEDULE

INTERVAL	SERVICE	FLUID/LUBRICANT	INSTRUCTIONS
Run-in period; every 2 hours until stabilized	Torque wheel bolts/nuts Front - 150-170 ft. lbs., dry Rear - 220-240 ft. lbs., dry		
Run-in period after first 20 hours only	Change engine oil. Replace engine oil filter. Change hydraulic oil. Replace hydraulic oil filter. Check drive belts tension.	See chart, page 4.	 Section 82.
Every 10 hours or daily	Check engine oil level. Empty air cleaner dust cup. Drain water from air reservoir. Check radiator coolant level. Grease loader pivot points. Grease backhoe pivot points.	See chart, page 4. See chart, page 4. See chart, page 4.	 Section 24. Section 72.
Every 50 hours	Grease front axle pivot and king pins. Grease loader anti-rollback link. Check battery fluid level. Check transmission oil level. Check tire pressure. Check hydraulic oil level.	See chart, page 4. See chart, page 4. See chart, page 4. Case TCH Fluid	 Section 63. Section 51. Section 41.
Every 100 hours	Change engine oil. (With turbo-charger.)	See chart, page 4.	
Every 150 hours	Change engine oil (Without turbocharger.) Grease driveshaft.	See chart, page 4. See chart, page 4.	
Every 200 hours	Replace engine oil filter. (With turbocharger.)	See chart, page 4.	
Every 300 hours	Grease backhoe control levers. Replace engine oil filter. (Without turbocharger.)	See chart, page 4.	

INTERVAL	SERVICE	FLUID/LUBRICANT	INSTRUCTIONS
Every 300 hours (cont'd)	Drain fuel tank water trap, first stage fuel filter, and transfer pump sediment bowl.		
	Check brake master cylinders fluid level.	SAE J1703 Brake Fluid	
	Replace transmission filter element.		Section 63.
	Check rear axle oil level.	See chart, page 4.	Section 67.
Every 600 hours	Replace fuel filters.		
	Change transmission oil	See chart, page 4.	Section 63.
	Clean transmission suction screen.		Section 63.
	Clean transmission breather		Section 63.
	Repack front wheel bearings.	No. 2 wheel bearing grease.	Section 58.
	Replace hydraulic oil filter.		Section 41.
Every 1200 hours	Remove air compressor cylinder head and clean (by Authorized Case Dealer only).		Section 72.
	Change rear axle oil.	See chart, page 4.	Section 67.
	Change hydraulic oil.	Case TCH Fluid	Section 41
	Clean hydraulic suction screen.		Section 41.
	Clean hydraulic reservoir intake and relief valves.		Section 41.
Every 2000 hours or yearly	Drain, flush and refill radiator.	See chart, page 4.	
	Lubricate starter motor.	SAE 10 engine oil	Section 82.
Every 3000 hours	Rebuild or replace air compressor (by Authorized Case Dealer only).		Section 72.
As required	Clean air cleaner filter element when indicator red band is showing.		Section 24.
	Replace fuel filters.		

FLUIDS AND LUBRICANTS CHART

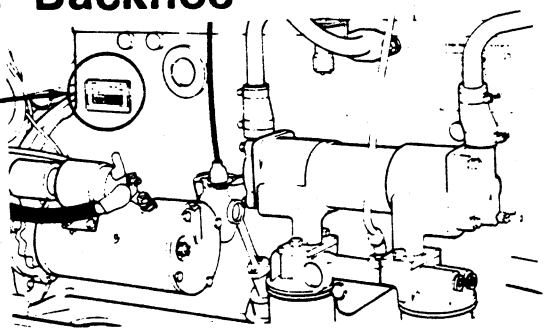
COMPONENT	CAPACITY U.S.	CAPACITY Metric	SPECIFICATION
Fuel tank	35 gals.	133 liters	No. 2 diesel fuel
Engine coolant	25 qts.	24 liters	1/2 permanent antifreeze, 1/2 soft water (protects down to -34° F.)
Engine crankcase Without turbocharger With filter change Without filter change With turbocharger With filter change Without filter change	 10 qts. 9 qts. 11 qts. 10 qts.	 9,4 liters 8,5 liters 10,4 liters 9,4 liters	Engine oil: CD - Commercial class D (Service DS, Series 3) MIL-L-45199B Above 32° F. - SAE 30 10° to 50° F. - SAE 20W Below 32° F. - SAE 10W
Brake master cylinders			SAE J1703 brake fluid
Transmission	5 gals.	19 liters	Case TCH fluid Alternate oils: Type A, Suffix A, automatic transmission fluid Type C-2 transmission and hydraulic fluid (above 0° F.)
Rear axle: before S/N 5500354 and S/N 5500426 thru 5500439 Center bowl Each wheel end Rear axle: after S/N 5500354 except S/N 5500426 thru 5500439 Center bowl Each wheel end	 16 pints 5 pints 14 pints 8 pints	 7,6 liters 2,4 liters 6,6 liters 3,8 liters	SAE 90 SCL multipurpose gear lubricant (API-GL-4, MIL-L-2105)
Wheel bearings	As required		No. 2 wheel bearing grease
Hydraulic reservoir (refill) System total	12 gals. 45 gals.	45 liters 170 liters	Case TCH fluid Alternate oils: Engine oil - SD - Service class D, or CA - Commercial class A (Service MS or DG) Above 32° F. - SAE 10W Below 32° F. - SAE 5W
Pressure fittings	As required		Below 32° F. - Multipurpose or No. 1 lithium-soap base grease Above 32° F. - Multipurpose or No. 2 lithium-soap base grease

Section 1010

GENERAL ENGINE SPECIFICATIONS

780CK Loader Backhoe

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



DIESEL ENGINES

General

Type	4 Cylinder, 4 Stroke Cycle, Valve-in-Head Turbo-Charged
Firing Order	1-3-4-2
Bore	4-5/8 Inches (117.5mm)
Stroke	5 Inches (127mm)
Piston Displacement	336 Cubic Inches (8 259 cm^3)
Compression Ratio	15.8 to 1
No Load Governed Speed	2330 to 2370 RPM
Rated Engine Speed	2200 RPM
Engine Idling Speed	700 to 750 RPM
*Valve Tappet Clearance (Exhaust)	(Hot) .020 inch (Cold) .025 Inch (0.635mm)
(Intake)	(Hot and Cold) .015 Inch (0.381mm)

*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

Crankcase capacity	10 Qts. (9.4 litre)
with Filter Change	11 Qts. (10.34 litre)
Oil Pressure	46 to 59 Pounds with Engine Warm and Operating At Rated Engine Speed
Type System	Pressure and Spray Circulation
Oil Pump	Gear Type
Oil Filter	Full Flow Spin on Type

Fuel System

Fuel Injection Pump	Robert Bosch, Type PES Multiple Plunger
Pump Timing	30 Degrees Before Top Dead Center (Port Closing)
Fuel Injectors	Pencil Type (Opening Pressure 2800 PSI)
Fuel Transfer Pump	Plunger Type, Integral Part of Injection Pump
Governor	Variable Speed, Fly-Weight Centrifugal Type, Integral Part of Injection Pump
1st Stage Fuel Filter	Full Flow Spin on Type
2nd Stage Fuel Filter	Full Flow Spin on Type

Section

1023

SPECIFICATION DETAILS

336BD AND 336BDT ENGINE

Written In *Clear And Simple English*

CASE CORPORATION

Rac 9-78647

Printed in U.S.A.
March, 1981

FRACTION to DECIMAL to MILLIMETER CONVERSION TABLE

Fraction	Decimal	MM	Fraction	Decimal	MM	Fraction	Decimal	MM
1/64	.0156	0.397	23/64	.3593	9.128	45/64	.7031	17.859
1/32	.0312	0.794	**3/8**	**.3750**	**9.525**	23/32	.7187	18.256
3/64	.0468	1.191	25/64	.3906	9.922	47/64	.7343	18.653
1/16	.0625	1.587	13/32	.4062	10.319	**3/4**	**.7500**	**19.050**
5/64	.0781	1.984	27/64	.4218	10.716	49/64	.7656	19.447
3/32	.0937	2.381	7/16	.4375	11.113	25/32	.7812	19.844
7/64	.1093	2.778	29/64	.4531	11.509	51/64	.7968	20.240
1/8	**.1250**	**3.175**	15/32	.4687	11.906	13/16	.8125	20.637
9/64	.1406	3.572	31/64	.4843	12.303	53/64	.8281	21.034
5/32	.1562	3.969	**1/2**	**.5000**	**12.700**	27/32	.8437	21.431
11/64	.1718	4.366	33/64	.5156	13.097	55/64	.8593	21.828
3/16	.1875	4.762	17/32	.5312	13.494	**7/8**	**.8750**	**22.225**
13/64	.2031	5.159	35/64	.5468	13.890	57/64	.8906	22.622
7/32	.2187	5.556	9/16	.5625	14.287	29/32	.9062	23.019
15/64	.2343	5.953	37/64	.5781	14.684	59/64	.9218	23.415
1/4	**.2500**	**6.350**	19/32	.5937	15.081	15/16	.9375	23.812
17/64	.2656	6.747	39/64	.6093	15.478	61/64	.9531	24.209
9/32	.2812	7.144	**5/8**	**.6250**	**15.875**	31/32	.9687	24.606
19/64	.2968	7.541	41/64	.6406	16.272	63/64	.9843	25.003
5/16	.3125	7.937	21/32	.6562	16.669	**1**	**1.0000**	**25.400**
21/64	.3281	8.334	43/64	.6718	17.065			
11/32	.3437	8.731	11/16	.6875	17.462			

INCH to MILLIMETER CONVERSION TABLE

Inch	MM	Inch	MM	Inch	MM	Inch	MM
1	25.400	6	152.000	10	254.000	60	1,524.000
2	50.800	7	177.800	20	508.000	70	1,778.000
3	76.200	8	203.200	30	762.000	80	2,032.000
4	101.600	9	228.600	40	1,016.000	90	2,286.000
5	127.000	10	254.000	50	1,270.000	100	2,540.000

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RUN-IN INSTRUCTIONS

Engine Lubrication

Fill the engine crankcase with CASE HDM oil and install new engine oil filters, after an engine has been rebuilt.

NOTE: *Use a SERIES 3 DS or CD SERVICE CLASSIFICATION oil that has the correct viscosity rating for ambient air temperature, if CASE HDM oil is not used.*

Change the engine oil while the engine is hot and replace the engine oil filters, after the first 20 hours of operation.

Change the engine oil and filters at the given intervals, after the 20 hours, as found in the Operator's Manual.

Run-In Procedure For Rebuilt Engines (With A Dynamometer)

The following procedure must be followed when using a PTO dynamometer to run-in the engine. The dynamometer will make sure of the control of 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	**10 Minutes	1000 RPM	Not Any
2	**10 Minutes	1800 RPM	Not Any
3	20 Minutes	1800 RPM	1/3
4	20 Minutes	1800 RPM	1/2
5	***30 Minutes	100 RPM below rated speed	3/4
6	Tighten the cylinder head bolts to the torque that is found in Section 2015 of the service manual.		

* According to normal dynamometer scale load at rated speed for the specific vehicle model. Decrease this scale load as shown.

** The best run-in procedure will constantly change the throttle between 750 to 1000 RPM, for the first 10 minutes and from 1000 to 1800 RPM, for the next 10 minutes. The purpose of this changing RPM is to change the lubrication and coolant flow.

*** 30 minutes at 3/4 load is a minimum amount of time the engine can be run. It is best that when possible, the engine (especially a turbocharged diesel) must be run for four (4) hours or more, at the above speed and load before checking the full engine horsepower or before using the engine for heavy field work.

Run-In Procedure For Rebuilt Engines (Without A Dynamometer)

STEP	TIME	ENGINE SPEED	LOAD
1	*10 Minutes	1000 RPM	Not Any
2	* 10 Minutes	1800 RPM	Not Any
3	30 Minutes	2/3 Rated RPM	Light Load
4	1 Hour	Full RPM (not over 2000 RPM)	80 to 90%
5	Tighten the cylinder head bolts to the torque that is found in Section 2015 of the service manual.		

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

Run-In Procedure

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

ENGINE SPECIFICATION DETAILS

Cylinder Sleeves

	U.S. Value	Metric Value
Type	Wet, Can Be Replaced	
Material	Cast Iron	
ID of Sleeve	4.6250 to 4.6263"	117.475 to 117.508 mm
Maximum Service Limit	4.6283"	117.5588 mm
Sleeve Out of Round (Installed in Block)	0.002"	0.0508 mm
Maximum Service Limit	0.002"	0.0508 mm
Taper (Installed in Block)	0.001"	0.0254 mm
Maximum Service Limit	0.002"	0.051 mm
Clearance at Bottom of Piston, 90 Degrees to Piston Pin	0.0052 to 0.0075"	0.1321 to 0.1905 mm
Maximum Service Limit	0.0100"	0.2540 mm

Piston with 1.62" (41.15 mm) Pin Bore

Type	Cam Ground	
Material	Aluminum Alloy	
OD At Bottom, 90 Degrees to Piston Pin	4.6188 to 4.6198"	117.3175 to 117.3429 mm
Minimum Service Limit	4.6178"	117.2921 mm
ID of Piston Pin Bore	1.6251 to 1.6253"	41.2775 to 41.2826 mm
Maximum Service Limit	1.6258"	41.2953 mm
Width of 1st Ring Groove	0.097 to 0.098"	2.464 to 2.489 mm
Maximum Service Limit	0.0985"	2.5019 mm
Width of 2nd Ring Groove	0.097 to 0.098"	2.464 to 2.489 mm
Maximum Service Limit	0.0985"	2.5019 mm
Width of 3rd Ring Groove	0.188 to 0.189"	4.775 to 4.801 mm
Maximum Service Limit	0.190"	4.826 mm

Piston with 1.80" (45.72 mm) Pin Bore

Type	Cam Ground	
Material	Aluminum Alloy	
OD at Bottom, 90 Degree to Piston Pin	4.6188 to 4.6198"	117.3175 to 117.3429 mm
Minimum Service Limit	4.6178"	117.2921 mm
ID of Piston Pin Bore	1.8001 to 1.8005"	45.7225 to 45.7327 mm
Maximum Service Limit	1.8010"	45.7454 mm
Width of 1st Ring Groove	Not Measureable	
Width of 2nd Ring Groove	Not Measureable	
Width of 3rd Ring Groove	0.188 to 0.189"	4.775 to 4.801 mm
Maximum Service Limit	0.190"	4.826 mm

Piston Pin for Piston with 1.62" (41.15 mm) Pin Bore

Type	Floats	
OD of Pin	1.6244 to 1.6246"	41.2598 to 41.2648 mm

Piston Pin for Piston with 1.80" (45.72 mm) Pin Bore

Type	Floats	
OD of Pin	1.7994 to 1.7996"	45.7048 to 45.7098 mm

Piston Rings

	U.S. Value	Metric Value
Number One Compression (Top)	Square Type with Chrome Face	
End Gap in 4.625" (117.475 mm) ID Sleeve	0.015 to 0.025"	0.381 to 0.635 mm
Maximum Service Limit	0.030"	0.762 mm
Side Clearance	0.0035 to 0.0050"	0.0889 to 0.127 mm
Maximum Service Limit	0.006"	0.152 mm
Number One Compression (Top)	Keystone Type	
End Gap in 4.625" (117.475 mm) ID Sleeve	0.015 to 0.025"	0.381 to 0.635 mm
Maximum Service Limit	0.030"	0.762 mm
Side Clearance	Not Measureable	
Number Two Compression (Intermediate)	Square Type with Tapered Face	
End Gap in 4.625" (117.475 mm) ID Sleeve	0.013 to 0.023"	0.330 to 0.584 mm
Maximum Service Limit	0.028"	0.711 mm
Side Clearance	0.003 to 0.005"	0.076 to 0.127 mm
Maximum Service Limit	0.006"	0.152 mm
Number Two Compression (Intermediate)	Keystone Type	
End Gap in 4.625" (117.475 mm) ID Sleeve	0.015 to 0.025"	0.381 to 0.635 mm
Maximum Service Limit	0.030"	0.762 mm
Side Clearance	Not Measureable	
Number Three Oil Control Ring (Bottom)	Two Piece	
Width	0.1860 to 0.1865"	4.7244 to 4.7371 mm
End Gap in 4.625" (117.475 mm) ID Sleeve	0.016 to 0.026"	0.406 to 0.660 mm
Maximum Service Limit	0.031"	0.787 mm
Side Clearance	0.0015 to 0.003"	0.0381 to 0.0762 mm
Maximum Service Limit	0.0035"	0.0889 mm

Connecting Rod for Piston with 1.62" (41.15 mm) Pin Bore

Bushing	Replaceable	
Bushing ID, Installed (Ream to Size)	1.6254 to 1.6258"	41.2852 to 41.2953 mm
Maximum Service Limit	1.6265"	41.3131 mm
Bearing Liners	Replaceable	
Bearing Liner Width	1.586 to 1.596"	40.284 to 40.538 mm
Bore ID without Bearing Liners	2.9003 to 2.9013"	73.6676 to 73.6930 mm
Bearing Oil Clearance	0.0013 to 0.0038"	0.0330 to 0.0965 mm
Maximum Service Limit	0.0043"	0.1092 mm
Undersize Bearings for Service	0.002, 0.010, 0.020, 0.030"	0.051, 0.254, 0.508, 0.762 mm
Side Clearance	0.007 to 0.016"	0.178 to 0.406 mm

Connecting Rod for Piston with 1.80" (45.72 mm) Pin Bore

Bushing	Replaceable	
Bushing ID, Installed (Ream to Size)	1.8004 to 1.8008"	45.7302 to 45.7403 mm
Maximum Service Limit	1.8015"	45.7581 mm
Bearing Liners	Replaceable	
Bearing Liner Width	1.586 to 1.596"	40.284 to 40.538 mm
Bore ID without Bearing Liners	3.1503 to 3.1513"	80.0176 to 80.043 mm
Bearing Oil Clearance	0.0013 to 0.0038"	0.0330 to 0.0965 mm
Maximum Service Limit	0.0043"	0.1092 mm
Undersize Bearings for Service	0.002, 0.010, 0.020, 0.030"	0.051, 0.254, 0.508, 0.762 mm
Side Clearance	0.007 to 0.016"	0.178 to 0.406 mm

Crankshaft with 3" (76.2 mm) Main Bearing Journals

	U.S. Value	Metric Value
Type	Forged, Heat Treated and Balanced	
End Play, Number Five Main Bearing Cap	0.003 to 0.015"	0.076 to 0.381 mm
Thrust Bearing, Standard Thickness	0.184 to 0.186"	4.674 to 4.724 mm
Thrust Bearing, Oversize Thickness for Service	0.190 to 0.192"	4.826 to 4.877 mm
Connecting Rod Journal Width	1.9975 to 2.0025"	50.7365 to 50.8635 mm
Connecting Rod Journal, Standard OD	2.748 to 2.749"	69.799 to 69.825 mm
0.010" (0.254 mm) OD Undersize, Grind to	2.738 to 2.739"	69.545 to 69.571 mm
0.020" (0.508 mm) OD Undersize, Grind to	2.728 to 2.729"	69.291 to 69.317 mm
0.030" (0.762 mm) OD Undersize, Grind to	2.718 to 2.719"	69.037 to 69.063 mm
Connecting Rod Journal Maximum Taper	0.0005"	0.0127 mm
Connecting Rod Journals Out of Round	0.0005"	0.0127 mm
Main Bearing Liners	Replaceable	
Main Bearing Liner Width, 1st, 3rd and 5th	2.1515 to 2.1615"	54.6481 to 54.9021 mm
Main Bearing Liner Width, 2nd and 4th	1.151 to 1.161"	29.235 to 29.489 mm
Main Bearing Oil Clearance	0.0016 to 0.0046"	0.0406 to 0.1168 mm
Maximum Service Limit	0.005"	0.127 mm
Undersize Main Bearing Liners for Service	0.002, 0.010, 0.020, 0.030"	0.051, 0.254, 0.508, 0.762 mm
Main Bearing Journal, Standard OD	2.998 to 2.999"	76.149 to 76.175 mm
0.010" (0.254 mm) OD Undersize, Grind to	2.988 to 2.989"	75.895 to 75.921 mm
0.020" (0.508 mm) OD Undersize, Grind to	2.978 to 2.979"	75.641 to 75.667 mm
0.030" (0.762 mm) OD Undersize, Grind to	2.968 to 2.969"	75.387 to 75.413 mm
Main Bearing Journal Bore ID without Liners	3.191 to 3.192"	81.051 to 81.077 mm
Main Bearing Journal Width		
2nd and 4th	1.555 to 1.570"	39.497 to 39.878 mm
3rd	2.623 to 2.627"	66.624 to 66.726 mm
5th	2.6175 to 2.6325"	66.4845 to 66.8655 mm

Crankshaft with 3.5" (88.9 mm) Main Bearing Journals

Type	Forged, Heat Treated and Balanced	
End Play, Number Three Main Bearing Cap	0.003 to 0.015"	0.076 to 0.381 mm
Thrust Bearing, Standard Thickness	0.155 to 0.157"	3.937 to 3.988 mm
Thrust Bearing, Oversize Thickness for Service	0.161 to 0.163"	4.089 to 4.140 mm
Connecting Rod Journal Width	1.9775 to 2.0025"	50.2285 to 50.8635 mm
Connecting Rod Journal, Standard OD	2.998 to 2.999"	76.149 to 76.175 mm
0.010" (0.254 mm) OD Undersize, Grind to	2.988 to 2.989"	75.895 to 75.921 mm
0.020" (0.508 mm) OD Undersize, Grind to	2.978 to 2.979"	75.641 to 75.667 mm
0.030" (0.762 mm) OD Undersize, Grind to	2.968 to 2.969"	75.387 to 75.413 mm
Connecting Rod Journal Maximum Taper	0.0005"	0.0127 mm
Connecting Rod Journals Out of Round	0.0005"	0.0127 mm
Main Bearing Liners	Replaceable	
Main Bearing Liner Width, 1st, 3rd and 5th	2.1515 to 2.1615"	54.6481 to 54.9021 mm
Main Bearing Liner Width, 2nd and 4th	1.214 to 1.224"	30.836 to 31.089 mm
Main Bearing Oil Clearance	0.0016 to 0.0046"	0.0406 to 0.1168 mm
Maximum Service Limit	0.005"	0.127 mm
Undersize Main Bearing Liners for Service	0.002, 0.010, 0.020, 0.030"	0.051, 0.254, 0.508, 0.762 mm

Crankshaft With 3.5" (88.9 mm) Main Bearing Journals (Continued)

	U.S. Value	Metric Value
Main Bearing Journal, Standard OD	3.498 to 3.499"	88.849 to 88.875 mm
0.010" (0.254 mm) OD Undersize, Grind to	3.488 to 3.489"	88.595 to 88.621 mm
0.020" (0.508 mm) OD Undersize, Grind to	3.478 to 3.479"	88.341 to 88.367 mm
0.030" (0.762 mm) OD Undersize, Grind to	3.468 to 3.469"	88.087 to 88.113 mm
Main Bearing Journal Bore ID without Liners	3.691 to 3.692"	93.751 to 93.777 mm
Main Bearing Journal Width		
2nd and 4th	1.618 to 1.633"	41.097 to 41.478 mm
3rd	2.561 to 2.565"	65.049 to 65.151 mm
5th	2.5855 to 2.6005"	65.6717 to 66.0527 mm

Camshaft

Type	Parabolic	
Bushing	Four, Replaceable	
Bushing Lubrication	Under Pressure	
ID of Bushing	2.2484 to 2.2514"	57.1094 to 57.1856 mm
Maximum Service Limit	2.2524"	57.2110 mm
Bushing Width		
1st (Front)	1.646 to 1.666"	41.808 to 42.316 mm
2nd and 3rd	1.4275 to 1.4475"	36.2585 to 36.7665 mm
4th	1.1462 to 1.1662"	29.1135 to 29.6215 mm
OD of Each Bearing Surface	2.2460 to 2.2470"	57.0484 to 57.0738 mm
Minimum Service Limit	2.2455"	57.0357 mm
Thrust Washer Thickness	0.1225 to 0.1275"	3.1115 to 3.2385 mm
Minimum Service Limit	0.1215"	3.0861 mm
Thrust Plunger Spring		
Free Length	3.625"	92.075 mm
OD of Spring	0.3912 to 0.4062"	9.9365 to 10.3175 mm
Compress to 2.750" (69.85 mm)	45 to 55 lbs.	200 to 245 N

Valve Push Rod Lifters

OD of Lifter Stem, Standard	0.8097 to 0.8102"	20.5664 to 20.5791 mm
OD of Lifter Stem, Oversize for Service	0.8190 to 0.8195"	20.8026 to 20.8153 mm
ID of Block Bore, Standard	0.8118 to 0.8130"	20.6197 to 20.6502 mm
Maximum Service Limit	0.8135"	20.6629 mm
ID of Block Bore, Oversize for Service	0.8215 to 0.8225"	20.8661 to 20.8915 mm

Gear Train

	U.S. Value	Metric Value
Backlash		
Crankshaft Gear to Camshaft Gear	0.004 to 0.011"	0.102 to 0.279 mm
Idler Drive Gear to Idler Gear	0.003 to 0.010"	0.076 to 0.254 mm
Idler Gear to Fuel Pump Gear	0.004 to 0.012"	0.102 to 0.305 mm
Crankshaft Gear to Oil Pump Gear	0.006 to 0.011"	0.152 to 0.279 mm
Crankshaft Gear to Fuel Pump Gear	0.027" Max.	0.686 mm Max.
OD of Idler Gear Shaft	1.7325 to 1.7330"	44.0055 to 44.0182 mm
ID of Idler Gear Bushing	1.7345 to 1.7355"	44.0563 to 44.0817 mm
Maximum Service Limit	1.7375"	44.1325 mm
Idler Gear Thrust Washer Thickness	0.061 to 0.063"	1.5494 to 1.6002 mm
Idler Gear Lateral Movement	0.002 to 0.012"	0.051 to 0.305 mm

Oil Pump and Two Gear Balancer

Positive Displacement Pump	Gear Type	
Pump Gears to Cover Clearance	0.005 max.	0.127 mm max.
Pump Gear to Housing - Radial Clearance	0.006" max.	0.152 mm max.
Backlash		
Crankshaft Gear to Counterweight Gear	0.008 to 0.013"	0.203 to 0.330 mm
Counterweight Gear to Counterweight Gear	0.003 to 0.024"	0.076 to 0.610 mm
Relief Valve Spring		
Free Length	2.000"	50.800 mm
Wire Diameter	0.080"	2.032 mm
Maximum OD of Spring	0.673"	17.094 mm
Number of Coils	11	11
Compress to 1.234" (31.344 mm)	24.4 to 26.2 lbs.	108 to 116 N

Oil Pump and Three Gear Balancer

Positive Displacement Pump	Gear Type	
Pump Gears to Cover Clearance	0.005" max.	0127 mm max.
Backlash		
Crankshaft Gear to Counterweight Gear	0.008 to 0.013"	0.203 to 0.330 mm
Counterweight Gear to Counterweight Gear	0.005 to 0.013"	0.127 to 0.330 mm
Counterweight Gear and Drive Gear Bushing Wear	0.007 max.	0.178 mm max.
Relief Valve Spring		
Free Length	3.00"	76.20 mm
Wire Diameter	0.062"	1.575 mm
OD of Spring	0.515"	13.081 mm
Number of Coils	25	25
Compress to 1.68" (42.67 mm)	13.5 to 15.5 lbs.	60 to 69 N

Oil Pump, Front Mount

	U.S. Value	Metric Value
Positive Displacement Pump	Gear Type	
Backlash		
Pump Gear To Crankshaft Gear	0.006 to 0.011"	0.152 to 0.279 mm
Pump Gears to Body Radial Clearance	0.006" max.	0.152 mm max.
Pump Gears to Pump Cover Clearance	0.005" max.	0.127 mm max.
Oil Pressure at Rated Speed, Hot Oil	45 to 60 PSI	310 to 413 kPa
Relief Valve Spring - Inner		
Number of Coils	14.5	14.5
Direction of Coils	L.H.	L.H.
Wire Diameter	0.063"	1.600 mm
Maximum OD	0.454"	11.532 mm
Free Length	1.750"	44.450 mm
Compress to 1.234 (31.344)	16.4 to 17.6 lbs.	73 to 78 N
Relief Valve Spring - Outer (Also For Pumps With One Spring)		
Number of Coils	11	11
Direction of Coils	RH	RH
Wire Diameter	0.080"	2.032 mm
Minimum ID	0.493"	12.522 mm
Maximum OD	0.673"	17.094 mm
Free Length	2.000"	50.800 mm
Compress to 1.234 (31.344)	24.4 to 26.2 lbs.	108 to 116 N
Relief Valve Cup Plug Depth	0.375"	9.525 mm

Cylinder Head

	U.S. Value	Metric Value
Warpage	0.005"	0.127 mm

Exhaust Valve

Tappet Clearance	0.025"	0.635 mm
Face Angle	44 Degrees	44 Degrees
Face Run-Out	0.002" max.	0.051 mm
OD of Head	1.745 to 1.755"	44.323 to 44.577 mm
OD of Stem	0.402 to 0.403"	10.211 to 10.236 mm
Minimum Service Limit	0.4018"	10.2057 mm
OD of Taper at 4.2675" (108.3945 mm)	0.401 to 0.402"	10.185 to 10.211 mm
Minimum Service Limit	0.4008"	10.1803 mm
Length	6.4195 to 6.4405"	163.0553 to 163.5887 mm
Insert Seat Angle	45 Degrees	45 Degrees
Seat Contact Width	0.0800 to 0.1000"	2.0320 to 2.5400 mm
Seat Run-Out	0.002"	0.051 mm
Insert Height	0.3115 to 0.3175"	7.9121 to 8.0645 mm
OD of Insert	1.9455 to 1.9465"	49.4157 to 49.4411 mm
ID of Insert	1.569 to 1.579"	39.853 to 40.107 mm

Intake Valve - 45 Degree

Tappet Clearance	0.015"	0.381 mm
Face Angle	44 Degrees	44 Degrees
Face Run-Out	0.002" max.	0.051 mm
OD of Stem	0.402 to 0.403"	10.211 to 10.236 mm
Minimum Service Limit	0.4018"	10.2057 mm
OD of Head	1.995 to 2.005"	50.673 to 50.927 mm
Length	6.4195 to 6.4405"	163.0553 to 163.5887 mm
Seat Angle	45 Degrees	45 Degrees
Seat Contact Width	0.0775 to 0.0975"	1.9685 to 2.4765 mm
Seat Run-Out	0.002" max.	0.051 mm

Intake Valve - 30 Degree

Tappet Clearance	0.015"	0.381 mm
Face Angle	29 Degrees	29 Degrees
Face Run-Out	0.002" max.	0.051 mm
OD of Stem	0.402 to 0.403"	10.211 to 10.236 mm
Minimum Service Limit	0.4018"	10.2057 mm
OD of Head	1.995 to 2.005"	50.673 to 50.927 mm
Length	6.4195 to 6.4405"	163.0553 to 163.5887 mm
Seat Angle	30 Degrees	30 Degrees
Seat Contact Width	0.075 to 0.1.000"	1.905 to 2.540 mm
Seat Run-Out	0.002" max.	0.051 mm max.
Insert Height (If Equipped)	0.2660 to 0.2670	6.7564 to 6.7818 mm
OD of Insert (If Equipped)	2.099 to 2.100"	53.315 to 53.340 mm
ID of Insert (If Equipped)	1.777 to 1.787"	45.136 to 45.390 mm

Intake and Exhaust Valve Guides

	U.S. Value	Metric Value
Length	3.219"	81.763 mm
OD of Guide	0.7510 to 0.7515"	19.075 to 19.088 mm
ID of Guide (Installed and Reamed)	0.4045 to 0.4055"	10.2743 to 10.2997 mm
Maximum Service Limit	0.4065"	10.3251 mm
Protrusion Above Cylinder Head	0.953"	24.206 mm

Valve Spring

Free Length	2.18"	55.372 mm
Number of Coils	7-1/4	7-1/4
Wire Diameter	0.192"	4.877 mm
Compress Spring to 1.484" (37.694 mm), Valve Open	153 to 167 lbs.	681 to 743 N
Compress Spring to 1.937" (49.200 mm), Valve Closed	50.5 to 60.5 lbs.	225 to 269 N

Rocker Arm Assembly

OD of Shaft	0.860 to 0.866"	21.844 to 21.996 mm
ID of Arm Bore	0.8745 to 0.8755"	22.2123 to 22.2377 mm
Shaft Assembly Lateral Movement (Both Ends)	0.010" to 0.030"	0.254 to 0.762 mm
Shaft Spring		
Number of Working Coils	4	4
Wire Diameter	0.080"	2.032 mm
Compress Spring to 1.562" (39.675 mm)	8.5 to 11.5 lbs.	38 to 51 N
Lubrication	Engine Oil, Camshaft Metering	
Shaft Oil Holes	Toward Valve Side of Engine	
	Shaft Can Not Be Turned	

Intake Valve Timing

Valve Timing ..... With the Number One Intake Valve to Rocker Arm Clearance Set at 0.015" (0.381 mm) and the Dial Indicator on the Number One Valve Retainer, 0.053" (1.346 mm) Movement of the Valve From the Seat (Clockwise Pulley Rotation) Will Give 7 Degrees After Top Center Timing Indication on the Crank Pulley.

Special Torque

	U.S. Value	Metric Value
Camshaft Nut with Lock Washer	95 to 105 Ft. Lbs.	129 to 142 Nm (12.9 to 14.2 kgm)
Camshaft Nut with Hardened Washer	195 to 205 Ft. Lbs.	264 to 278 Nm (26.4 to 27.8 kgm)
Connecting Rod Bolts (Add Lubrication to Threads and Under Bolt Heads with 30W Oil)	95 to 105 Ft. Lbs.	129 to 142 Nm (12.9 to 14.2 kgm)
Crankshaft Pulley Bolt	100 to 110 Ft. Lbs.	136 to 149 Nm (13.6 to 14.9 kgm)
Crankshaft Pulley Nut	125 to 135 Ft. Lbs.	169 to 183 Nm (16.9 to 18.3 kgm)
Crankshaft Main Bearing Bolts		
Without Hardened Washers	145 to 155 Ft. Lbs.	197 to 210 Nm (19.7 to 21.0 kgm)
With Hardened Washers	195 to 215 Ft. Lbs.	264 to 291 Nm (26.4 to 29.1 kgm)
Oil Cooler Outlet Cover Screw	35 to 42 Ft. Lbs.	48 to 57 Nm (4.8 to 5.7 kgm)
Cylinder Head Bolts	195 to 215 Ft. Lbs.	264 to 291 Nm (26.4 to 29.1 kgm)
Cylinder Head Cover Stud Nut	8 to 10 Ft. Lbs.	11 to 14 Nm (1.1 to 1.4 kgm)
Flywheel to Crankshaft Bolts		
Without Hardened Washers	180 to 190 Ft. Lbs.	244 to 258 Nm (24.4 to 25.8 kgm)
With Hardened Washers	230 to 250 Ft. Lbs.	312 to 339 Nm (31.2 to 33.9 kgm)
Intake and Exhaust Manifold Studs	25 to 30 Ft. Lbs.	34 to 41 Nm (3.4 to 4.1 kgm)
Intake Manifold Hex Nuts		
Standard	25 to 30 Ft. Lbs.	34 to 41 Nm (3.4 to 4.1 kgm)
Heavy	35 to 42 Ft. Lbs.	48 to 57 Nm (4.8 to 5.7 kgm)
Exhaust Manifold Hex Nuts	25 to 30 Ft. Lbs.	34 to 41 Nm (3.4 to 4.1 kgm)
Oil Pan Capscrews	15 to 20 Ft. Lbs.	20 to 27 Nm (2.0 to 2.7 kgm)
Oil Pan Drain Plug	29 to 31 Ft. Lbs.	39 to 42 Nm (3.9 to 4.2 kgm)

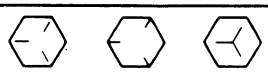
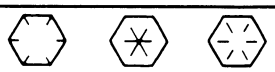
Special Torque (Continued)

	U.S. Value	Metric Value
Oil Pump Inlet Connector	105 to 115 Ft. Lbs.	142 to 156 Nm (14.2 to 15.6 kgm)
Oil Pump Inlet Tube Nut	90 to 100 Ft. Lbs.	122 to 135 Nm (12.2 to 13.5 kgm)
Oil Pump Outlet Connector	35 to 47 Ft. Lbs.	47 to 64 Nm (4.7 to 6.4 kgm)
Oil Pump Outlet Hose Nut	67 to 75 Ft. Lbs.	91 to 102 Nm (9.1 to 10.2 kgm)
Rocker Arm Adjusting Screw Lock Nut	20 to 25 Ft. Lbs.	27 to 34 Nm (2.7 to 3.4 kgm)
Rocker Arm Bracket Stud Nut or Bolt	40 to 45 Ft. Lbs.	54 to 61 Nm (5.4 to 6.1 kgm)
Fan Pulley to Water Pump Shaft Bolt	50 to 65 Ft. Lbs.	68 to 88 Nm (6.8 to 8.8 kgm)
Water Pump and Fan Shaft Nut (Standard)	60 to 70 Ft. Lbs.	81 to 95 Nm (8.1 to 9.5 kgm)
Water Pump and Fan Shaft Nut (Crownlock)	45 to 50 Ft. Lbs.	61 to 68 Nm (6.1 to 6.8 kgm)
Balancer Mounting Bolts - Grade 5	80 to 96 Ft. Lbs.	108 to 130 Nm (10.8 to 13.0 kgm)
- Grade 8	110 to 132 Ft. Lbs.	149 to 179 Nm (14.9 to 17.9 kgm)
Balancer Counterweight Set Screws	70 to 80 Ft Lbs.	95 to 108 Nm (9.5 to 10.8 kgm)
Balancer Gear to Crankshaft Screw	50 to 55 Ft. Lbs.	68 to 75 Nm (6.8 to 7.5 kgm)
Engine Oil Filter	Install Until Gasket Contacts Filter Head, Then Hand Tighten an Extra 1/2 Turn. Loosen Filter Approximately 1 Full Turn, Then Tighten Again Until Gasket Contact is Made and Hand Tighten an Extra 1/2 to 3/4 Turn.	

GENERAL TORQUE SPECIFICATION TABLE (Revised 2-74)

USE THE FOLLOWING TORQUES WHEN SPECIAL TORQUES ARE NOT GIVEN

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

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

* Thick nuts must be used with Grade 8 bolts

NOTE: CASE CORPORATION reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.

20 SERIES ENGINE

SECTION 21

GENERAL ENGINE SERVICE AND REMOVAL

Burl. Form 9–71435 AHCOE

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STALL CHECKS TO TEST CONDITION OF ENGINE, TORQUE CONVERTER AND EQUIPMENT HYDRAULIC SYSTEM

During these tests, engine speed will be recorded at full throttle when the converter and/or equipment hydraulic systems are installed. The results of these tests can help determine whether wear or other faults exist in the engine, converter, or equipment hydraulic system.

WARNING: The parking brake must be able to hold the tractor during the tests. If required, repair and adjust the parking brake and block the tractor wheels.

Oil Temperature

Before making the tests to follow, bring the transmission oil and equipment hydraulic oil to operating temperature. Apply the parking brake. Start the engine. With engine at low idle, shift into forward, high. Speed engine up to about 2/3 speed and roll back the bucket. Hold until normal operating temperature is recorded on the converter temperature gauge.

CAUTION: Watch gauge carefully to prevent overheating.

Test 1 - Combined Converter Equipment Hydraulic Stall Test

1. Apply parking brake. With engine at low idle, shift into forward, high range.
2. Increase engine speed to full throttle. Tilt bucket back and hold lever back to open the main relief valve. Record the engine rpm.

Test Summary

Engine speed should be 1320 ± 50 rpm (naturally aspirated engine) or 1750 ± 50 rpm (turbocharged). If engine speed is below specifications or if the engine quits, it may be due to:

a. Engine worn, damaged, or improperly adjusted.

b. Excessive hydraulic pressure in equipment circuit or mechanical faults in the transmission/converter and/or equipment hydraulic system.

If engine speed is above specifications, it indicates inefficiency in the converter and/or equipment hydraulic system. Possible sources of the trouble are:

a. Internal leakage.

b. Worn charging or equipment pump.

c. Low main relief valve setting.

To narrow down the problem area, conduct Tests 2 and 3. If one system tests satisfactory and the other system tests unsatisfactory, it shows that the engine is O.K.

If both systems test unsatisfactory, the cause of the trouble is very likely the engine.

Test 2 - Converter Stall Test

1. Apply parking brake. With engine at low idle, shift into forward, high range.
2. Increase engine speed to full throttle. Record the engine rpm.

Test Summary

Engine speed should be 1950 ± 50 rpm (naturally aspirated engine) or 2150 ± 50 rpm (turbocharged). If within this range, proceed to Test 3. If engine speed is below specifications, a worn engine or faulty transmission/converter could be the trouble source. Perform Test 3. If this test is also unsatisfactory, it can be concluded that the engine is at fault.

However, if Test 3 is satisfactory it indicates transmission/converter problems. Make necessary repairs and adjustments, then repeat Test 2.

If engine speed is above specifications, the converter hydraulic system is inefficient.

This may be caused by internal leakage of oil, wear in the charging pump, or a faulty regulator valve.

Test 3- Equipment Hydraulics Stall Test

1. Place bucket on ground. Operate engine at full throttle.

2. Tilt bucket back and hold lever in power position to open the main relief valve. Record the engine rpm.

Test Summary

Engine speed should be 2230 ± 50 rpm (naturally aspirated engine) or 2220 ± 50 rpm (turbocharged).

If engine speed is above specifications, it indicates engine wear or excessive pressure or restriction somewhere in the system. Check main relief valve pressure setting. If faulty, repair or adjust. Repeat Test 3. If engine speed is still low, the engine is likely at fault.

If engine speed is above specifications, the equipment hydraulic system is inefficient, indicating leakage, pump wear, or a low main relief valve setting.

ENGINE REMOVAL

The engine is removed by lifting it out of the tractor after it has been separated from the transmission. The transmission remains in the tractor. Have on hand a two-ton hoist and a supply of assorted, clean caplugs. Tag or mark wires, tubes, hoses, etc. as they are disconnected or removed for proper reinstallation.

1. Make necessary preparations:

   a. Lower the loader bucket to the ground. Block the tractor so it cannot move.

   b. Remove floor plates and engine side plates, if so equipped.

2. Drain the following:

   a. Radiator

   b. Engine crankcase

3. Remove the following:

   a. Air cap

   b. Exhaust stack and tubing

   c. Hood

   d. Grille and radiator shroud

   e. Starter.

   CAUTION: When removing the starter, disconnect the battery negative (-) cable first.

4. Disconnect the following:

   a. Air compressor air lines

   b. Tachometer cable

   c. Fuel lines. Close fuel shutoff valve.

   d. All wiring that will interfere with removal.

   e. Throttle linkage from backhoe and foot pedal at left side of engine.

   f. Unclamp steering cylinder lines on right hand side.

5. Remove the radiator and oil cooler:

   a. Disconnect the hydraulic lines (two from transmission to the radiator and attached oil cooler. Close openings with caplugs.

   NOTE: Some oil may drain out of hydraulic reservoir when steering circuit line to reservoir is disconnected.

b. Remove the upper and lower radiator hoses.

c. Attach a hoist to the shroud. Remove shroud mounting bolts. Lift the shroud and radiator assembly free of the tractor, using caution not to damage the fan blades or radiator.

6. Place floor jacks or other suitable supports under the transmission.

7. Attach a lifting sling to the engine.

Remove the engine-to-transmission mounting bolts and lockwashers.

8. At this point make sure that everything necessary (excepting the front engine mounting bolt) has been removed or disconnected.

9. Remove the engine-to-chassis mounting bolt and associated hardware at the front of the engine.

10. Carry the engine forward until it is clear of the hydraulic reservoir, then lift it from the tractor.

ENGINE INSTALLATION

The engine is installed in the reverse order of the removal. Refer to Figures 1 and 2 for details of mounting the engine and throttle linkage. Torque specifications are on page 11.

Before installing the engine, lubricate the starter. Remove three slotted plugs and saturate wicks with SAE 10 engine oil.

For pictures and drawings of hydraulics, wiring, linkages, etc., refer to the various sections of this manual as required.

When the engine has been installed, service all the filters and install coolant and engine oil as specified in Section 13.

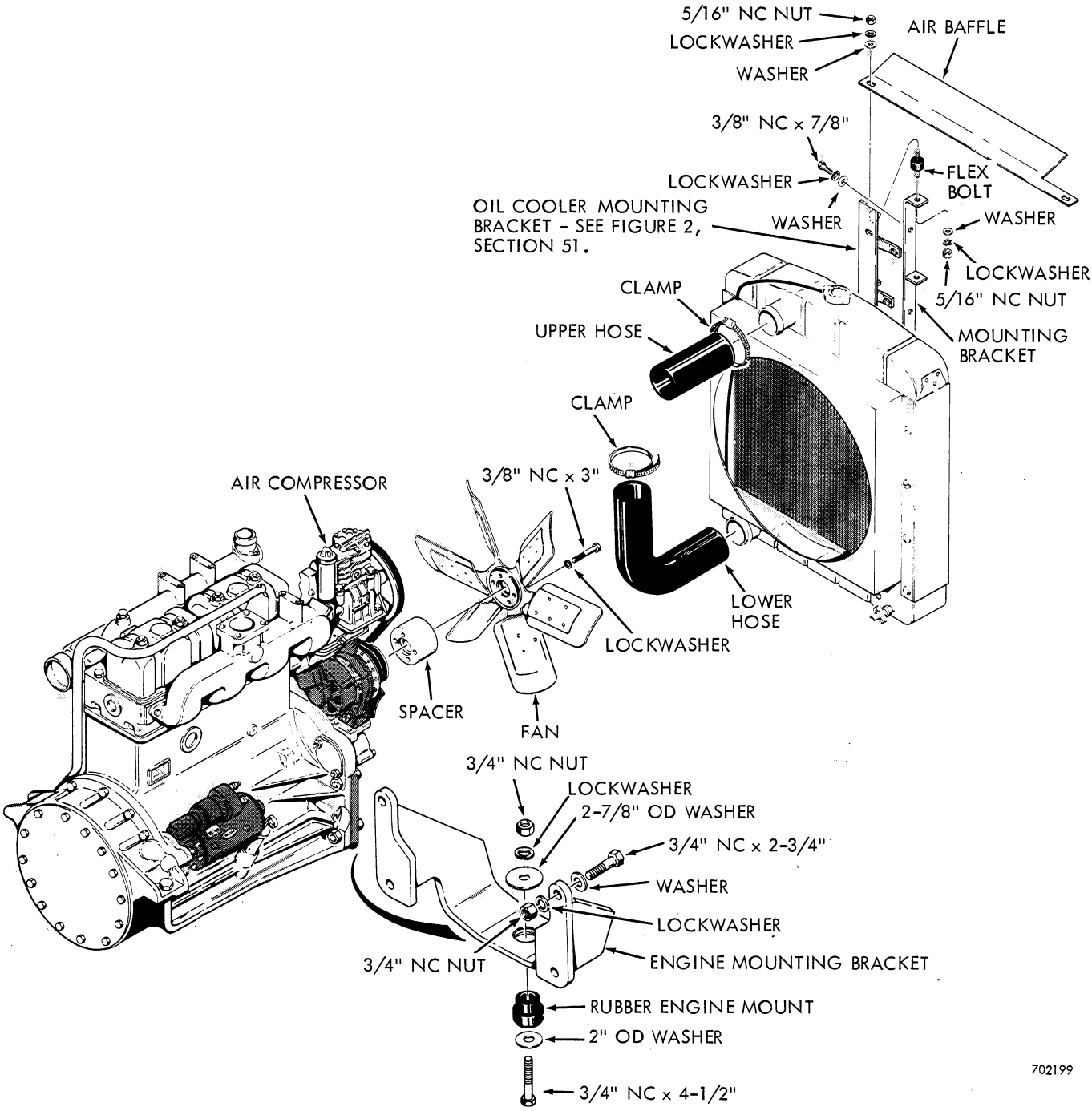

Figure 1 - Engine and Radiator Installation

ADJUSTMENT/INSTALLATION OF THROTTLE LINKAGE

Specifications

Low idle speed . . . . . 750 ± 50 rpm
High idle speed (no load)
N.A. engine . . . . . 2350 ± 50 rpm
Turbocharged engine . . . 2400 ± 15 rpm

Adjustments

Refer to Figures 2 and 3.

1. Disconnect the throttle rod at the injection pump. Check engine speed and make required adjustments at injection pump as described in Section 32, pages 6-10.

2. When the injection pump is in correct adjustment, adjust the accelerator and backhoe throttle linkage:

   a. Adjust low idle speed to specifications by turning the adjustment bolt at left rear of engine, Figure 2.

   b. Check accelerator pedal for the 00" dimension shown in Figure 2. If required, adjust the linkage. Recheck low idle speed and adjust, if necessary.

   c. Adjust stop bolt, Figure 2, to contact accelerator pedal at high idle.

   d. Position backhoe throttle lever for low idle speed. Adjust the cable stop, Figure 3, to within 1/4" of the turnbuckle on the throttle rod.

   e. Adjust the "feel" of the backhoe throttle lever by turning the adjusting bolt on the control console, Figure 3.

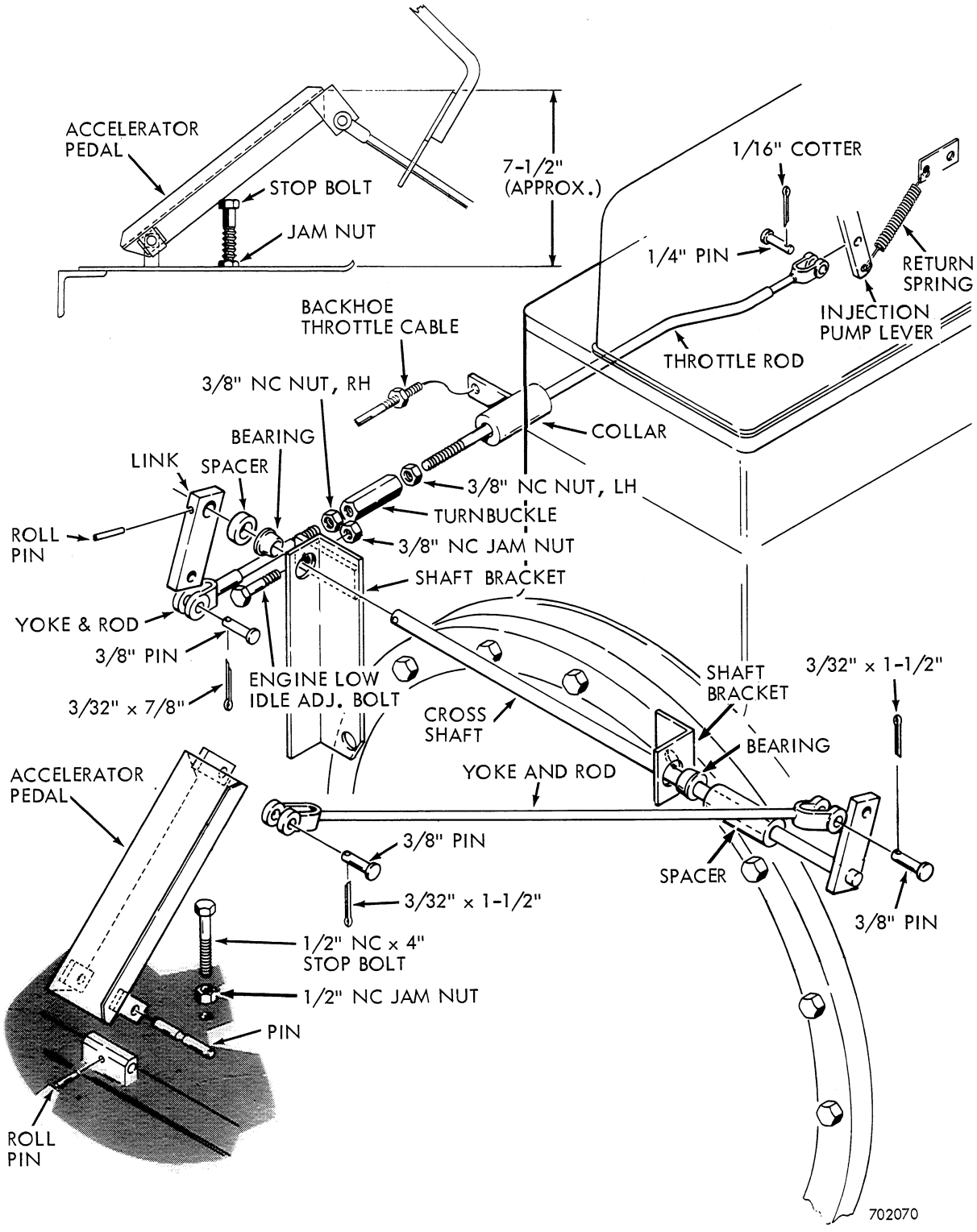

Figure 2 - Exploded View of Accelerator Linkage

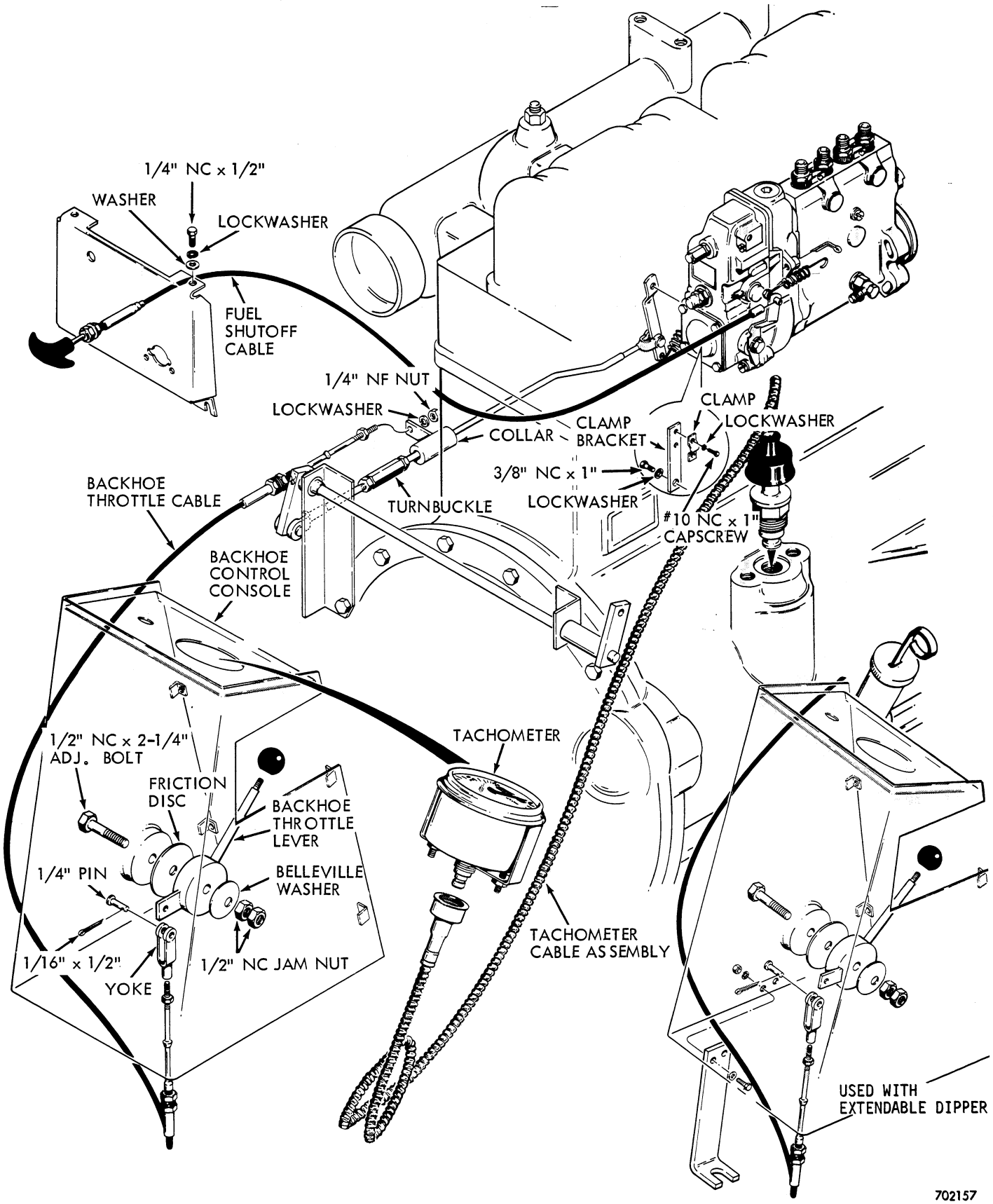

Figure 3 - Exploded View of Backhoe Throttle Linkage

INSTALLATION OF CONVERTER DRIVE RING ON ENGINE FLYWHEEL

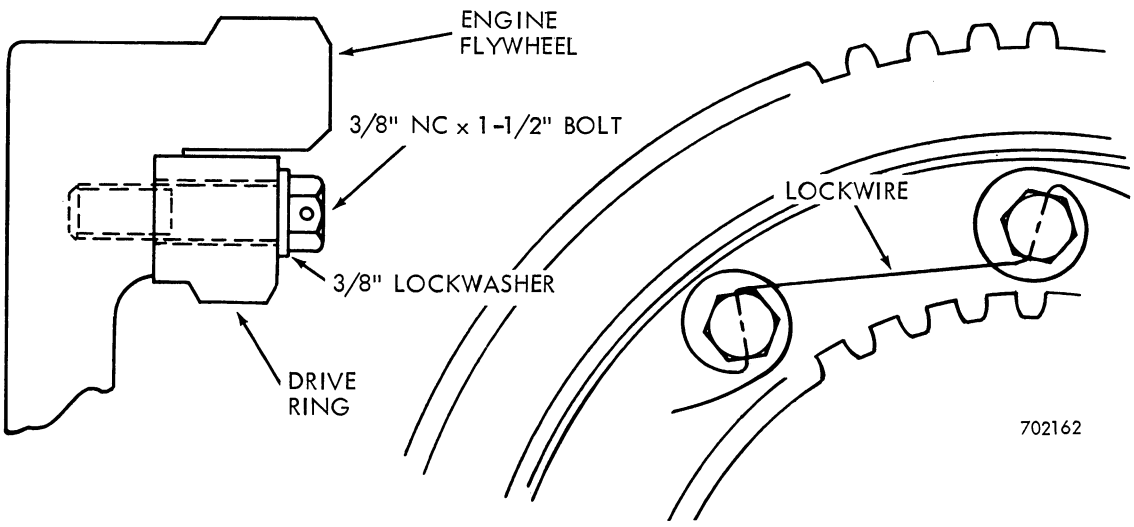

Figure 4 - Drive Ring Installation

1. Install drive ring on flywheel and torque bolts 20-25 foot pounds above the torque required to run bolts in place. When torquing drive ring bolts do not tighten consecutive bolts; tighten opposites.

2. Lock wire bolts with continuous wire so it does not interfere with gear teeth.

CAUTION: Bolts and washers supplied with the drive ring must be used. The use of washers with a smaller O.D. than those supplied will result in damage to the drive ring.

U.S. AND METRIC TORQUE SPECIFICATIONS

Torque values for all situations unless special torque is specified.

Grade 5 Bolts, Nuts, Studs (Dry)

Thread Size	Torque ft. lbs.	Torque m-kg
1/4" - 20 NC	5-10	0,7-1,4
1/4" - 28 NF	10-15	1,4-2,1
5/16" - 18 NC	15-20	2,1-2,8
5/16" - 24 NF	15-20	2,1-2,8
3/8" - 16 NC	25-35	3,5-4,8
3/8" - 24 NF	30-40	4,1-5,5
7/16" - 14 NC	45-55	6,2-7,6
7/16" - 20 NF	50-60	6,9-8,3
1/2" - 13 NC	65-85	9,0-12,0
1/2" - 20 NF	80-100	11-14
9/16" - 12 NC	100-120	14-17
9/16" - 18 NF	110-130	15-18
5/8" - 11 NC	135-165	19-23
5/8" - 18 NF	160-200	22-28

Thread Size	Torque ft. lbs.	Torque m-kg
3/4" - 10 NC	235-285	32-39
3/4" - 16 NF	270-330	37-46
7/8" - 9 NC	360-440	50-61
7/8" - 14 NF	395-490	55-68
1" - 8 NC	520-640	72-88
1" - 12 NF	575-705	79-97
1-1/8" - 7 NC	720-820	99-113
1-1/8" - 12 NF	790-970	109-134
1-1/4" - 7 NC	1010-1240	139-171
1-1/4" - 12 NF	1115-1365	154-188
1-3/8" - 6 NC	1315-1610	181-222
1-3/8" - 12 NF	1510-1850	208-255
1-1/2" - 6 NC	1745-2135	241-295
1-1/2" - 12 NF	1880-2420	259-334

Grade 8 Bolts, Nuts, Studs (Dry)

Thread Size	Torque ft. lbs.	Torque m-kg
1/4" - 20 NC	10-15	1,4-2,1
1/4" - 28 NF	15-20	2,1-2,8
5/16" - 18 NC	20-30	2,8-4,1
5/16" - 24 NF	25-30	3,5-4,1
3/8" - 16 NC	40-50	5,5-6,9
3/8" - 24 NF	45-55	6,2-7,6
7/16" - 14 NC	60-80	8,3-11,0
7/16" - 20 NF	70-90	9,7-12,0
1/2" - 13 NC	100-120	14-17
1/2" - 20 NF	110-130	15-18
9/16" - 12 NC	135-165	19-23
9/16" - 18 NF	155-190	21-26
5/8" - 11 NC	200-240	28-33
5/8" - 18 NF	215-265	30-37

Thread Size	Torque ft. lbs.	Torque m-kg
3/4" - 10 NC	340-420	47-58
3/4" - 16 NF	380-460	52-63
7/8" - 9 NC	540-660	75-91
7/8" - 14 NF	595-725	82-100
1" - 8 NC	810-990	112-137
1" - 12 NF	900-1100	124-152
1-1/8" - 7 NC	1150-1400	159-193
1-1/8" - 12 NF	1295-1585	179-219
1-1/4" - 7 NC	1640-2000	226-276
1-1/4" - 12 NF	1800-2200	248-304
1-3/8" - 6 NC	2140-2620	295-362
1-3/8" - 12 NF	2450-3000	338-414
1-1/2" - 6 NC	2845-3475	393-480
1-1/2" - 12 NF	3200-3900	442-538

Hydraulic Fittings (Steel)

Dash Size	Tube O.D.	Thread Size	37° Flare Female Swivel Torque ft. lbs.	37° Flare Female Swivel Torque m-kg	Straight Thread O-Ring Torque ft. lbs.	Straight Thread O-Ring Torque m-kg
4	1/4"	7/16" - 20	6-12	0,8-1,7	12-19	1,7-2,6
5	5/16"	1/2" - 20	8-16	1,1-2,2	16-25	2,2-3,5
6	3/8"	9/16" - 18	10-25	1,4-3,5	25-40	3,5-5,5
8	1/2"	3/4" - 16	15-42	2,1-5,8	42-67	5,8-9,2
10	5/8"	7/8" - 14	25-58	3,5-8,0	58-92	8,0-12,7
12	3/4"	1-1/16" - 12	40-80	5,5-11,0	80-128	11-18
14	7/8"	1-3/16" - 12	60-100	8,3-14,0	100-160	14-22
16	1"	1-5/16" - 12	75-117	10-16	117-187	16-26
20	1-1/4"	1-5/8" - 12	125-165	17-23	165-264	23-36
24	1-1/2"	1-7/8" - 12	210-250	29-35	250-400	35-55

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