W24B LOADER

TABLE OF CONTENTS

SERIES/SECTION		SECTION NO.	FORM NO.
10	SERIES - GENERAL		
	Maintenance and Lubrication	13	9-72395
	Torque Chart	14	9-72395
	General Engine Specifications	1010	9-75456
	Detailed Engine Specifications	1020	9-77185
20	SERIES - ENGINE		
	Stall Checks, Engine Removal and Installation	21	9-72396
	Air Cleaner	24	9-72395
	Engine Diagnosis	2001	9-76365
	Engine Tune-Up	2002	9-76379
	Cylinder Head, Valve Train and Camshaft	2015	9-76166
	Cylinder Block, Sleeves, Pistons and Rods	2025	9-76176
	Crankshaft, Main Bearings, Flywheel and Oil Seal Replacement	2035	9-76187
	Lubrication System	2046	9-76805
	Cooling System	2055	9-76337
	Turbocharger Failure Analysis	2565	9-78235
30	SERIES - FUEL SYSTEM		
	Fuel System and Filters	3010	9-75297
	Robert Bosch Fuel Injection Pumps	3012	9-74937
	Roosa Master Fuel Injectors	3013	9-74959
	Electric Fuel Pump	3051	9-72395
40	SERIES - HYDRAULICS		
	Hydraulic Diagram, Trouble Shooting, Testing and Adjustments	42	9-72396
	Hydraulic Pump	43	9-72396
	Loader Control Valve	44	9-72396
	Hydraulic Cylinders	46	9-75465
50	SERIES - STEERING		
	Hydraulic Diagram, Trouble Shooting and Testing	52	9-72395
	Steering Control Valve and Flow Control Valve	54	9-72396
	Center Pivot	57	9-72395
60	SERIES - POWER TRAIN		
	Allison Powershift Transmission Service Manual		SA 2003
	Transmission Removal and Installation and Service	63	9-72396
	Differentials and Planetaries	67	9-72396
	Drive Shafts and Trunnion	69	9-72396
70	SERIES - BRAKES		
	Air System Operation and Diagram	71	9-72396
	Brakes and Air System Components	72	9-72396

CASE CORPORATION
C.E. Div. Form 9-72398
April 1978
PRINTED IN U.S.A.

SERIES/SECTION	SECTION NO.	FORM NO.
80 SERIES - ELECTRICAL		
Wiring Diagram	81	9-72397
Trouble Shooting and Adjustments	82	9-72396
Batteries	84	9-72395
Starter, Starter Solenoid Magnetic Switches	85	9-72396
Alternator	86	9-72395
90 SERIES - MOUNTED EQUIPMENT		
Loader	92	9-72396
Rollover Protection Structure	93	9-72395

Section 13

MAINTENANCE

AND

LUBRICATION

CASE CORPORATION August, 1972 Printed in U.S.A.

CAUTION: The following chart is based on maximum intervals, if the machine operates in severe conditions, service more often.

INTERVAL	SERVICE	INSTRUCTIONS
Run-In: Every 2 Hours Until Stabilized	Torque wheel nuts to 380-420 foot pounds.	
	Torque axle mounting nuts to 900-1000 foot pounds.	
Run-In: After First 20 Hours	Change engine crankcase oil.	
	Change engine oil filters.	
	Check drive belt tension.	Section 72, 82
	Drain deposits from fuel tank.	
	Change fuel filters.	Section 31
	Service electric fuel pump and transfer pump filters.	Section 31, 34
Every 10 Hours Or Daily. Whichever Comes First	Grease loader pivot points.	
	Check engine crankcase oil level.	
	Check radiator coolant level.	
	Drain water from air reservoirs.	
	Check transfer pump sediment bowl for water — if found, drain bowl, first stage filter and fuel tank.	
	Inspect machine and ground under it for leaks.	
Every 50 Hours	Check transmission oil level.	Section 63
	Check hydraulic oil level.	Section 42
	Grease steering cylinder pivots.	
	Grease frame hinge pin pivots.	
	Grease rear axle trunnion pivots.	
Every 100 Hours	Check battery fluid level.	
	Check drive belt tension.	Section 72, 82
	Grease front shaft support bearing.	
Every 150 Hours	Change engine crankcase oil.	

INTERVAL	SERVICE	INSTRUCTIONS
Every 250 Hours	Grease equipment control lever pivots.	
	Check fluid level in both brake master cylinders.	
	Clean alcohol evaporator filter.	Section 72
	Check front and rear axle oil level.	
	Grease all driveshaft universals and slip splines.	
Every 300 Hours	Change engine oil filter.	
Every 500 Hours	Drain deposits from fuel tank.	
	Change fuel filters	Section 31
	Service electric fuel pump and transfer pump filters.	Section 31, 34
	Grease shifting lever lower pivot.	
Every 1000 Hours	Change hydraulic system oil.	Section 42
	Change hydraulic oil filter.	Section 42
	Change transmission oil.	Section 63
	Change transmission oil filter.	Section 63
	Clean transmission oil strainer.	Section 63
	Clean transmission breather.	Section 63
	Change front and rear axle oil.	
	Clean air compressor cylinder head (by dealer only).	Section 72
	Drain, flush and refill cooling system.	
Every 2000 Hours	Disassemble and clean alcohol evaporator (by dealer only).	Section 72
	Lubricate starter motor wicks.	Section 85
Every 3000 Hours	Rebuild/replace air compressor (by dealer only).	Section 72
As Required	Service air cleaner elements when restriction indicator shows red signal band.	Section 24
	Torque wheel nuts to 380-420 foot-pounds (dry threads) every two hours until stabilized whenever wheel is removed and installed.	
	Replace fire extinguisher shell.	
	Fill alcohol evaporator with clean wood alcohol.	

FLUIDS AND LUBRICANTS

COMPONENT	CAPACITY U.S.	CAPACITY Metric	SPECIFICATIONS
Fuel tank	20 gals.	75,5 liters	No. 2 diesel fuel
Engine crankcase oil Without filter change With filter change	 12 qts. 14 qts.	 11,4 liters 13,2 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
Equipment/Steering hydraulic reservoir (refill capacity) Total system	17 gals. 29-1/4 gals.	64,3 liters 110,7 liters	Case TCH Fluid or Alternate oils: Engine oil - SD - Service class D CA - Commercial class A (Service Ms or DG) Above 32° F. - SAE 10W Below 32° F. - SAE 5W Type C-2 transmission and hydraulic fluid such as Tenneco Hytrans Fluid
Transmission Complete system Transmission oil change Transmission only, dry after overhaul	 10 gals. 7-1/2 gals. 8-1/2 gals.	 32,9 liters 28,4 liters 32,2 liters	Case TCH Fluid. Alternate oils: Type C-2 transmission hydraulic fluid such as Tenneco Hytrans Fluid.
Cooling system	42 qts.	39,7 liters	Ethylene glycol and water should be mixed for prevailing temperatures. Follow antifreeze manufacturer's specifications.
Brake master cylinders	As required		SAE J1703c brake fluid (DOT 3)
Axles: Front - center bowl - each wheel end Rear - center bowl - each wheel end	 13 qts. 2 qts. 11 qts. 2 qts.	 12,3 liters 1,9 liters 10,4 liters 1,9 liters	Multipurpose gear lubricant SAE 90 (API-GL-4, MIL-L-2105B)
Grease 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
Alcohol evaporator	1 pint	0,47 liters	Clean wood alcohol

Section 14

TORQUE CHART

CASE CORPORATION

August, 1972

Printed in U.S.A.

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

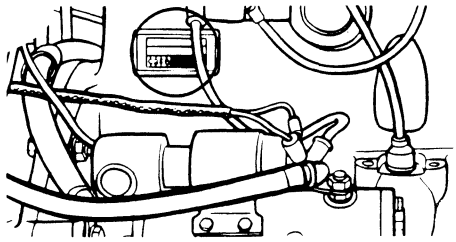
Hydraulic Fittings (Steel)

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

Section 1010

GENERAL ENGINE SPECIFICATIONS W24B LOADER

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



DIESEL ENGINE

General

Type ..... 6 Cylinder, 4 Stroke Cycle, Valve-in-Head
Firing Order 1-5-3-6-2-4
Bore ..... 4-5/8 Inches
Stroke ..... 5 Inches
Piston Displacement ..... 504 Cubic Inches
Compression Ratio ..... 16.5 to 1
No Load Governed Speed ..... 2330 to 2370 RPM
Rated Engine Speed ..... 2200 RPM
Engine Idling Speed ..... 700 to 750 RPM
Exhaust Valve Rotators ..... Positive Type
*Valve Tappet Clearance (Exhaust) ..... (Hot) .020 Inch ..... (Cold) .025 Inch
(Intake) ..... (Hot and Cold) .015 Inch
*Hot Settings Are Made After the Engine Has Operated At Thermostat Controlled Temperature For At Least Fifteen Minutes.
Cranking Motor ..... 24 Volt Negative Ground
Thermostat Operating Range ..... 175°F. to 202°F.

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 7
Type Bearings ..... Replaceable Precision, Steel Back, Copper-Lead Alloy Liners

Engine Lubricating System

Oil Pressure ..... 45 to 55 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
Engine Oil Capacity (without filter change) ..... 12 U.S. Quarts
(with filter change) ..... 14 U.S. Quarts

Fuel System

Fuel Injection Pump ..... Robert Bosch, Type PES Multiple Plunger
Pump Timing ..... 34 Degrees Before Top Dead Center (Port Closing)
Fuel Injectors ..... Pencil Type (Opening Pressure 3200 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

Rac. 9-75456

PRINTED IN U.S.A.

CASE CORPORATION

Section
1020

DETAILED SPECIFICATIONS

504BD ENGINE

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

Rac. 9-77185

PRINTED IN U.S.A.

CASE CORPORATION

TABLE OF CONTENTS

RUN-IN INSTRUCTIONS 3,4
DETAILED ENGINE SPECIFICATIONS
Cylinder Sleeves 5
Piston 5
Piston Rings 5
Oil Ring 5
Piston Pin 5
Connecting Rod 6
Crankshaft 6,7
Camshaft 7
Valve Push Rod Lifters 7
Gear Train 8
Oil Pump 8
Cylinder Head 8
Intake Valve 8,9
Exhaust Valve 9
Intake and Exhaust Valve Guides 9
Valve Spring 9
Rocker Arm Assembly 10
SPECIAL TORQUES 10
GENERAL TORQUE SPECIFICATION TABLE 11

RUN-IN-INSTRUCTIONS

Engine Lubrication

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

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

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

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

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

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

STEP	TIME	ENGINE SPEED	DYNAMOMETER SCALE LOAD*
1	**10 Minutes	1000 RPM	None
2	**10 Minutes	1800 RPM	None
3	20 Minutes	1800 RPM	1/3
4	20 Minutes	1800 RPM	1/2
5	***30 Minutes	100 RPM below rated speed	3/4
6	Retorque the cylinder head bolts using the procedure described in Section 2015 of this service manual.		

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

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

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

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

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

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

Run-In Procedure (Agricultural Tractors)

For the first 8 hours of field operation stay one gear lower than normal. For the next 12 hours DO NOT "lug" the engine. Prevent "lugging" by shifting to a lower gear. The engine must not be "lugged" below its Rated Engine RPM during the early hours of life.

Run-In Procedure (Construction Equipment)

For the first 8 hours, operate the engine at full throttle maintaining a normal load. DO NOT baby the engine, but avoid prolonged converter or hydraulic stall. Engine must not be "lugged" below its Rated Engine RPM (Do not exceed 10 seconds of stall).

Run-In Procedure (Power Units)

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

DETAILED ENGINE SPECIFICATIONS

Cylinder Sleeves

	Decimal System	Metric System
I.D. of sleeve including wear	4.6250 to 4.6333″	117.475 to 117.7163mm
Sleeve out of round (installed in block)	.001″	.025mm
Maximum Limit including wear	.002″	.0508mm
Taper (installed in block)	.001″	.0254mm
Maximum limit including wear	.007″	.1778mm
Clearance to bottom of piston skirt, 90° to piston pin including wear	.0052 to .0175″	.1321 to .445mm

Piston

Type	Cam ground	
Material	Aluminum Alloy	
O.D. at bottom of skirt, 90° to piston pin including wear	4.6178 to 4.6198″	117.2921 to 117.3429mm
I.D. of piston pin bore including wear	1.8001 to 1.8015″	45.7225 to 45.7581mm
Width of 3rd ring groove including wear	.2505 to .2535″	6.3627 to 6.4389mm

Piston Rings

No. 1 Compression (chrome)	Keystone	
End gap in 4.625 I.D. (117.475 I.D.) sleeve including wear	.017 to .036″	.432 to .914mm
No. 2 Compression	Square Section	
End gap in 4.625 I.D. (117.475mm I.D.) sleeve including wear	.013 to .033″	.330 to .838mm

Oil Ring

Width	.2485 to .2490″	6.3119 to 6.3246mm
End gap in 4.625 I.D. (117.475mm I.D.) sleeve	.013 to .038″	.330 to .838mm
Side clearance including wear	.001 to .005″	.025 to .127mm

Piston Pin

Type	Full Floating	
O.D. of pin	1.7994 to 1.7996″	45.7052 to 45.7102mm
Fit in piston	.0005 to .0011″	.0127 to .0279mm
Fit in rod bushing	.0008 to .0014″	.0203 to .0356mm

Connecting Rod

	Decimal System	Metric System
Bushing	Replaceable	
Bushing I.D. installed (ream to size)	1.8004 to 1.8008″	45.7302 to 45.7403mm
Maximum limit including wear	1.8018″	45.7657mm
Bushing out of round including wear	.0015″	.0377mm
Bearing liners	Replaceable	
Bearing liner width	1.586 to 1.596″	40.284 to 40.538mm
Journal I.D. without bearing liners	3.1503 to 3.1513″	80.0176 to 80.0426mm
Bearing oil clearance including wear	.0013 to .005″	.0326 to .127mm
Undersize bearings for service	.002,.010,.020,.030″	.051,.254,.508,.762mm
Side clearance	.007 to .016″	.178 to .406mm
Cap bolts	12 point flange head	

Crankshaft

Type	Balanced	
Main bearing liners	Replaceable	
End play, No. 5 main bearing cap including wear	.003 to .020″	.076 to .508mm
Thrust bearings std. thickness including wear	.147 to .157″	3.734 to 3.988mm
Thrust bearings oversize thickness for service including wear	.153 to .163″	3.886 to 4.140mm
Connecting rod journal std. O.D.	2.998 to 2.999″	76.149 to 76.175mm
.010″ (.254mm) O.D. undersize, grind to	2.988 to 2.989″	75.895 to 75.921mm
.020″ (.508mm) O.D. undersize, grind to	2.978 to 2.979″	75.641 to 75.667mm
.030″ (.762mm) O.D. undersize, grind to	2.968 to 2.969″	75.387 to 75.413mm
Connecting rod journal maximum taper including wear	.0015″	.0377mm
Journals out of round	.0005″	.0127mm
Main bearing liner width 1st, 3rd, 5th and 7th	2.1515 to 2.1615″	54.6477 to 54.9017mm
Main bearing liner width 2nd, 4th and 6th	1.214 to 1.224″	30.836 to 31.09mm
Undersize main bearing liners for service	.002,.010,.020,.030″	.051,.254,.508,.762mm
Main bearing oil clearance including wear	.0016 to .006″	.0402 to .152mm
Main bearing journal std. O.D.	3.498 to 3.499″	88.849 to 88.875mm
.010″ (.254mm) O.D. undersize, grind to	3.488 to 3.489″	88.595 to 88.621mm
.020″ (.508mm) O.D. undersize, grind to	3.478 to 3.479″	88.341 to 88.367mm
.030″ (.762mm) O.D. undersize, grind to	3.468 to 3.469″	88.087 to 88.113mm
Main journal bore I.D. without liners	3.691 to 3.692″	93.751 to 93.777mm

Crankshaft (Cont'd)

	Decimal System	Metric System
Main journal width between cheeks:		
2nd, 4th and 6th	1.618 to 1.633″	41.097 to 41.478mm
3rd	2.555 to 2.570″	64.897 to 65.278mm
5th	2.561 to 2.565″	65.049 to 65.151mm
7th	2.585 to 2.600″	65.659 to 66.040mm
Connecting rod journals width between cheeks	1.9775 to 2.0025″	50.2287 to 50.8637mm

Camshaft

Type	Parabolic	
Bushings	5, Replaceable	
Bushing Lubrication	Pressurized	
Oil clearance including wear	.0014 to .0124″	.0352 to .3150mm
I.D. of bushing including wear	2.2484 to 2.2554″	57.1092 to 57.2872mm
Bushing width:		
1st (front)	1.646 to 1.666″	41.808 to 42.316mm
2nd, 3rd and 4th	1.4275 to 1.4475″	36.2587 to 36.7667mm
5th	1.1462 to 1.1662″	29.1131 to 29.6211mm
O.D. of each bearing surface including wear	2.242 to 2.247″	56.947 to 57.074mm
Thrust washer thickness including wear	.1105 to .1275″	2.8067 to 3.2385mm
Thrust plunger spring:		
Free length	3.625″	92.075mm
O.D. of spring	.3912 to .4062″	9.9361 to 10.317mm
Compressed 2.750″ (69.85mm)	45 to 55 lbs.	20.37 kg. to 24.97 kg.

Valve Push Rod Lifters

Type	Mushroom	
O.D. of lifter stem, standard	.8097 to .8102″	20.5668 to 20.5791mm
O.D. of lifter stem, oversize for service	.8190 to .8195″	20.803 to 20.8157mm
I.D. of block bore, std. including wear	.8115 to .8145″	20.6117 to 20.6883mm
I.D. of block bore, oversize for service	.8215 to .8225″	20.8657 to 20.8917mm

Gear Train

	Decimal System	Metric System
Backlash:		
Crankshaft gear to camshaft gear	.004 to .011″	.102 to .279mm
Idler drive gear to idler gear	.003 to .010″	.076 to .254mm
Idler gear to fuel pump gear	.004 to .012″	.102 to .305mm
Crankshaft gear to oil pump gear	.006 to .011″	.152 to .279mm
Crankshaft gear to fuel pump gear	Maximum .027″	Maximum .686mm
O.D. of idler gear shaft including wear	1.732 to 1.733″	43.993 to 44.019mm
I.D. of idler gear with bushing including wear	1.7345 to 1.740″	44.0567 to 44.196mm
Idler gear thrust washer thickness	.057 to .063″	1.448 to 1.600mm
Idler gear end play (maximum limit including wear)	.010″	.254mm

Oil Pump

Postive displacement	Gear Type	
Backlash, pump gear to crankshaft gear	.006 to .011″	.152 to .279mm
Drive gear to pump body clearance	.0035 to .0065″	.0889 to .1651mm
Pump gears to body radial clearance including wear	.003 to .009″	.0760 to .229mm
Pump gears to pump cover clearance including wear	.0015 to .008″	.0377 to .203mm
Oil pressure	45 to 60 PSI	3.164 to 4.218 kg/cm^2
Relief valve spring:		
No. coils	12	
Wire thickness	.071″	1.803mm
Minimum I.D.	.469″	11.913mm
Free length	2.06″	52.32mm
Compressed 1.252″ (31.801mm)	17.25 to 19 lbs.	7.84 to 8.62 kg

Cylinder Head

Warpage	(Max. Limit Incl. wear) .005″	0.127mm

Intake Valve

Tappet clearance (COLD and HOT)	.015″	3.81mm
Face angle	44^0	44^0
Face run-out (max. limit Incl. wear)	.002″	.051mm
Length	6.4195 to 6.4405″	163.0557 to 163.5887mm
O.D. of stem including wear	.400 to .403″	10.160 to 10.236mm
O.D. of head	1.995 to 2.005″	50.673 to 50.927mm
Seat angle	45^0	45^0

Intake Valve (Cont'd)

	Decimal System	Metric System
Seat contact width	.0775 to .0975″	1.9685 to 2.4511mm
Seat run-out (max. limit Incl. wear)	.002″	.051mm
Insert height	.2775 to .2825″	7.0485 to 7.1755
O.D. of insert	2.0990 to 2.1000″	53.315 to 53.34mm
I.D. of insert	1.805 to 1.815″	45.847 to 46.101mm

Exhaust Valve

Tappet clearance (COLD)	.025″	.635mm
Tappet clearance (HOT)	.020″	.508mm
Face angle	44^0	44^0
Fan run-out	(Max. Limit Incl. wear) .002″	.051mm
O.D. of head	1.745 to 1.755″	44.323 to 44.577mm
O.D. of stem end including wear	.400 to .403″	10.160 to 10.236mm
O.D. of taper 4.2675″ (108.3947mm) including wear	.399 to .402″	10.135 to 10.211mm
Length	6.4195 to 6.4405″	163.0557 to 163.5887mm
Insert seat angle	45^0	45^0
Seat contact width	.0800 to .1000″	2.032 to 2.540mm
Seat run-out (max. limit Incl. wear)	.002″	.051mm
Insert height	.313 to .316″	7.95 to 8.026mm
O.D. of insert	1.9455 to 1.9465″	49.4157 to 49.4407mm
I.D. of insert	1.571 to 1.577″	39.903 to 40.056mm

Intake and Exhaust Valve Guides

Length	3.219″	81.763mm
O.D.	.7510 to .7515″	19.075 to 19.202mm
I.D. (installed and reamed)	.4045 to .4055″	10.2747 to 10.2997mm
Maximum limit including wear	.4065″	10.3251mm
Protrusion above cylinder head	.953″	24.206mm

Valve Spring

Free length	2.28″	57.912mm
Total coils	7.75	
Wire diameter	.171″	4.343mm
Compressed to 1.48″ (30.480mm) (valve open)	135 to 145 lbs.	61.24 to 65.78 kg.
Compressed to 1.94″ (49.276mm) (valve closed)	40 to 50 lbs.	18.14 to 22.68 kg.

Rocker Arm Assembly

	Decimal System	Metric System
O.D. of shaft	.872 to .873"	22.149 to 22.174mm
I.D. of arm bore	.8745 to .8755"	22.2127 to 22.2377mm
Shaft assembly end play (both ends)	.010 to .030"	.254 to .762mm
Shaft spring:		
Total coils (working coils)	4	
Wire diameter	.080"	2.033mm
Compressed to 1.562" (39.675mm)	8.5 to 11.5 lbs.	3.86 to 5.22 kg.
Lubrication	Engine oil, camshaft metering	
Shaft oil holes	Toward valve side of engine. Shaft cannot be rotated.	

SPECIAL TORQUES

	Decimal System	Metric System
Camshaft nut	95 to 105 ft. lbs.	13.134 to 14.517m-kg.
Connecting rod bolts	95 to 105 ft. lbs.	13.134 to 14.517m-kg.
Crankshaft nut	125 to 135 ft. lbs.	17.3 to 18.7 m-kg.
Crankshaft pulley bolt	100 to 110 ft. lbs.	13.825 to 15.208m-kg.
Cylinder block oil cooler outlet cover screw	35 to 42 ft. lbs.	4.8 to 5.8m-kg.
Cylinder head bolts	200 to 210 ft. lbs.	27.660 to 29.043m-kg.
Cylinder head cover stud nut	60 to 70 in. lbs.	691.3 to 806.5mm-kg.
Engine oil filter	Install until gasket contacts filter head then hand tighten 1/2 turn. Loosen filter approximately 1 full turn and retighten until gasket contact is made, then hand tighten an additional 1/2 to 3/4 turn.	
Flywheel to crankshaft bolts	180 to 190 ft. lbs.	24.886 to 26.268m-kg.
Intake and Exhaust manifold stud nut	25 to 30 ft. lbs.	3.4 to 4.2m-kg.
Oil pan capscrews	13 to 17 ft. lbs.	1.797 to 2.350m-kg.
Oil pan drain plug (copper or nylon)	18 to 20 ft. lbs.	2.5 to 2.9m-kg.
Oil pump idler gear shaft bolt	40 to 45 ft. lbs.	5.5 to 6.2m-kg.
Oil pump suction tube nut	95 to 105 ft. lbs.	13.134 to 14.517m-kg.
Rocker arm adjusting screw locknut	20 to 25 ft. lbs.	2.8 to 3.5m-kg.
Rocker arm bracket stud nut and bolt	40 to 45 ft. lbs.	5.5 to 6.2m-kg.
Water pump and fan shaft nut	60 to 70 ft. lbs.	8.3 to 9.7m-kg.
Crankshaft main bearing bolts	145 to 155 ft. lbs.	20 to 21.4m-kg.

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									
Bolt Size		Torque Foot Pounds		Torque Meter Kilograms		Torque Foot Pounds		Torque 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

Section 21

STALL CHECKS, AND ENGINE REMOVAL AND INSTALLATION

Burl. Form 9-72396 Rev. March 1974 PRINTED IN U.S.A.

CASE CORPORATION

STALL CHECKS

During these tests, engine stall speed will be recorded at full throttle with engine working against the torque converter and/or hydraulic system. The results of these tests will help determine whether poor performance is caused by the engine, converter, hydraulic system or any combination of the three.

Test Specifications

Idle speed	750-825 rpm
Maximum no load speed	2315-2365 rpm
Converter stall speed	2100-2200 rpm
Hydraulic stall speed	2200-2300 rpm
Converter and hydraulic stall speed	1500-1600 rpm
Converter oil temperature	200° - 250° F.
Hydraulic oil temperature	125° - 175° F.

Oil Heating Procedure

Converter Oil

1. Engage parking brake and start engine.

2. Apply foot brake, shift to high forward and accelerate to wide open throttle. Run engine for 30 seconds at converter stall then shift to neutral and run for 10 seconds at full throttle.

3. Repeat step 2 until needle on converter temperature gauge is 1/8" from red zone on gauge.

Hydraulic Oil

Roll the bucket back and hold control lever in power position to force oil through the main relief valve. Hold control lever in this position until the oil reaches the specified temperature. If a thermometer is not available, the inlet tube at the control valve will be very warm to touch at the specified temperature.

NOTE: After oil is at specified temperature, check main relief valve pressure setting as instructed in Section 42.

Test 1 - Combined Converter Hydraulic Stall

1. Apply parking brake. With engine running at low idle, shift into high forward.

2. Apply foot brake and increase engine speed to half throttle and completely roll bucket back. Hold control lever in the power position to open main relief valve and accelerate to wide open throttle. Record the engine rpm.

Test Summary

If engine speed is below the specified rpm or quits, it may be due to:

a. Engine worn, damaged or improperly adjusted.

b. Excessive hydraulic system pressure or damaged or defective parts in the transmission, converter or hydraulic system.

If engine speed is above the specified rpm it indicates inefficiency in the converter, transmission or hydraulic system. Possible sources of trouble are:

a. Internal leakage.

b. Worn charging or hydraulic pump.

c. Low main relief setting. (Should have been checked prior to test.)

To identify the problem area, conduct Tests 2 and 3. If both tests are unsatisfactory, the cause of trouble is very likely in the engine.

Test 2 - Converter Stall

1. Apply parking brake. With engine running at low idle, shift into high forward.

2. Apply foot brake and accelerator to wide open throttle. Record engine rpm.

Test Summary

If engine speed is as specified, proceed to Test 3.

If engine speed is below the specified rpm, a worn engine or faulty transmission converter could be the source of trouble. Perform Test 3. If this test is also unsatisfactory, it can be concluded that the engine is at fault.

If Test 3 is satisfactory it indicates transmission/converter problems.

If engine speed is above the specified rpm, the converter hydraulic system is at fault. Causes may be internal oil leakage, wear in charging pump or a faulty regulator valve.

Test 3 - Hydraulic Stall

1. Start engine and run at half throttle.

2. Roll the bucket back and hold control lever in the power position. Accelerate to wide open throttle and record engine rpm.

Test Summary

If engine speed is below the specified rpm, it indicates engine wear or excessive pressure or restriction in the hydraulic system. Check main relief valve pressure setting (should have been done prior to testing) and adjust as required. If engine speed is still low, the engine is likely at fault.

If engine speed is above the specified rpm, the hydraulic system is inefficient. Causes may be internal oil leakage, pump wear or low main relief valve setting.

Further tests of the hydraulic system can be made with a flowmeter as instructed in Section 42.

ENGINE REMOVAL

1. Drain cooling system. Disconnect battery ground cable and remove batteries. Open draincock on main air reservoir.

2. Remove exhaust stack, rubber hose between air cleaner and intake manifold, engine hood and side panels. It is not necessary to remove air cleaner from the left hand hood section.

3. Disconnect transmission oil cooler hoses at transmission. Then disconnect cooler hoses at radiator, and remove the upper and lower radiator hoses.

4. Attach chain hoist to the radiator shroud and remove shroud mounting bolts, washers and nuts.

5. Work the radiator shroud to the rear to clear the fan blades and remove radiator assembly.

6. Disconnect or remove from right side of engine:

   a. Fuel supply line at transfer pump and fuel return line at rear of engine.

   b. Wire from engine temperature sending unit.

   c. Remove transmission filter clamp to mounting bracket bolts and provide support for filter.

   d. Throttle linkage and fuel shut off cable at injection pump. Also remove fuel shut off cable clamp.

   e. Hose and tube from air compressor and governor at the main reservoir. Remove hose and tube support bracket.

7. Disconnect or remove from the left side of the engine:

   a. Battery cables from starter and starter solenoid.

b. Tachometer cable.

c. Wiring from oil pressure sending unit and oil pressure switch.

d. Tube to air cleaner restriction indicator at intake manifold.

e. Wiring from alternator. Remove wiring clamp below alternator.

f. Magnetic switches and bracket as an assembly. Then remove cable from manifold heater and position harness out of way.

8. Attach lifting sling and chain hoist to engine. Remove slack from hoist.

9. Check for access cover on top right of flywheel housing. If cover is present, the torque converter is flex plate driven. Remove cover and remove the eight flex plate to flywheel cap screws and special washers. Turn engine over by hand to position cap screws in access hole. The cap screws are Grade 8; make sure proper cap screws are installed during installation.

10. Remove rear engine mounting bolt.

11. Carefully move engine to the rear and remove from machine.

ENGINE INSTALLATION

The engine is installed in the reverse order of removal.

Before installing the starter on the engine, disassemble the starter and inspect the brushes, starter drive, bearings, etc. and repair or replace as required. Also saturate the lubrication wicks with 10 weight oil. Refer to Section 85 for starter information.

Install and lubricate transmission drive ring as instructed on page 21-7.

Refer to the various sections in this manual to make sure connections are correct.

When the engine is being mated to the transmission it may be necessary to turn the engine over by hand to align the drive coupling.

The flex plate cap screws are Grade 8 and self locking. It is recommended that they be replaced whenever the engine is removed.

Place washers on flex plate cap screws as shown in Figure 1A. If washers are lost, refer to parts catalog for correct washer.

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

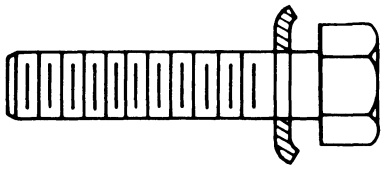


Figure 1A

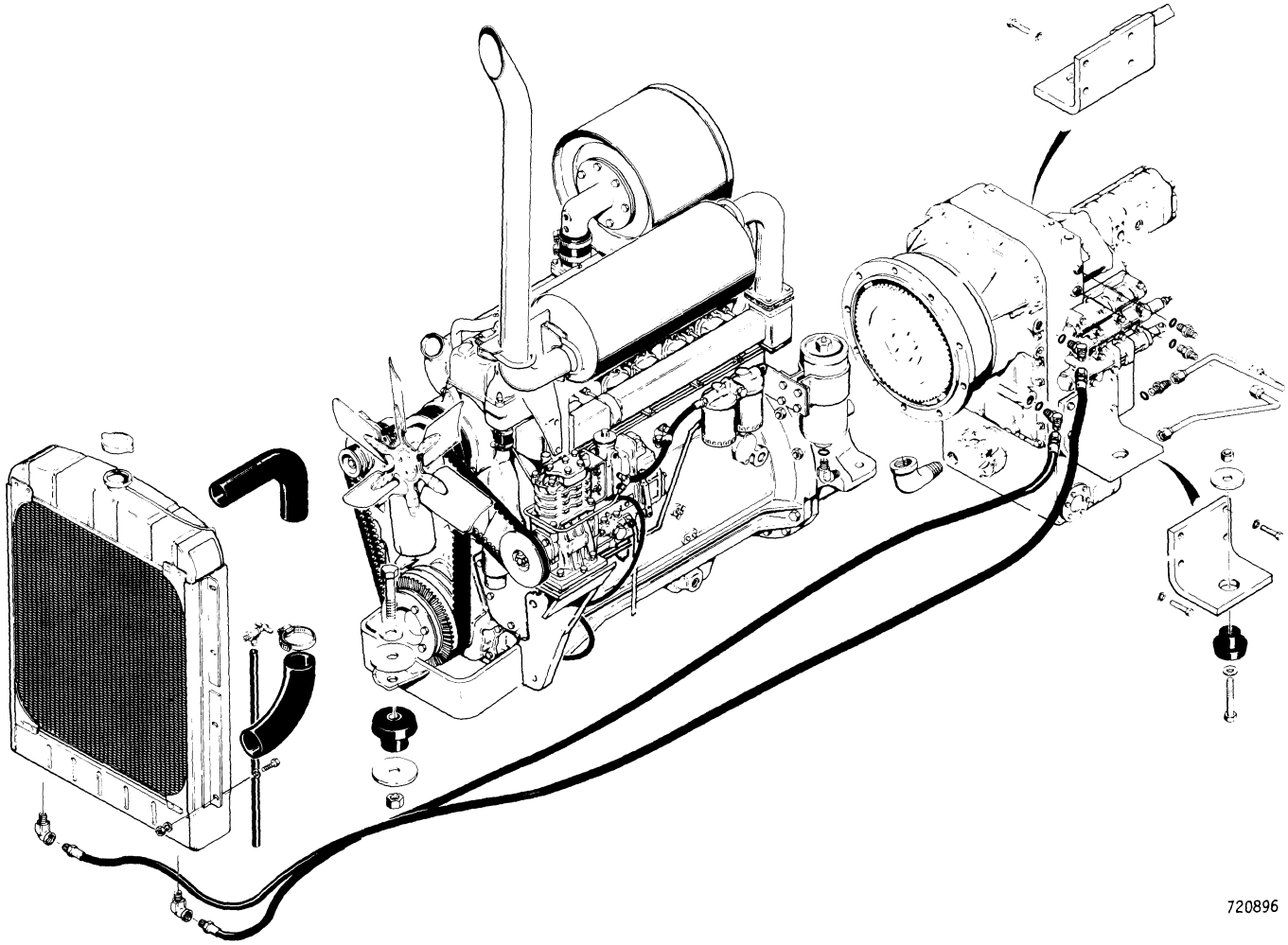


Figure 1 - Engine Installation

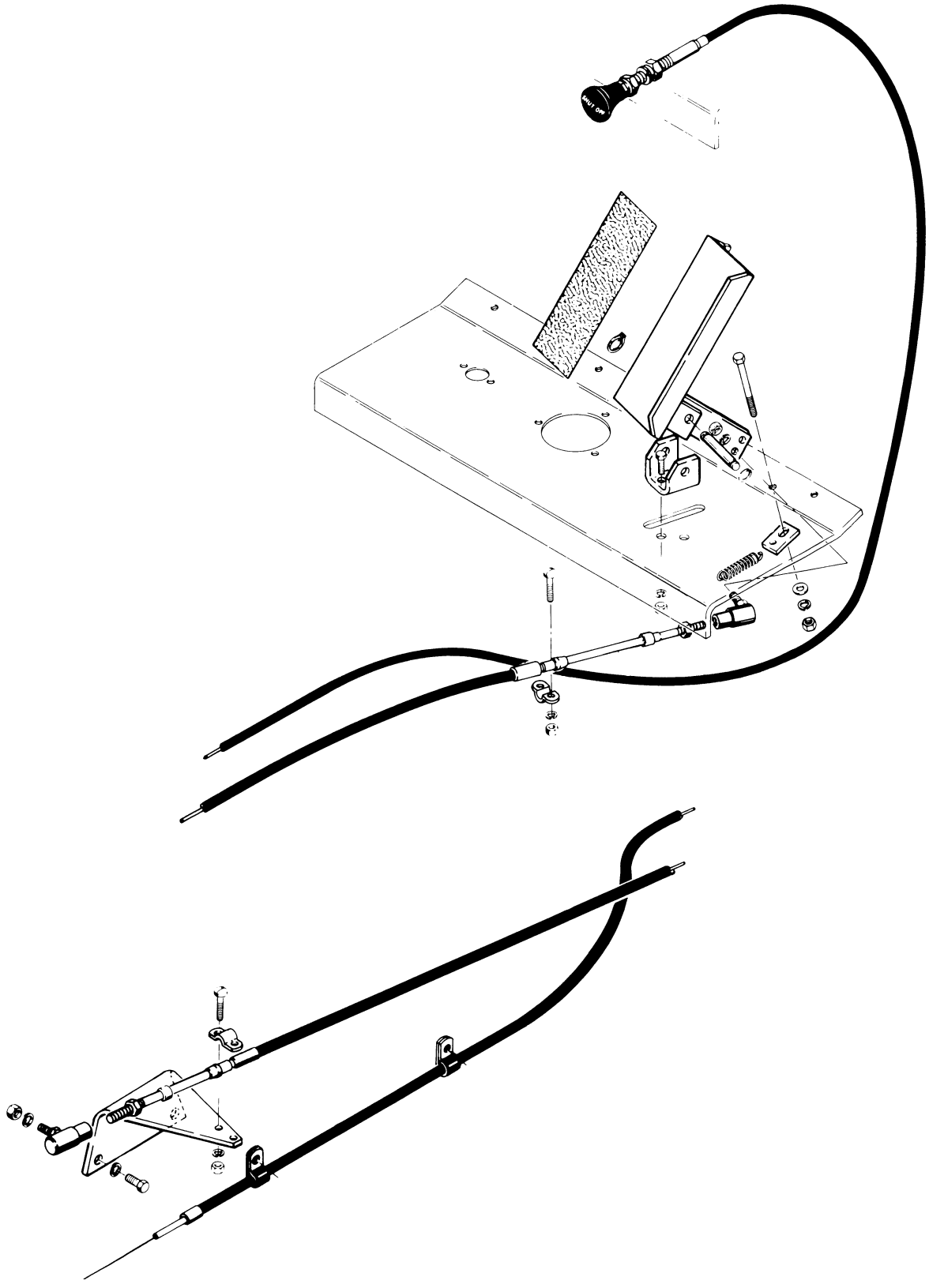


Figure 2 - Throttle and Fuel Shutoff Cable Installation

THROTTLE AND FUEL SHUTOFF CABLE ADJUSTMENT

Specifications

Low idle speed . . . . . 750-825 rpm
High idle speed 2315-2365

Adjustments

Refer to Figure 2.

1. Disconnect the throttle cable at the injection pump. Check engine speed and make required adjustments at injection pump as instructed in Section 32, pages 6 to 10.

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

   a. Raise the foot pedal until the lever contacts the front of slot in the floorboard.

   b. Adjust cable length by turning ball joint(s) on ends of the accelerator cable.

   c. Adjust the stop bolt to contact the foot pedal at high idle.

   CAUTION: If there is any doubt about the accuracy of the vehicle tachometer, refer to Section 32, page 6, Checking Engine Speed.

3. Attach fuel shutoff cable to lever at the injection pump so that the lever is all the way to the rear with the handle at the instrument panel pushed all the way in.

INSTALLATION OF CONVERTER DRIVE RING

1. Apply a thin even coat of No. 3 Permatex to surface A of flywheel.

2. Assemble the drive ring to the flywheel. Torque the mounting bolts to 36 to 43 foot-pounds. Torque bolts in the order shown in Figure 3.

3. Distribute grease evenly around the drive ring to fill the gear teeth spaces and the small cavity behind the drive ring. Use a No. 2 moly disulfide grease.

   CAUTION: Do not overlubricate. About two ounces of grease is sufficient.

4. Apply a light coating of grease to the drive ring seal. Install the seal into the groove on the converter cover.

5. When mating the converter to the engine, take care not to damage the seal.

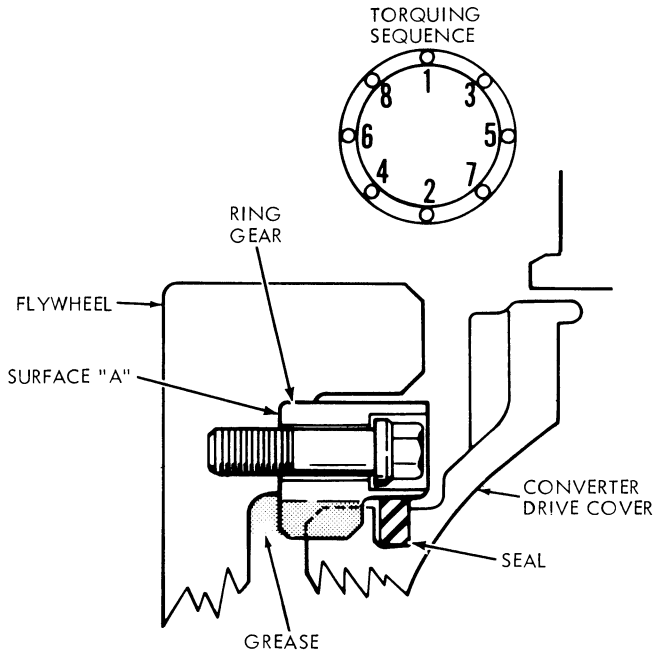


Figure 3 - Drive Ring Installation