D E P A R T M E N T O F T H E A R M Y T E C H N I C A L M A N U A L

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

CRANE, TRUCK MOUNTED, 3/4 CU. YDS., 20 TON,

W/CLAMSHELL, DRAGLINE AND BACKHOE ATTACHMENTS,

G.E.D., (HARNISHFEGER MODEL M320T2)

FSN 3810-151-4431

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PART ONE

CRANE (REVOLVING FRAME)

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual contains instructions for the use of Direct Support and General Support personnel maintaining the model M320T2 truck crane. It gives instructions for maintenance, as specified in the Maintenance Allocation Chart (MAC), which is beyond the scope of Operator/Crew or Organizational Maintenance personnel.

b. This manual is divided into two parts. Part One covers repair instructions for the crane (revolving frame) portion of the truck crane. Part Two covers repair of the carrier portion of the truck crane. Maintenance personnel should read the instructions contained in this manual before
repairing the equipment.

c. Refer to appendix A for a list of publications applicable to this manual.

d. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

1-2. Forms and Records

a. Maintenance records and reports which are used by maintenance personnel at all levels are listed in and prescribed by TM 38-750.

b. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, (Recommended Changes to Publications) and forwarded direct to Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Blvd., St. Louis, Mo. 63120. --

Section II. DESCRIPTION AND DATA

1-3. Description

a. A general description of the model M320T2 truck crane and information pertaining to the identification plates are contained in TM 5-3810-294-10 and TM 5-381**0**_-294-20. Equipment operating instructions are also contained in TM 5-3810-294-10.

b. A detailed description of specific components and assemblies is contained, as applicable, in the maintenance sections of this manual.

14. Tabulated Data

a. *General.* This section supplements the tabulated data contained in TM 5-3810-294-10 and TM 5-3810-294-20. (Refer to these technical
manuals as required.)

b. Tabulated data.

(1) Truck crane.

Manufacturer	Harnischfeger Corporation
Model	M320T2

(2) Carrier engine.

Manufacturer	International Harvester Company
Model	UV-549
Number of cylinders	8
Horsepower ,	201 net hp at 2800 rp
	full load
Displacement	549 cubic inches
Ignition timing	Top dead center
Governed speed (high idle)	2800+10 rpm
Low idle speed	450+50 rpm
Maximum oil pressure (above 1500 rpm)	50 to 55 pounds per square inch
Minimum oil pressure (idling)	15 to 20 pounds per square inch
Intake and exhaust valve tappet clearance	Engine equipped with hydraulic valve lifters. Tappet clearance adjustments not required.
Electrical system	24 volts, negative ground
Spark plug gap	0.028 to 0.033 inch
Distributor point gap	0.017 inch

(*3) Crane engine.*

Manufacturer	International Harvester Company

Model	U-450
Ignition timing	Top dead center
Number. of cylinders	6
Horsepower	92.5 net hp at 1800 rpm full load
Intake valve tappet clearance (hot)	0.024 to 0.026 inch
Exhaust valve tappet clearance (hot)	0.024 to 0.026 inch
Displacement	450.9 cubic inches
Governed speed	2025:25
Low idle speed	475 to 525 rpm
Maximum oil pressure at governed speed	35 to 45 psi (approx.)
Minimum oil pressure at low idle	8 to 15 psi
Electrical system	24 volts, negative ground
Spark plug gap	0.015 to 0.030 inch
Distributor point gap	0.022 inch

(4) Dimensions and transportation data.

Overall length, with boom in travel position	536 inches
Overall length, without boom	326.25 inches
Overall width	119 inches
Overall height, at gantry sheave shaft	149.25 inches
Shipping cubage	3,354 cubic feet
Shipping tonnage	85 tons

(5) Approximate weights.

Truck crane with counterweight and boom	59,860 pounds
Truck crane with counterweight and without boom	55,380 pounds
Carrier	29,640 pounds
Crane upper with counterweight	25,740 pounds
Crane upper without counter weight	20,360 pounds
Boom tip section with two guy lines attached	1,460 pounds
Boom insert, 10 foot	500 pounds
Guy lines, 10 foot, set of two	100 pounds
Boom base section	1,020 pounds
Upper spreader	220 pounds
Hook block	480 pounds
Boom backstops with pins	1,000 pounds
Fairlead	32 pounds

(6) Speeds (full throttle and full load.)

Rear drum shaft	48.4 rpm
Rear drum shaft lowering	Gravity
Front drum shaft raising	48.4 rpm
Front drum shaft lowering	26.175 rpm
Front drum line speed, lowering	92.4 feet per minute
Boom hoist drum shaft	96.8 rpm
Boom hoist drum shaft, lowering	45.8 rpm
Boom hoist drum line speed, lowering	112.5 feet per minute
Revolving frame rotation	4.06 rpm

(7) Rated capacities.

Crane	20 tons (See rating plate)
Clamshell	cubic yard
Dragline	4 cubic yard
Backhoe	cubic yard
Shovel	4 cubic yard
Rear drum line pull, sea level	15,900 pounds
Rear drum line pull, 5000 feet altitude	12,550 pounds
Front drum line pull, sea level	15,400 pounds
Front drum line pull, 5000 feet altitude	12,200 pounds
Boom hoist drum line pull	7,000 pounds

(8) *Fuel, water, oil, and grease capacities, Carrier.*

Engine fuel tank	75 gallons
Cooling system	40 quarts
Crankcase	12 quarts including filter
Transmission	8 quarts
Drop box	4 quarts
Transfer case	8½ pints
Front axle	11 quarts
Forward rear axle	111A quarts
Rear axle	11 quarts
Steering gear and tank ;	7 pints

(9) Fuel, water, and oil capacities, Crane

Engine fuel tank	50 gallons
Cooling system	35 quarts
Crankcase	9 quarts including filter
Transmission	9 pints
Gear and chain case	18 gallons
Hydraulic system reservoir	3 quarts

(10) Working ranges. Refer to TM 5-3810-294-10 for the working ranges of the front end attachments furnished with the model M320T2 truck crane.

(11) Wiring diagram. Refer to TM 5-3810-294-20 for the truck crane wiring diagram.

(12) Hydraulic schematic. Refer to figure 1-1 for the schematic of the upper hydraulic system.

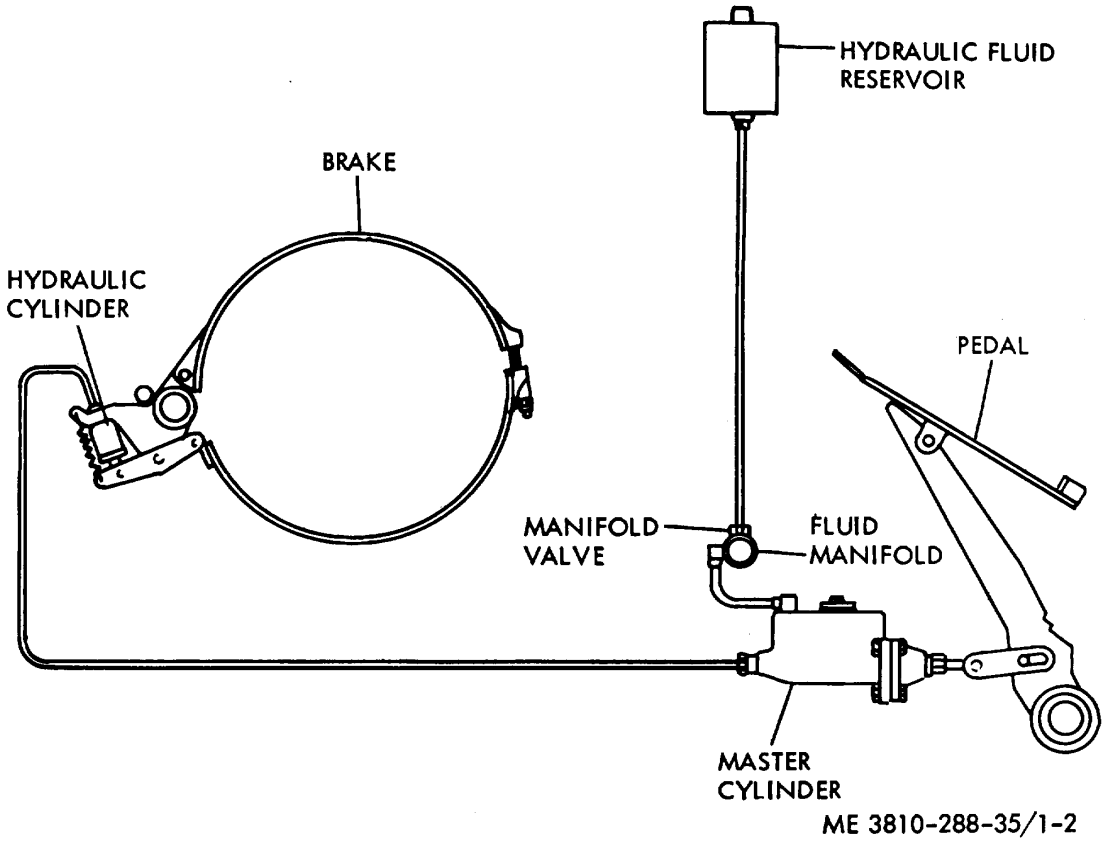

Figure 1-1. Upper hydraulic system, schematic diagram.

(13) *Torque values.* General torque values are listed in tables 1-1 and 1-2. When specific torque values are given, refer to table 1-3.

(14) *Repair and replacement standards.* Refer to table 1-4 for the model M320T2 truck crane repair and replacement standards.

Table 1-1. General torque values (except engines)

SAE Grade No.	1 or 2		5	
Bolt body size (Inches) — (thread)	Torque Foot-Pounds		Torque Foot-Pounds	
	Minimum	Maximum	Minimum	Maximum
1/4-20	4	6	7	9
1/4-28	5	7	9	11
5/16-18	10	12	16	18
5/16-24	12	14	18	20
3/8-16	17	19	30	32
3/8-24	19	21	34	36
7/16-14	27	29	48	50
7/16-20	29	31	54	56
1/2-13	38	40	73	77
1/2-20	40	42	83	87
9/16-12	50	52	105	115
9/16-18	54	56	115	125
5/8-11	81	85	145	155
5/8-18	93	97	165	175
3/4-10	110	110	265	275
3/4-16	110	120	290	300
7/8-9	155	165	390	400
7/8-14	170	180	425	440
1-8	230	240	580	600
1-14	240	250	650	670

Table 1-2. General torque values for engine

SAE GRADE No.	5		8	
Bolt body size (Inches)	Torque Foot-Pounds		Torque Foot-Pounds	
	Minimum	Maximum	Minimum	Maximum
1/4	9	10	12	14
5/16	19	21	27	30
3/8	33	37	45	50
7/16	53	60	75	85
1/2	80	90	115	130
9/16	115	130	160	180
5/8	160	180	220	250
3/4	290	320	400	450
7/8	420	470	650	730
1	630	710	970	1090
1-1/8	850	950	1380	1550
1-1/4	1200	1350	1940	2180
1-1/2	2000	2300	3300	3700
1-3/4	3300	3700	5300	6000
2	5000	5500	8000	9000

Bolt Identification Guide

SAE Grade No.	Bolt Head Marking
5	Will have three equally spaced radial lines. Quenched and tempered medium carbon steel.
8	Will have six equally spaced radial lines. Quenched and tempered medium carbon alloy or medium carbon baron steel.

Notes for table 1-2

1. When reusing bolts and nuts in service, use minimum torque values.
2. Torque values are for rigid joints. No gaskets or compressible material are used.
3. Torque values are for threads lubricated with engine oil or chassis grease. When other lubricants or materials are used, multiply standard assembly torques by the following factors:
   a. 0.85 when metallic plated bolts or nuts are used.
   b. 0.75 when parkerized bolts or nuts are used.
   c. 0.70 when Molykote, white lead or similar mixtures are used as lubricants
   d. 0.90 when hardened surfaces are used under the nut or bolt heed.
   e. 1.20 when Loctite is used on the threads of standard bolts and nuts.
   f. 1.25 when taper heed bolts are used (with bolt head torquedl
   g. 1.40 when Loctite in used on taper head bolt threads (with bolt head torqued.).

Table 1-3. Specific torque values

Component	Torque Value Foot-Pounds		
	Minimum		Maximum
CRANE ENGINE:			
Distributor bracket to cylinder head	18	-	22
Crankshaft rear oil seal, upper	18	-	22
Crankshaft rear oil seal, lower	18	-	22
Carburetor to manifold	20	-	24
Starting motor mounting	25	-	30
Oil pump body to crankcase	25	-	30
Camshaft thrust washer	25	-	30
Damper to pulley hub	30	-	35
Fuel pump to crankcase	25	-	30
Rocker arm bracket to head	25	-	30
Gear case to crankcase	25	-	30
Water pump to cylinder head	25	-	30
Oil pan to crankcase	25	-	30
Oil filler	25	-	30
Gear case cover to crankcase plate	25	-	30
Gear case cover	25	-	28
Manifold to cylinder head	25	-	30

Table 1-3. Specific torque values (Continued)

Component	Torque Value Foot-Pounds		
	Minimum		Maximum
Intake to exhaust manifold	55	-	65
Connecting rod bolt (place type)	75	-	85
Carburetor to manifold	40	-	45
Oil filter hold-down bolt	30	-	35
Oil filter mounting	40	-	50
Cylinder head bolt, oil	60	-	70
Cylinder head bolt, long	100	-	110
Cylinder head bolt, short	100	-	110
Flywheel housing to crankcase	75	-	85
Crankshaft to flywheel	150	-	160
Crankshaft bearing cap	100	-	110
Camshaft gear nut	110	-	120
Spark plug	28	-	30
Note Torque values are for bolt thread free of dirt and pit and lightly lubricated with engine oil.			
CARRIER ENGINE:			
Crankshaft main bearing cap bolts	100	-	110
Connecting rod bolts ,	60 (w / hardened washer)	-	70
Camshaft nut	125	-	150
	125	-	150
Camshaft thrust flange	30	-	40
Cylinder head bolts	80	-	90
Rocker arm bracket-to cylinder head	80	-	90
Flywheel housing-to-crankcase	65	-	75
Flywheel-to-crankshaft	90	-	100
Oil filter-to-crankcase	35	-	40
Oil filter shell retainer screw	30	-	35
Carburetor-to-manifold	20	-	24
Idler pulley adjuster	30	-	35
Alternator bracket-to-cylinder head	50	-	60
Alternator-to-bracket	35	-	40
Spark plugs	28	-	30
Note Torque values are for bolt threads free of dirt and grit and lightly lubricated with engine.			
TRANSFER CASE:			
Housing and cover	38	-	42
Main shaft rear bearing cap	60	-	66
Drive shaft rear bearing cap	60	-	66
Declutch housing to transfer case housing	60	-	66
Declutch bearing cage	38	-	42
Main shaft flange nut	300	-	400
Front axle drive shaft yoke nut	300	-	400
Axle drive shaft yoke nut	300	-	400
Shift cover plate	38	-	42
Idler shaft front and rear bearing caps	60	-	66
Main shaft front bearing cap	60	-	66
Idler shaft bearing retainer	60	-	66
REAR AXLE ASSEMBLIES:			
Cross shaft bearing cage	116	-	129
Cross shaft bearing cover	116	-	129
Differential carrier top, rear, and side covers	26	-	29
Interaxle differential case	92	-	102
Pinion bearing adjusting nut	1000	-	1200
Pinion bearing lock nut	1000	-	1200
Interaxle differential housing	160	-	180
Interaxle differential cover	30	-	33
Input and output yokes	800	-	1100
Air shift housing	54	-	58
Interaxle output bearing cover	52	-	58
Axle differential case assemblies	92	-	102

Table 1-3. Specific torque values (Continued)

Component	Torque Value Foot-Pounds Minimum	Maximum
Carrier bearing caps	160	- 180
Carrier to axle housing	320	- 360
Gear set (pinion and through shaft bearing cage	82	- 91
OTHER:		
Reversing shaft drum capscrews	20	- 25
Horizontal swing shaft drum capscrews	20	- 25
Steering wheel nut	55	- 65
Carrier clutch mounting capscrews	35	- 40
Release lever adjustment lock nut	60	- 60

Table 1-4. Repair and Replacement Standards

Component	Manufacturing Dimensions and tolerances inches From	To	Maximum allowable wear or clearance maximum
CRANE ENGINE			
General:			
Bore - inches	4		
Stroke - inches	5		
Displacement (cubic inches)	450.990		
Compression ratio	6.5:1		
Compression pressure (at 200 rpm) psi	141		
Firing order 1-5-3-6-24			
CRANKSHAFT:			
Main journal diameter	3.2494	3.2496	
Number of main bearings	7		
Crankpin diameter	2.751		2.752
Bearing clearance	0.0013		0.0043
Crankshaft end play	.006		0.015
Thrust taken by	Rear		
Hardening method	Tocco		
Bearing OD and spread	3.424	3.449	
CAMSHAFT:			
Camshaft journal diameter:			
Front	2.109	2.110	
Second	2.089		2.090
Third 2.069	2.070		
Fourth	1.4995	1.5005	
Camshaft bearing clearance	0.0010	0.0035	
Cam lobe lift	0.271	0.271	
Camshaft end play	0.0015	0.0095	
Thrust taken by Thrust flange			
Timing gear blacklash	0.004	0.007	
CONNECTING RODS:			
Connecting rod bearing end clearance	.007	0.013	
Connecting rod bearing clearance	0.012	0.0037	
Bearing OD and spread	2.8985	2.9135	
CYLINDER SLEEVES:			
Inside diameter	4.3740	4.3755	
Max permissible taper in sleeve			.005
Max permissible out-of-round			.002
Outside diameter	4.5015	4.5020	
Sleeve bore in crankcase	4.5015	4.5020	
Height above crankcase	0.000		+0.006
Length			8-11/ 16 ±1/64
Flange thickness			1/32
PISTONS:			
Material .....Aluminum Alloy			
Recommended piston clearance:			
Top of skirt	0.004	0.0041	
Bottom of skirt	0.003	0.0031	

Table 1-4. Repair and Replacement Standards (Continued)

Component	Manufacturing Dimensions and tolerances inches From	To	Maximum allowable wear or clearance maximum
PISTON PINS:			
Length	3.795	3.797	
Diameter	1.1089	1.1090	
Pin fit (room temperature 70F)			
Recommended clearance in rod	0.0005	0.0007	
Recommended clearance in piston:			
Tight end	0.0001L	0.0002T	
Loose end	0.0001L	0.0005L	
FEELER GAUGE RIBBON CHECKING:			
Width - inch	1/2	1/2	
Thickness - inch	0.003	0 003	
Tension on scales (pounds}	6	18	
Desired tension (pounds)	11	13	
PISTON RINGS:			
Compression rings			
Number used on each piston	2		
Size	3/32	3/32	
Oil rings:			
Number used on each piston	1		
Size	3/16		
Ring diameter	4-3/8	4	
Ring gap:			
Compression	0.025	0.035	
U-Flex-No gap at ring joint (Gap built between ring segments})			
Fit in groove:			
Top	0.0040	0.0055	
Second	0.0020	0.0035	
Third 0.0015	0.0035		
INTAKE VALVES:			
Stem diameter	0.435	0.435	
Valve to rocker arm clearance (hot)	0.024	0.026	
Stem clearance in guide	0.0015	0.0040	
Width of valve seat	5/64	7/64	
Note Valve face angle is 4 degrees			
EXHAUST VALVES:			
Stem diameter	0.4365	0.4375	
Valve to rocker arm clearance (hot)	0.024	0.026	
Stem clearance in guide	0.0020	0.0045	
Width of valve seat	1/8		3/32
Slo-roto valve cap to stem clearance	0.001	0.005	
Note Valve face angle is 45 degrees			
VALVE GUIDES:			
Distance above head	1-1/16		
Inside diameter	0.438	0.499	
VALVE LIFTERS:			
Clearance in block	0.0010	0.0035	
VALVES SPRINGS:			
Free length:			
Inner (new)	2-11/32		2-9/32
Outer (new)	2-9/16		2-1/2
Length - valve open:			
Inner (new)	1-1/2		
Outer (new)	1-45/64		1-5/8
Pounds pressure-valve open:			
Inner	88	88	
Outer	133	141	

Table 1-4. Repair and Replacement Standards (Continued)

Component	Manufacturing Dimensions and tolerances inches From	To	Maximum allowable wear or clearance maximum
VALVE ROCKER ARM CLEAHANCE			
ON SHAFT	0.0015	0.0040	
VALVE TIMING:			
Intake opens (before TDC) degree	16		
Intake closes (after BDC) degrees	44		
Exhaust opens (before BDC) degrees	50		
Exhaust closes (after TDC) degree	20		
Intake valve timing checking clearance	0.023		
OIL PUMP:			
Body gear end clearance	0.0025	0.0055	
Pump body to gear clearance	0.0023	0.0025	
Pump shaft diameter	0.4980	0.4979	
Pump shaft clearance In bore (Max)			0.0018
Body gear backlash	0.003	0.006	
Idler gear to shaft clearance	0.0015	0.0035	
Drive gear backlash	0.005	0.014	
Note Oil pressure is from 8 to 45 psi (engine at low idle and maximum governed speed, respectively)			
FLYWHEEL HOUSING:			
Permissible run-out	0.000	0.010	
CARRIER ENGINE			
General:			
Bore	4 1/2		
Stroke	4 5/16		
Displacement - cubic inches	549		
Compression ratio	7.57:1		
Gage Compression - 145 pal at 200 rpm			
Firing order 1-8-7-3-6-5-4-2			
CRANKSHAFT:			
Main journal diameter	3.123	3.124	
Crankpin diameter	2.623	2.624	
Bearing clearance	0.0014	0.0044	
Crankshaft end play	0.004	0.009	
Thrust taken by Intermediate			
Hardening method Tocco			
Main bearing bore in crankcase (line reamed with cape in place)	3.316	3.317	
CAMSHAFT:			
Camshaft journal diameter			
Front	2.347	2.348	
Second	2.316	2.317	
Third	2.290	2.291	
Fourth	2.247	2.248	
Camshaft bearing clearance	0.001	0.003	
Camshaft end play	0.0035	0.0115	
Thrust taken by Thrust flange			
Timing gear backlash	0.001	0.008	
CYLINDER HEAD:			
Over-all height, inches	4.372	4.378	4.362
CONNECTING RODS:			
Connecting rod bearing end clearance	0.010	0.018	
Connecting rod bearing clearance	0.0017	0.0042	
PISTONS:			
Material			
Recommended piston clearance Aluminum Alloy.	0.0035	0.0035	
Piston clearance check with 1/2 inch feeler gage ribbon			
Ribbon thickness	0.0035	0.0035	
Clearance pull - pounds	10	12	14
PISTON PINS:			
Length	3.262	3.265	
Diameter	1.3118	1.3119	
Pin fit (room temperature 70-F)			

Table 1-4. Repair and Replacement Standards (Continued)

Component	Manufacturing Dimensions and tolerances inches From	To	Maximum allowable wear or clearance maximum
PISTON PINS (Continued):			
Clearance in rod	0.0008	0.0011	
Clearance in piston	0.0001T	0.0002T	
PISTON RINGS:			
Compression rings:			
Number used on each piston	3		
Size - inch	3/32	3/32	
Oil rings:			
Number used on each piston	1		
Size - inch	3/16	3/ 16	
Ring gap:			
Compression	0.013	0.025	
U-Flex-No gap at ring joint (Gap built between ring segments)			
Fit in groove			
Top	0.0035	0.005	(Comp)
Second	0.0035	0.005	(Comp)
Third 0.0035	0.005	(Comp)	
Fourth	0.001	0.003	(Oil Control)
INTAKE VALVES:			
Stem diameter	0.434	0.435	
Valve guide bore	0.4365	0.4380	
Stem clearance	0.0015	0.0040	
Valve to rocker arm clearance (hot)	0	0	
Hydraulic lifter bleed-down rate (1/2 inch travel) 6 Sec Min			
Width of valve seat	3/32		1/16
Note Valve face angle is 15 degree			
EXHAUST VALVES:			
Stem diameter	0.433	0.434	
Valve guide bore	0.4365	0.4380	
Stem clearance in guide	0.0025	0.0050	
Valve to rocker arm clearance (hot)	0		
Hydraulic lifter bleed-down rate (1/8 inch travel) 6 Sec Min			
Width of valve seat - inch	3/32		1/8
Note Valve face angle is 15 degrees			
VALVE GUIDE:			
Distance above head (Intake)	1 1/16		
Distance above head (Exhaust)	1		
VALVE TAPPET:			
Clearance in block	0.0015	0.0040	
VALVE SPRINGS:			
Free length			
Inner (new)	2-9/32		
Outer (new)	2-19/32		
Length-valve open			
Inner (new)	1.495		
Outer (new)	1.620		
Lbs. pressure-valve open			
Inner 86	93		
Outer	121	129	
VALVE ROCKER ARM CLEARANCE			
IN SHAFT 0.0015	0.0040		
VALVE TIMING:			
Intake opens (before TDC)	22°		
Intake closes (after BDC)	58°		
Exhaust opens (before BDC)	62°		
Exhaust closes (after TDC)	18°		
OIL PUMP:			
Body gear end clearance	0.0015	0.009	
Pump body to gear clearance	0.0046	0.0086	