SPECIFICATIONS

General Data

Number of cylinders	4
Type of cylinder sleeves	Replaceable dry
Bore and stroke - inches	3-11/16 x 4.390
Displacement - cubic inches	188

Engine Speed

Rated load - rpm	2200 ± 10
High idle - rpm	2400 ± 40
Low idle - rpm	700-750

Compression Ratio	18.7 : 1
Compression Pressure at 100 rpm (cranking speed) with a Motorite Tester - psi	250 - 300
Firing Order	1 - 3 - 4 - 2

Cylinder Sleeves (Light press fit)

Wall thickness - inch	1/16
Height of flange above crankcase - inch	+.001 - +.004
Flange thickness - inch	.188 - .191
Outside diameter - inches	3.8112 - 3.8122
Inside diameter - inches	3.6875 - 3.6891
Crankcase sleeve bore I. D. - inches	3.8125 - 3.8135
Fit in crankcase - inches loose	.0003 - .0023
Maximum allowable wear (taper) - inch	.008
Sleeve shim gap - inch	.080 - .100
Cylinder Sleeves (Heavy press fit)	Refer to page 11

Pistons

Type	Cam ground
Skirt clearance - measured 90° from pin hole at bottom - inch	.0040 - .0056
Number of rings per piston	3
Piston pin hole bore - inches	1.249 - 1.251
Width of ring groove	
Top compression	Tapered
Second compression - inch	.1260 - .1270
Oil control - inch	.2505 - .2515
Ring clearance in groove	
Top compression	Tapered
Second compression - inch	.0025 - .0040
Oil control - inch	.0025 - .0040

Valve Timing (camshaft timing) - degrees

Valve Lever Clearance must be set at .030" to check valve timing

Intake opens	22 ± 4 before TDC
Intake closes	48 ± 4 after BDC
Exhaust opens	65 ± 4 before BDC
Exhaust closes	25 ± 4 after TDC

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Standard Torque Data for Nuts and Bolts

Recommended torque, in foot pounds, for all Standard Application Nuts and Bolts, provided:

A. All thread surfaces are clean and lubricated with SAE-30 engine oil. (See NOTE.)
B. Joints are rigid, that is, no gaskets or compressible materials are used.
C. When reusing nuts or bolts use minimum torque values.

NOTE: Multiply the standard torque by:

.65 when finished jam nuts are used.
.70 when Molykote, white lead or similar mixtures are used as lubricants.
.75 when parkerized bolts or nuts are used.
.85 when cadmium plated bolts or nuts are used.
.90 when hardened surfaces are used under the nut or bolt head.

Bolt or Stud Diameter	Type 1 Studs Only		Type 1 Bolts 6" length or less		Type 1 Bolts longer than 6"		Type 2 (all lengths)		Type 3 (all lengths)		Type 4 (all lengths)			
											Only when used in cast (gray) iron		All other applications	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/4	5	6	5	6	3	3	9	10	11	13	11	13	12	14
5/16	12	13	12	13	6	7	19	21	24	27	24	27	27	30
3/8	21	24	21	24	11	13	33	37	43	47	43	47	45	50
7/16	35	38	35	38	19	21	53	60	69	76	69	76	75	85
1/2	52	58	52	58	29	32	80	90	104	117	104	117	115	130
9/16	70	80	70	80	41	46	115	130	150	170	150	170	165	185
5/8	98	110	98	110	57	63	160	180	210	230	210	230	220	250
3/4	174	195	174	195	100	112	290	320	350	390	350	390	400	450
7/8	300	330	162	181	162	181	420	470	570	630	570	630	650	730
1	420	470	250	270	250	270	630	710	850	950	850	950	970	10[illegible]
1-1/8	600	660	350	380	350	380	850	950	1200	1350	1200	1350	1380	15[illegible]
1-1/4	840	940	490	540	490	540	1200	1350	1700	1900	1700	1900	1940	2180
1-3/8	1100	1230	640	710	640	710	1570	1760	2300	2500	2300	2500	2600	2800
1-1/2	1470	1640	850	940	850	940	2000	2300	3000	3300	3000	3300	3300	3700
1-3/4	2350	2450	1330	1490	1330	1490	3300	3700	4700	5200	4700	5200	5300	6000
2	3500	3900	2000	2200	2000	2200	5000	5500	7000	7800	7000	7800	8000	9000

BOLT TYPE IDENTIFICATION CHART

IH TYPE	S.A.E. GRADE	DESCRIPTION	BOLT HEAD MARKING *
1	1 or 2 Equivalent	WILL HAVE IH STANDARD MONOGRAM IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
2	5	WILL HAVE AN IH AND 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
3	6	WILL HAVE AN IH AND 4 RADIAL LINES No longer used in production. For replacement, use Type 4 if Type 3 is not available.	
4	8	WILL HAVE AN IH AND 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

* The center marking identifies the bolt manufacturer. The IH monogram is currently used. Some bolts may still have a raised dot which previously identified IH bolts.

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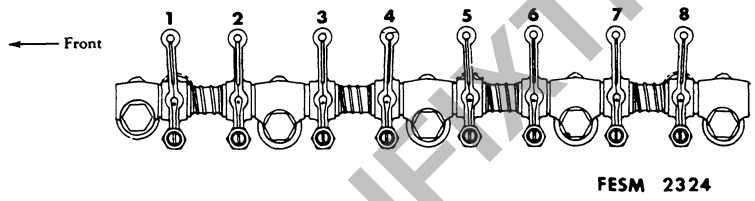
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VALVE LASH ADJUSTING PROCEDURE

Following the simplified procedure shown in the chart below, all valves can be adjusted accurately. Note that the engine need not be cranked four times to position the piston of each cylinder on T. D. C. All valves are adjusted by cranking the engine only twice.

Four valves are adjusted when the No. 1 piston is at T. D. C. (Compression) and the remaining four are adjusted when the No. 4 piston is at T. D. C. (Compression). The following chart shows the numbering sequence of the valves which correspond to the chart.

WITH	ADJUST VALVES (Engine Warm) *							
No. 1 Piston at T.D.C. (Compression)	1	2	3		5			
No. 4 Piston at T.D.C. (Compression)				4		6	7	8



FESM 2324

Illust. 1. Numbering sequence of the valves which correspond to the chart.

* Engine warm means – any temerature above freezing. Valve lash may be adjusted while the engine is hot. - however the quality of workmanship usually suffers due to heat.

VALVE TIMING

Valve timing can be determined by checking only one valve. If the timing on the valve is within specification, the other valves, barring extreme camshaft lobe wear or poor adjustment, will be in time.

The procedure for checking valve timing is as follows:

1. Turn the crankshaft until the number one piston is on the compression stroke and the timing pointer (at the flywheel) is in line with the T. D. C. mark on the flywheel.

2. Adjust the intake valve to exactly .030 inch clearance (engine cold).

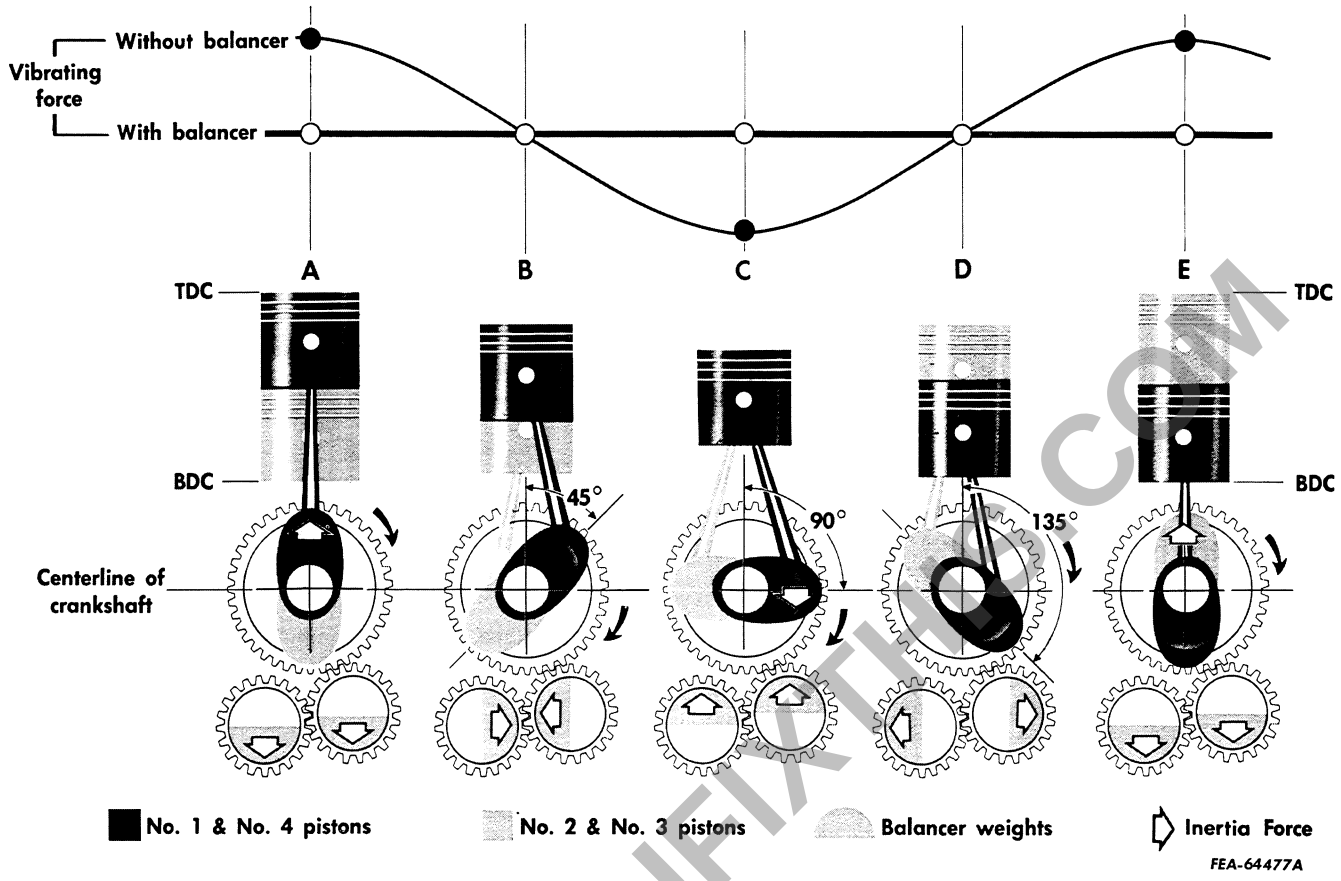
3. Turn the crankshaft in the direction of engine rotation until the push rod of the intake valve can no longer be turned by hand.

4. Continue turning the engine slowly until the intake valve starts to move. Note the degree mark at the timing pointer. This should read 22 ± 4 degrees B. T. D. C.

NOTE: Each tooth of the camshaft gear changes the valve timing approximately 14 crankshaft degrees.

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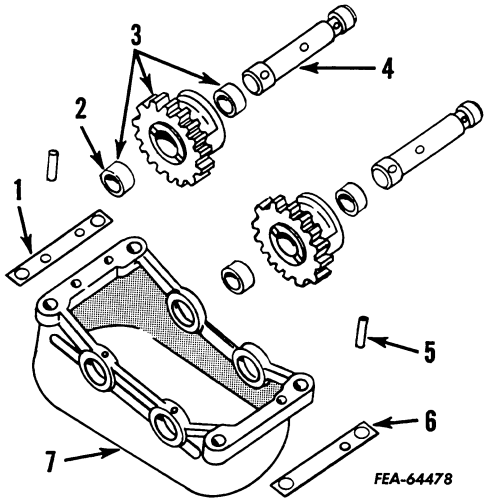


Illust. 10. Engine balancer operation.

These two forces reach their maximum when the crankshaft reaches 90 degrees from TDC. At this instant, the weights of the balancer are at the top of their travel, Position C, with a force equal to the inertia unbalance forces of the pistons. There is no compensation for engines without a balancer.

With the engine continuing to turn, this unbalanced inertia force declines and becomes zero at the 135 degree (from TDC) position of the crankshaft. Again the balancer weights are to the side or neutral Position D. The vibration effect is similar in engines with or without a balancer.

With pistons 2 and 3 at TDC, and 1 and 4 at BDC, Position E, the effect of the balancer weights is the same as shown in Position A for pistons 1 and 4.



Illust. 11. Exploded view of engine balancer.

1. Shim, L. H.
2. Bushing, weight shaft
3. Weight with two bushings
4. Shaft with two balls
5. Pin
6. Shim, R. H.
7. Housing

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Engine Balancer

Backlash - between driving and driven weight gears - inch . . . . . .003 - .009
Backlash - between crankshaft ring gear and driving weight gear - inch . . .004 - .015
Balancer weight shaft bore in housing
Roll pin side of housing - inch . . . . . .7545 - .7555
Opposite side of roll pin - inch . . . . . .7495 - .7505
Weight shaft bushing I. D. - inch . . . . . .752 - .753

Shaft diameter
Roll pin end - inch . . . . . .7545 - .7550
Bearing surface area - inch . . . . . .7495 - .7500
Opposite roll pin end - inch . . . . . .7505 - .7510
Weight assembly running clearance on shaft - inch . . . . . .001 - .0035
Weight assembly end clearance in housing - inch . . . . . .008 - .016

Oil Cooler

Drain coolant from oil cooler and flush clean when cleaning the engine cooling system.

Exhaust temperature - maximum degrees F. . . . . .1200 (See Notes 1 & 2)

Note 1: Install a pyrometer at the same location as a gauge for checking exhaust pressure.

Note 2: Temperature will rise with an increase in altitude, air cleaner restriction or bad nozzles. It should not be allowed to exceed the maximun permitted temperature.

Fuel Rator Specifications

Tractor Model	PUMP			RATED LOAD			OVERLOAD		
	Make	I. H. Part Number	High Idle	R. P. M.	Max. Fuel lbs./hr.	Min. Time* sec./qt.	R. P. M.	Max. Fuel lbs./hr.	Min. Time* sec./qt.
F&I-504	Roosa-Master	313 237 R91 324 279 R91	2400 ± 40	2200 ± 10	25-1/2	248	1500 ± 25	18-1/2	342
3514	Roosa-Master	606 150 C91 610 009 C91 324 279 R91	2400 ± 40	2200 ± 10	24-1/2	258	1500 ± 25	18	351

*Seconds per quart is based on #2 diesel fuel weighing 7.03 pounds per gallon, having approximately 138,200 BTU per gallon and a API gravity of 36".

Important: Horsepower, automatic advance and transfer pump pressure are affected by the soft rubber hose used in filling the fuel rator. Shut-off valve (FES 97-34) should be installed at the transfer pump test port, when checking or adjusting transfer pump pressure, automatic advance or horsepower. The valve should be opened only enough to obtain a transfer pump pressure reading in making the above checks. When filling the fuel rator the valve should be fully opened.

SPECIAL TORQUES

(Foot pounds)

Nozzle body bolts 23
Cylinder head 115
Main bearing 80
Connecting rod 45
Flywheel 50
Manifold 23
Camshaft gear nut 105
Front pulley to crankshaft nut 95
Oil pan drain plug 33
Injection pump gear bolt 28
Lube oil filter case bolt 15
Generator pulley nut 65
Oil pan to crankcase 15
Injection pump gear hub nut 38
Valve cover 11
Injection pipe connecting screw 25

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