1961 FORD TRUCK

100-800 SERIES

SHOP MANUAL

Includes 1962 - 63
Ford Truck Supplement

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1961

FORD TRUCK

100-800 SERIES

SHOP MANUAL

EPARTMENT
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FOREWORD

This manual provides information for the proper servicing of 1961 100-800 Series Ford Trucks. Service procedures for the Ranchero are covered in the 1961 Ford Falcon Shop Manual. The descriptions and specifications contained in this manual were in effect at the time the manual was approved for printing. The Ford Division of Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY

FORD TRUCK IDENTIFICATION

MODEL DESIGNATIONS

Ford truck designations consist of two elements, a letter and a three or four digit number. The letter determines the type of truck and the number indicates the size, as follows:

F.....Conventional Series
C.....Tilt Cab Series
T.....Tandem Axle Series
B.....School Bus Series
P.....Parcel Delivery Series
100, 250, 350, 400.....Light Duty Models
500, 550, 600.....Medium Duty Models
700, 750, 800.....Heavy Duty Models

For example: the F-350 is a Light Duty conventional model. The C-600 is a Medium Duty Tilt Cab model.

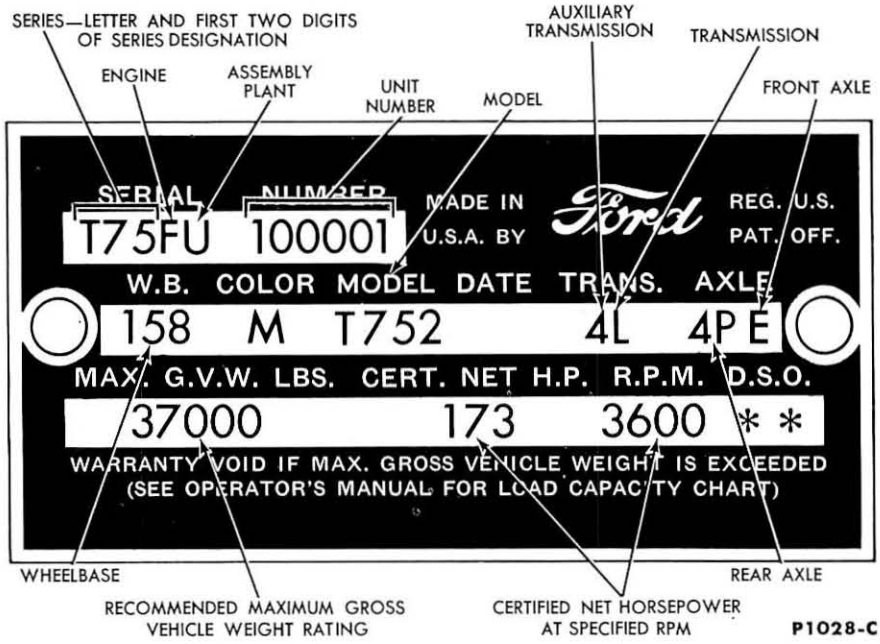

FIG. 1—Typical Truck Rating Plate

TRUCK REGISTRATION RATINGS

Series	Model	RATING GVW (lb)	RATING Nominal (ton)
F-100	F-100	5,000	½
	F-101	4,000	½
	F-102	5,000	½
	F-113	5,600	½
	F-114	4,000	½
	F-115	5,600	½
F-250	F-250	7,400	¾
	F-251	4,900	½
	F-262	6,600	¾
F-350	F-350	9,800	1
	F-351	7,600	¾
F-500	F-500	15,000	1½
	F-501	10,000	1
F-600	F-600	17,000	2
	F-601	15,000	1½
	F-602	19,500	2½
	F-613	21,000	2½
	F-614	21,000	2½
F-700	F-700	21,000	2½
	F-701	17,000	1¾
	F-702	22,000	2½
	F-704	25,000	3
	F-705	25,000	2
F-750	F-750	22,000	2½
	F-751	17,000	1¾
	F-752	25,000	3
	F-753	25,000	2

CONTINUED ON NEXT PAGE

TRUCK REGISTRATION RATINGS (Continued)

Series	Model	RATING	
		GVW (lb)	Nominal (ton)
F-800	F-800	24,000	3
	F-801	17,000	2
	F-802	22,000	3
	F-803	25,000	3½
	F-814	27,000	3½
	F-815	27,000	2
	F-816	27,000	3½
B-500	B-500	15,000	1½
	B-501	10,000	1
B-600	B-600	17,000	2
	B-601	15,000	1½
	B-602	19,500	2
B-700	B-700	21,000	2½
	B-701	17,000	1¾
	B-702	22,000	2½
	B-703	22,000	2½
	B-704	22,000	2½
B-750	B-750	22,000	2½
	B-751	17,000	1¾
	B-752	22,000	2½
	B-753	22,000	2½
C-550	C-550	18,000	1½
	C-551	10,000	1
C-600	C-600	19,500	2½
	C-601	15,000	1½
	C-612	21,000	2½
	C-613	21,000	2½
C-700	C-700	22,000	2½
	C-701	17,000	1¾
	C-702	23,000	2½
	C-703	25,000	3
	C-704	25,000	3
C-750	C-750	23,000	2½
	C-751	17,000	1¾
	C-752	25,000	3
	C-753	25,000	3
C-800	C-800	27,000	3½
	C-801	20,000	2
	C-802	27,000	3½
	C-803	27,000	3½
P-350	P-350	8,000	¾
	P-351	5,900	½
P-400	P-400	10,000	1
	P-401	7,700	¾
P-500	P-500	15,000	1½
	P-501	10,000	1
T-700	T-700	28,000	3
	T-701	22,000	2
	T-702	29,000	3
	T-703	32,000	3
	T-704	33,000	3
T-750	T-750	35,000	3½
	T-751	27,000	3
	T-752	37,000	3½
T-800	T-800	39,000	3½
	T-801	30,000	3
	T-802	41,000	3½
	T-803	43,000	4
	T-804	43,000	4
	T-805	45,000	4

FORD TRUCK IDENTIFICATION

ENGINE CODE

Code	Sales Designation	Service and Engineering Designation
A*	223 Six	
C	292 MD V-8	EEH, EEJ**—Dual
D	292 HD V-8	EEK—4-Barrel
F	332 HD V-8	ECT—4-Barrel
J	223 Six	EBR, EBS, EBT
N	302 HD V-8	ECS—4-Barrel

*Export only
**P-Series only

CONSECUTIVE UNIT NUMBER

A uniform serial number has been developed to provide a means of identifying annual model year programs and extended production cycles of five or more years without the use of the current model year designation. Basically the system requires the monthly assignment of serial numbers into blocks.

1961 MODEL YEAR

October	100,001 thru 109,999
November	110,000 thru 119,999
December	120,000 thru 129,999
January	130,000 thru 139,999
February	140,000 thru 149,999
March	150,000 thru 159,999
April	160,000 thru 169,999
May	170,000 thru 179,999
June	180,000 thru 189,999
July	190,000 thru 199,999

TRANSMISSION CODE

Code	Type
A	3-Speed Standard
B	3-Speed Overdrive
C	Fordomatic
D	3-Speed M/D Warner T-89C
E	3-Speed H/D Warner T-87E
F	4-Speed Warner T-98A
G	H/D Cruise-O-Matic
	peed Transmatic

COLOR CODE

Code	Color Name	Paint Spec. Number
A	Raven Black	M30J-1724
M	Corinthian White	M30J-1238
V	Academy Blue	M30J-1024
L	Dark Green	M30J-1237
J	Monte Carlo Red	M30J-1232
X	Goldenrod Yellow	M30J-358
B	Turquoise	M30J-556
D	Light Blue	M30J-1361
S	Light Green	M30J-1373

ASSEMBLY PLANT CODE

Code	Plant Location
D	Dallas
E	Mahwah
G	Chicago
H	Lorain (Ohio)
K	Kansas City
N	Norfolk
P	Twin City (St. Paul)
R	San Jose
U	Louisville

AUXILIARY TRANSMISSION CODE

Code	Type
1	Spicer 5831C
2	Spicer 5831B
3	Spicer 7231B
4	Spicer 7231D
5	Spicer 8341A

FRONT AXLE CODE

Code	Type
A	3.92 Ratio (4-Wheel Drive)
B	4.55 Ratio (4-Wheel Drive)
C	6,000 lb.
D	4.55 Ratio (4-Wheel Drive)
E	7,000 lb.

REAR AXLE CODE

Code	Ratio and Rating
100, 250, 350, 400 Models	
A1	3.73—3.3M
A2	3.92—3.3M
B4	4.56—5M
B6	4.88—5M
01	3.50—2.3M
02	4.00—2.3M
10	3.22—3.3M
11	3.70—3.3M
12	3.89—3.3M
13	4.11—3.3M
24	4.56—5M
25	4.86—7.2M
26	4.88—5M
27	5.14—7.2M
28	5.83—7.2M
32	6.20—11M
34	6.80—11M
41	5.83—13M
42	6.20—13M
44	6.80—13M
52	6.20—14M
54	6.80—14M
62	6.20—15M
64	6.80—15M
66	7.20—15M
73	6.50—16M
75	7.17—16M
82	5.57—18M
83	6.50—18M
85	7.17—18M
87	7.67—18M

REAR AXLE CODE

Code	Ratio and Rating
D1	5.83/8.11—13M
E1	5.83/8.11—14M
E2	6.33/8.81—14M
F1	5.83/8.11—15M
F2	6.33/8.81—15M
G3	6.50/9.04—16M
H2	5.57/7.60—18M
H3	6.50/8.87—18M
H5	7.17/9.77—18M
FCB 700-800	
J1	5.91—21M
J2	6.65—21M
K1	4.88—21M
K2	5.57—21M
K3	6.50—21M
K4	7.17—21M
L1	4.92—21M
L2	5.63—21M
L3	6.43—21M
L4	7.21—21M
FCB 700-800 (Continued)	
S1	4.88/6.65—21M
S2	5.57/7.60—21M
S3	6.50/8.87—21M
T1	4.92/6.79—21M
T2	7.17/9.77—18M
T3	6.39/8.82—21M
T4	7.33/10.12—21M
T—700-800	
1A	6.70—22M
1B	7.07—28M
2A	7.79—22M
2B	7.79—28M
T—800	
1C	4.63—30M
2C	4.88—30M
3C	5.57—30M
T—800 (Continued)	
4C	6.50—30M
5C	7.17—30M
1D	7.75—30M
2D	8.55—30M
1E	4.56—34M
2E	5.85—34M
3E	6.69—34M
4E	7.80—34M
5E	8.60—34M
2F	4.88—34M
3F	5.57—34M
4F	6.50—34M
5F	7.17—34M
1H	4.63—34M
2H	5.29—34M
3H	5.83—34M
4H	6.83—34M
5H	7.80—34M
6H	8.60—34M
1N	7.60—34M
3N	8.38—34M

1961 FORD TRUCK SHOP MANUAL 100-800 SERIES

GROUP 1

ENGINES AND EXHAUST SYSTEMS

PART 1-1 GENERAL ENGINE SERVICE

This part covers engine trouble diagnosis and tune-up procedures for the 223 Six engine, the medium-duty (292) and the heavy-duty (292, 302, and 332) V-8 engines. In addition, the cleaning, inspection, repair, and overhaul procedures for these engines are covered.

For engine removal, disassembly, assembly, and installation procedures, refer to the part of this group which covers the applicable engines.

1 ENGINE TROUBLE DIAGNOSIS

Engine performance complaints usually fall under one of the basic headings listed in the "Engine Trouble Diagnosis Guide." When a particular trouble can not be traced to a definite cause by a simple check, the possible items that could be at fault are listed in the order of their probable occurrence. Check the items in the order listed. For example, under Poor Acceleration the ignition system is listed as a probable cause of the trouble. All the ignition system items that affect acceleration are listed. Check all these items before proceeding to the next probable cause.

ENGINE TROUBLE DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK	The cause of this trouble is usually in the starting system (Part 12-2). If the starting system is not at fault, check for a hydrostatic lock or a seized engine, as follows: Remove the spark plugs, then attempt to crank the engine with the starter. If the engine cranks, it indicates that water is leaking into the cylinders. Remove the cylinder head(s) and inspect the gasket(s) and/or head(s) for cracks. Examine the cylinder block for cracks.
ENGINE CRANKS NORMALLY, BUT WILL NOT START	Check the fuel supply. If there is sufficient fuel in the tank, the cause of the trouble probably lies in either the ignition or the fuel system. To determine which system is at fault, perform the following test: Disconnect a spark plug wire. Check the spark intensity at the end of the wire by installing a terminal adapter in the terminal of the wire to be checked. Then, hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine. **IF THERE IS NO SPARK OR A WEAK SPARK AT THE SPARK PLUGS** The cause of the trouble is in the ignition system. To determine if the cause of the trouble is in the primary or the secondary circuit, remove the coil high tension lead from the top of the distributor and hold it approximately 3/16 inch from the cylinder head. With the ignition on, crank the engine and check for a spark. If the spark at the coil high ten-

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)	sion lead is good, the cause of the trouble is probably in the distributor cap or rotor. If there is no spark or a weak spark at the coil high tension lead, the cause of the trouble is probably in the primary circuit, coil to distributor high tension lead, or the coil. **IF THERE IS A GOOD SPARK AT THE SPARK PLUGS** Check the spark plugs. If the spark plugs are not at fault, check the following items: **CHOKE** Check the choke linkage for binding or damage. Make certain the choke plate closes when the choke knob on the instrument panel is pulled out and that the plate opens when the knob is pushed in. **FUEL SUPPLY AT CARBURETOR** Work the throttle by hand several times. Each time the throttle is actuated, fuel should spurt from the accelerating pump discharge nozzle(s). If fuel is discharged by the accelerating pump, the engine is probably flooded, or there is water in the fuel system, or an engine mechanical item is at fault. If fuel is not discharged by the accelerating pump, disconnect the carburetor fuel inlet line at the carburetor. Use a suitable container to catch the fuel. Crank the engine to see if fuel is reaching the carburetor. If fuel is not reaching the carburetor, check: The fuel pump. The fuel filter (HD V-8 engines). The carburetor fuel inlet line for obstructions. The fuel pump flexible inlet line for a collapsed condition (mechanical fuel pump). The fuel tank line for obstructions. The fuel tank vent. If fuel is reaching the carburetor, check: The fuel inlet system including, the fuel inlet screen, the fuel inlet needle and seat assembly, and the float assembly.
ENGINE STARTS, BUT FAILS TO KEEP RUNNING	**FUEL SYSTEM** Idle fuel mixture needle(s) not properly adjusted. Engine idle speed set too low. Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in fuel lines or carburetor. Carburetor icing. Fuel pump defective. Fuel pump safety switch defective (electric fuel pump) . Check for dirt in the carburetor not allowing fuel to enter or be discharged from the idle system. **IGNITION SYSTEM** Leakage in the high tension wiring.
ENGINE RUNS, BUT MISSES	Determine if the miss is steady or erratic and at what speed the miss occurs by operating the engine at various speeds under load. **MISSES STEADILY AT ALL SPEEDS** Isolate the miss by operating the engine with one cylinder not firing. This is done by operating the engine with the ignition wire removed from ne spark plug at a time, until all ylinders have been checked. Ground ne spark plug wire removed. If the engine speed changes when a particular cylinder is shorted out, that cylinder was delivering power before being shorted out. If no change in the engine operation is evident, the miss was caused by that cylinder not delivering power before being shorted out. In this case, check the: **IGNITION SYSTEM** If the miss is isolated in a particular cylinder, perform a spark test on the ignition lead of the cylinder.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE RUNS, BUT MISSES (Continued)	If a good spark does not occur, the trouble is in the secondary circuit of the system. Check the spark plug wire, and the distributor cap. If a good spark occurs, check the spark plug. If the spark plug is not at fault, a mechanical component of the engine is probably at fault. **ENGINE** Perform a compression test to determine which mechanical component of the engine is at fault (page 1-9). **MISSES ERRATICALLY AT ALL SPEEDS** **EXHAUST SYSTEM** Exhaust system restricted. **IGNITION SYSTEM** Defective breaker points, condenser, secondary wiring, coil, or spark plugs. High tension leakage across the coil, rotor, or distributor cap. **FUEL SYSTEM** Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in fuel lines or carburetor. Restricted fuel filter (HD V-8 engines). **COOLING SYSTEM** Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **ENGINE** Perform a compression test (page 1-9) to determine which mechanical component of the engine is at fault. **MISSES AT IDLE ONLY** **FUEL SYSTEM** Idle fuel mixture needle(s) not properly adjusted. **IGNITION SYSTEM** Excessive play in the distributor shaft. Worn distributor cam. **ENGINE** Perform a compression test (page 1-9) to determine which mechanical component of the engine is at fault. **MISSES AT HIGH SPEED ONLY** **FUEL SYSTEM** Power valve clogged or damaged. Low or erratic fuel pump pressure. Fuel inlet system not operating properly. Restricted fuel filter (HD V-8 engines). **COOLING SYSTEM** Engine overheating.
ROUGH ENGINE IDLE	**FUEL SYSTEM** Engine idle speed set too low. Idle fuel mixture needle(s) not properly adjusted. Float setting incorrect. Air leaks between the carburetor and the manifold and/or fittings. Fuel leakage at the carburetor fuel bowl(s). Power valve leaking fuel. Idle fuel system air bleeds or fuel passages restricted. Fuel bleeding from the accelerating pump discharge nozzle(s). Secondary throttle plates not closing (4-barrel carburetor). Improper secondary throttle plate stop adjustment (4 - barrel carburetors). Leaking fuel enrichment valve. **IGNITION SYSTEM** Improperly adjusted or defective breaker points. Fouled or improperly adjusted spark plugs. Incorrect ignition timing. Spark plug misfiring. **EXHAUST SYSTEM** Exhaust gas control valve inoperative or sticking (223 Six and 292 MD V-8).

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ROUGH ENGINE IDLE (Continued)	**VACUUM BOOSTER PUMP** Leaking pump, lines, or fittings. **ENGINE** Loose engine mounting bolts or worn insulator.	Cylinder head bolts not properly torqued. Valve lash set too tight. Crankcase ventilation regulator valve defective or a restricted tube (Positive Crankcase Ventilation System).
POOR ACCELERATION	**IGNITION SYSTEM** Incorrect ignition timing. Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. Distributor not advancing properly. **FUEL SYSTEM** Inoperative accelerating pump inlet ball check. Inoperative accelerating pump discharge needles or balls. Accelerating pump diaphragm defective. Float setting incorrect. Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted. Leaking power valve, gaskets, or	accelerating pump diaphragm. Leaking fuel enrichment valve. Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. **EXHAUST SYSTEM** Exhaust gas control valve stuck closed (223 Six and 292 MD V-8). **TRANSMISSION** Clutch slippage (manual - shift transmissions). Improper adjustment (automatic transmissions). Converter One-Way Clutch inoperative (Fordomatic and HD Cruise-O-Matic transmissions).
ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE	**FUEL SYSTEM** Restricted air cleaner. Restricted fuel filter. Clogged or undersize main jets and/or low float setting. Clogged or undersize secondary jets (4-barrel carburetor). Power valve clogged or damaged. Secondary throttle plates not opening (4-barrel carburetor). Fuel pump pressure incorrect. Distributor vacuum passage in the carburetor blocked. **IGNITION SYSTEM** Ignition timing not properly adjusted. Defective coil, condenser, or rotor. Distributor not advancing properly. Excessive play in the distributor shaft. Distributor cam worn.	Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. **EXHAUST SYSTEM** Exhaust gas control valve inoperative or sticking (223 Six and 292 MD V-8). Restriction in system. **COOLING SYSTEM** Thermostat inoperative or of incorrect heat range. Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **VACUUM GOVERNOR— HD V-8 ENGINES** Incorrect top speed adjustment. Valve shaft bent imparing operation of the valve sleeve in the gover-

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ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE DOES NOT DEVELOP FULL POWER, OR HAS POOR HIGH SPEED PERFORMANCE (Continued)	nor controlling unit in the distributor. Incorrect governor spring and/or spring pin installed in wrong hole in throttle actuating unit on carburetor. **VELOCITY GOVERNOR—223 SIX OR 292 MD V-8** Incorrect adjustment. Throttle plate(s) in governor not completely opening. **ENGINE** Perform an engine compression test (page 1-9) to determine which mechanical component is at fault. One or more camshaft lobes worn beyond wear limit. **TRANSMISSION** Improper adjustment (automatic transmissions).
EXCESSIVE FUEL CONSUMPTION	Determine the actual fuel consumption with test equipment installed in the truck. If the test indicates that the fuel consumption is not excessive, demonstrate to the owner how improper driving habits will affect fuel consumption. If the test indicates that the fuel consumption is excessive, make a preliminary check of the following items before proceeding to the fuel and ignition systems. **PRELIMINARY CHECKS** **CHASSIS ITEMS** Check: Tires for proper pressure. Front wheel alignment. Brake adjustment. **EXHAUST SYSTEM** Check the exhaust gas control valve operation (223 Six and 292 MD V-8). **ODOMETER** Check calibration. **IGNITION SYSTEM** Check ignition timing. **FINAL CHECKS** **FUEL SYSTEM** Check: Fuel pump pressure. Engine idle speed. Idle fuel mixture needle(s) for proper adjustment. Fast idle speed screw for proper adjustment. Accelerating pump stroke adjustment. Anti-stall dashpot for proper adjustment. Air cleaner for restrictions. Float setting or fuel level. Jets for wear and/or damage. Power valve operation. Fuel enrichment valve operation. Air bleeds for obstructions. Accelerating pump discharge nozzles for siphoning. **IGNITION SYSTEM** Check: Ignition timing. Spark plug condition and adjustment. Distributor spark advance operation. **ENGINE** Perform an engine compression test (page 1-9) to determine which mechanical component of the engine is at fault. **COOLING SYSTEM** Check thermostat operation and heat range. **TRANSMISSION** Check band adjustment (automatic transmissions).
ENGINE OVERHEATS	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective (not indicating correct temperature), or constant voltage regulator defective. **ENGINE** Cylinder head bolts not properly torqued.

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ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE OVERHEATS (Continued)	Incorrect valve lash. Low oil level or incorrect viscosity oil used. **COOLING SYSTEM** Insufficient coolant. Cooling system leaks. Drive belt tension incorrect.	Radiator fins obstructed. Thermostat defective. Thermostat improperly installed. Cooling system passages blocked. Water pump inoperative. **IGNITION SYSTEM** Incorrect ignition timing.
ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective (not indicating correct temperature), or constant voltage regulator defective. **COOLING SYSTEM** Thermostat inoperative or of incorrect heat range.	
LOSS OF COOLANT	**COOLING SYSTEM** Leaking radiator. Loose or damaged hose connections. Water pump leaking. Radiator cap defective. Overheating. **ENGINE** Cylinder head gasket defective.	Intake manifold to cylinder head gasket defective. Cylinder head or intake manifold bolts not properly torqued. Cylinder block core plugs leaking. Temperature sending unit leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface.

2 TUNE-UP

The recommended Tune-Up Schedule (Table 1) is for either a minor or a major tune-up. Perform all operations in the sequence listed. The recommended mileage interval for a minor tune-up is 4000 miles for off-highway operation and 8000 miles for highway operation. The recommended mileage interval for a major tune-up is 12,000 miles for off-highway operation and 24,000 miles for highway operation. For a detailed description of an operation procedure, refer to the operation number under "Operation Proce-

The first part is performed with the engine not operating. The first step consists of visual and mechanical checks and adjustments. The second step consists of an instrument check. Always follow the instructions of the manufacturer of the test equipment used.

The second part of the tune-up covers items that can be done while the engine is warming up for carburetor and valve adjustments.

The third part of the tune-up should be done with the engine operating at normal operating temperature. For the engine to reach normal operating temperature, it should be operated for 30 minutes at fast idle (1200 rpm).

For more detailed information on corrective action to be taken when a particular defect is encountered, refer to the appropriate part of the manual.

At the end of the "Tune-Up Procedure," additional engine checks and adjustments are described for use as necessary.

ENGINE NOT OPERATING

Perform the following tests with the engine off and at room temperature.

MECHANICAL CHECKS, TESTS, AND ADJUSTMENTS

1. Clean, Adjust, And Test Spark Plugs. Remove the wire from each spark plug by grasping the moulded cap only.

TABLE 1—Tune-Up Schedule

Operation No.	Operation	Minor	Major
	ENGINE NOT OPERATING		
	MECHANICAL CHECKS, TESTS, AND ADJUSTMENTS		
1	Clean, adjust, and test spark plugs.	X	X
2	Take compression reading of each cylinder.		X
3	Check and tighten intake manifold bolts.		X
4	Free exhaust gas control valve —223 Six and 292 MD V-8 engines.	X	X
5	Check and adjust the deflection of the drive belts.	X	X
6	Clean fuel pump sediment bowl and replace bowl filter—mechanical fuel pump.	X	X
7	Drain fuel system filter—332 HD V-8 engines.	X	
8	Replace fuel system filter element—HD V-8 engines.		X
9	Check and adjust carburetor fuel level.		X
10	Clean the distributor cap and rotor.	X	X
11	Check the condition of the distributor breaker points.	X	
12	Lubricate the distributor cam, lubricating wick, and the distributor bushing.	X	X
13	Clean battery cables and terminals.		X
14	Clean positive crankcase ventilation system.		X
	INSTRUMENT CHECKS		
15	Check battery state of charge.	X	X
16	Check starter motor current draw.		X
17	Check coil output.		X
18	Perform a primary circuit resistance test.		X
19	Check and adjust breaker point dwell.	X	
20	Replace the breaker points and condenser.		X
21	Check and adjust distributor spark advance.		X
22	Perform a spark intensity test of each spark plug wire.		X
23	Check fuel pump pressure and capacity.		X
	WHILE ENGINE IS WARMING-UP		
24	Clean carburetor air cleaner.	X	X
25	Replace dry-type air cleaner element.		X
26	Check and adjust ignition timing.	X	X
27	Check generator or alternator output.		X
	ENGINE OPERATING AT NORMAL TEMPERATURE		
28	Adjust accelerator pump link to seasonal position.	X	
29	Check and adjust engine idle speed.	X	X
30	Check and adjust idle fuel mixture.	X	X
31	Check and adjust anti-stall dashpot clearance—Fordomatic and HD Cruise-O-Matic	X	X
32	Check and adjust engine governed speed.	X	X
33	Check and adjust valve lash.	X	X

Clean the area around each spark plug with compressed air, then remove the spark plugs.

Clean the spark plugs on a sand blast cleaner following the equipment manufacturer's instructions. Remove carbon and other deposits from the threads with a stiff wire brush. Clean the electrode surfaces with a small ... to ... th ... ug

for a cracked or broken insulator, badly pitted electrodes, or other signs of failure. Replace as required.

Set the gap of all serviceable or new plugs to 0.028-0.032 inch by bending the ground electrode (Fig. 2).

After the gap has been adjusted, check the plugs on a testing machine. Compare the sparking efficiency of the cleaned and gapped plug with a new plug. Replace the plug if it fails to meet requirements. Apply a coating of oil to the shoulder of the plug where the insulator projects through the shell, and to the top of the plug, where the center electrode and terminal project from the insulator. Place the spark plug under pressure. Leakage is indicated by air bubbling through the oil. If the test indicates compression leakage, replace the plug. If the plug is satisfactory, wipe it clean.

If a major tune-up is being performed, leave the plugs out of the engine until after the compression test.


B1006-A

FIG. 1–Cleaning Plug Electrode

If a minor tune-up is being performed, install the spark plugs and torque them to 15-20 ft-lbs.

2. Take A Compression Reading Of Each Cylinder. Remove the coil high tension lead at the distributor cap. Set the throttle plates (primary throttle plates only on the 4-barrel carburetor) and choke plate in the wide open position.

Install a compression gauge in No. 1 cylinder.

Using a remote starter switch, crank the engine several times and record the highest reading recorded. Note the number of compression strokes required to obtain the highest reading.

Repeat the test on each cylinder, cranking the engine the same number of times for each cylinder as was required to obtain the highest reading on the No. 1 cylinder.

A variation of ±20 pounds from specified pressure (150 psi at cranking speed) is satisfactory. However, the compression of all cylinders should be uniform within 10 pounds.

A reading of more than the allowable tolerance above normal indicates excessive deposits in the cylinder.

A reading of more than the allowable tolerance below normal indicates leakage at the cylinder head gasket, piston rings, or valves.

A low even compression in two adjacent cylinders indicates a cylinder head gasket leak. This should be checked before condemning the rings or valves.

To determine whether the rings or the valves are at fault, squirt the equivalent of a tablespoon of heavy oil into the combustion chamber. Crank the engine to distribute the oil and repeat the compression test. The oil will temporarily seal leakage past the rings. If approximately the same reading is obtained, the rings are satisfactory, but the valves are leaking. If the compression has increased 10 pounds or more over the original reading, there is leakage past the rings.

During a compression test, if the pressure fails to climb steadily and remains the same during the first two successive strokes, but climbs higher on the succeeding strokes, or fails to climb during the entire test, it indicates a sticking valve.

After the compression test, install the spark plugs. Torque them to 15-20 ft-lbs. Do not install the coil high tension lead at this time.

3. Check And Tighten Intake Manifold Bolts. Check all intake manifold bolts for the recommended torque (23-28 ft-lbs). Torque the bolts as necessary starting at the center bolts and working outwards.

4. Free the Exhaust Gas Control Valve. Refer to Fig. 3 or 4. Check the thermostatic spring of the valve to make sure it is hooked on the stop pin. The spring stop is at the top of the valve housing when the valve is properly installed.

Make sure the spring holds the valve closed. Actuate the counterweight by hand to make sure it moves freely through approximately 90° of rotation without binding.

Free a stuck valve with FoMoCo Exhaust Gas Control Valve Solvent (COAA-19A501-A) or a penetrating oil and graphite mixture.

5. Check And Adjust The Deflection Of The Drive Belts. Check the deflection of the drive belts using tool 33-73F. Follow the instructions of the tool manufacturer. Adjust the tension as follows:

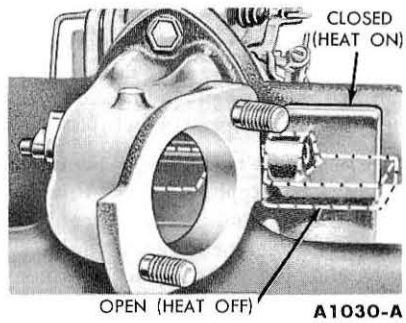


FIG. 3–223 Six Exhaust Gas Control Valve

SINGLE OR DOUBLE FAN BELTS AND ALL GENERATOR AND WATER PUMP BELTS.

Loosen the generator mounting bolts and the adjusting bracket bolt. Move the generator toward or away from the engine until the proper deflection is obtained between the water pump pulley and the generator pulley. Tighten the generator adjusting bracket bolt and the mounting bolts.

SEPARATE FAN BELT. Loosen the fan bracket mounting bolt. Slide the bracket up or down to obtain the recommended deflection between the fan pulley and the crankshaft pulley. Tighten the fan bracket mounting bolts.

On trucks equipped with an air compressor, it may be necessary to loosen the air compressor belt adjustment in order to obtain proper fan belt adjustment. When the fan belt adjustment is complete, always adjust the air compressor belt.

AIR COMPRESSOR BELT. Loosen the air compressor mounting bolts. Slide the compressor on its mounting bracket to obtain the recommended deflection between the compressor pulley and the fan pulley (crankshaft damper on a C-Series

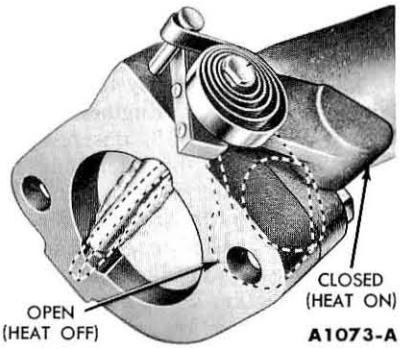


FIG. 4–292 MD V-8 Exhaust Gas Control Valve

truck.) Tighten the compressor mounting bolts. The air compressor belt should be adjusted whenever the fan belt is adjusted or replaced. Adjust the air compressor belt last.

6. Clean Fuel Pump Sediment Bowl And Replace Bowl Filter—Mechanical Fuel Pump. Clean the bowl and magnetic filter (if used) with cleaning solvent and dry them with compressed air (Fig. 5). Replace the gasket if it is defective.

If a filter element is used, discard the element and element gasket, and install a new element and gasket.

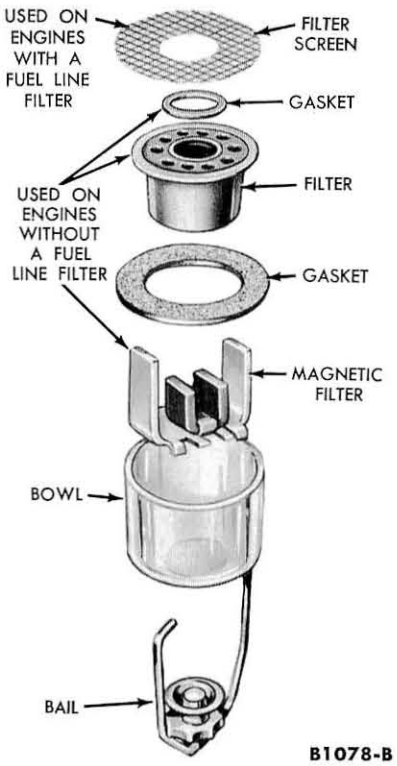


FIG. 5—Sediment Bowl

7. Drain Fuel System Filter—332 HD V-8. Remove the drain plug (Fig. 6) and drain the fuel from the filter into a suitable container. After draining, install the drain plug.

8. Replace Fuel System Filter Element—HD V-8 Engines. On a 292 or 302 HD V-8, unscrew the lower section of the filter, and remove it, the filter element, and the gasket (Fig. 7). Discard the filter element. Clean the lower section in solvent. Place a new filter element in

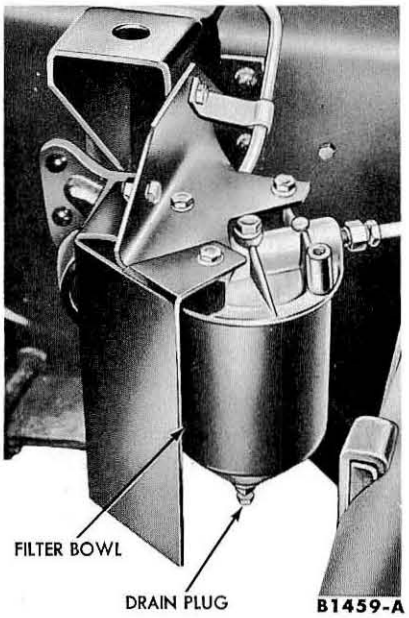


FIG. 6—332 HD Fuel Line Filter Installation

On a 332 HD V-8, drain the fuel from the filter bowl into a suitable container. Remove the center bolt and washer, then remove the filter bowl and gasket. Remove the filter element, gaskets, and spring assembly. Discard the filter element. Clean the filter bowl, and the inlet and outlet openings in the upper body. Inspect the bowl gasket and replace it if necessary. Position the gaskets and spring assembly in the filter bowl as shown in Fig. 8. Install a new element in the filter bowl. Position the filter and gasket against the upper body. Install and tighten the center bolt and washer.

9. Check And Adjust Carburetor Fuel Level

SINGLE-BARREL. Remove the power valve diaphragm cover and valve assembly.

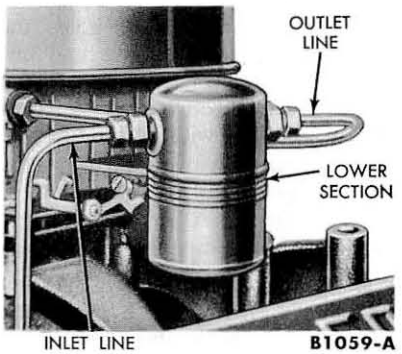


FIG. 7—292 and 302 HD V-8 Fuel Line Filter Installation

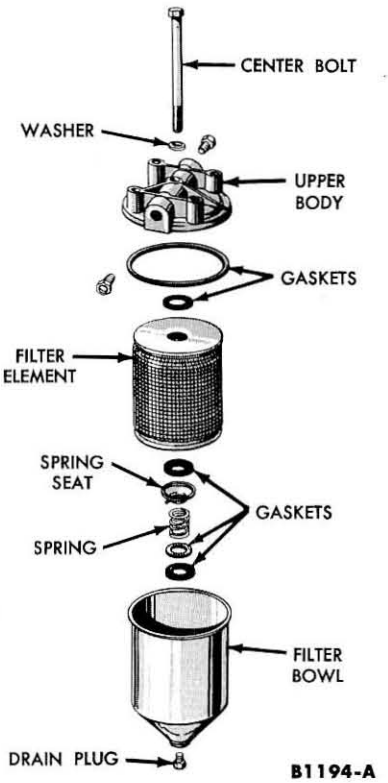


FIG. 8—332 HD Fuel Line Filter

Place the fuel gauge in the opening and crank the engine. The fuel should touch the tip of the "low" gauge pin and should not touch the tip of the "high" gauge pin (Fig. 9).

If the fuel level is too high or too low drain the fuel from the fuel bowl into a suitable container and remove the fuel bowl.

Install the dummy bowl using the fuel bowl gasket and three of the retaining screws (Fig. 9). Position a suitable container under the carburetor to collect any spill-over of fuel. To adjust the fuel level, bend the float arm tab. Crank the engine and check the fuel level.

DUAL AND 4-BARREL. Position the truck on a level floor. Be sure the fuel pump pressure is within specifications. Operate the engine until normal operating temperature has been reached. Place a suitable container below the fuel level sight plug to collect any spill-over of fuel (on a 4-barrel carburetor, check each bowl separately).

With the engine stopped, remove the fuel level sight plug and gasket and check the fuel level. The fuel level within the bowl should be at the lower edge of the sight plug opening ± 1/16 inch.

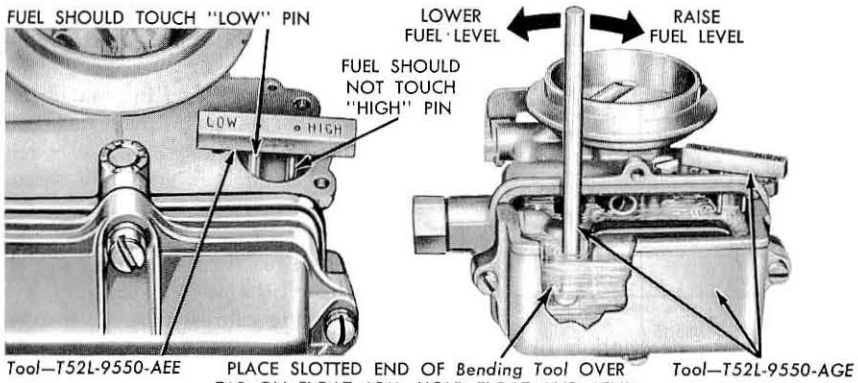


FIG. 9—Single-Barrel Fuel Level Check and Adjustment

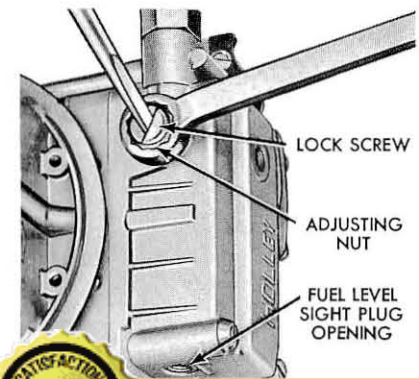
If the fuel level is satisfactory, install the sight plug. Do not install the air cleaner at this time.

If the fuel level is too high, drain the fuel bowl and fill it and check it again before altering the float setting.

If the fuel level is too high, it should first be lowered below specifications and then raised until it is just at the lower edge of the sight plug opening. If the fuel level is too low, it is only necessary to raise it to the specified level. Follow the procedure under "To Lower Fuel Level" or "To Raise Fuel Level," whichever is applicable.

TO LOWER FUEL LEVEL

1. With the engine stopped, loosen the lock screw on top of the fuel bowl just enough to allow rotation of the adjusting nut underneath (Fig. 10). **Do not loosen the lock screw or attempt to adjust the fuel level with the engine running because the pressure in the line will spray fuel out and present a fire hazard.**



2. Turn the adjusting nut approximately ½ turn in to lower the fuel level below specifications (⅛ turn of the adjusting nut, depending on the direction of rotation, will raise or lower the float assembly at the fuel level sight plug opening 3/64 inch).

3. Tighten the lock screw. Start the engine. After the fuel level has stabilized, stop the engine and check the level at the sight plug opening. The fuel level should be below specified limits. If it is not, repeat step 2, turning the adjusting nut an additional amount sufficient to lower the fuel below the specified level.

4. Loosen the lock screw and turn the adjusting nut out in increments of ⅛ turn or less until the correct fuel level is achieved. After each adjustment, tighten the lock screw, and then start the engine and stabilize the fuel level. Check the fuel level at the sight plug opening. Install the sight plug and gasket.

Do not install the air cleaner at this time.

TO RAISE FUEL LEVEL. Perform steps 1 and 4 under the procedure "To Lower Fuel Level."

10. Clean the Distributor Cap and Rotor. Disconnect the coil high tension lead and the spark plug wires at the distributor cap. Remove the distributor cap and rotor (and dust cover if applicable).

Clean the inside of the distributor cap and clean the rotor using a mild cleaning solvent or mineral spirits and a soft bristle brush. Remove dirt or corrosion from the sockets of the distributor cap. Inspect the cap for cracks, burned contacts, or permanent carbon tracks. Inspect the rotor for cracks or a burned tip. Replace the cap and/or rotor if they are defective.

Do not install the rotor or distributor cap at this time.

11. Check the Condition of the Distributor Breaker Points. Replace the breaker point assembly if the contacts are badly burned, pitted, or if excessive metal transfer between the points is evident.

If the breaker points have an overall grayish color and only slight roughness or pitting, they do not have to be replaced. However, they should be cleaned with chloroform and a stiff bristle brush.

If it is necessary to install new breaker points on a minor tune-up, refer to operation No. 20 "Replace the Breaker Points and Condenser."

12. Lubricate the Distributor Cam, Lubricating Wick, and the Distributor Bushing. Apply a light film of high temperature, non-fiber grease to the distributor cam. **Do not use engine oil.**

Saturate the lubricating wick of the V-8 engines with SAE 10W engine oil.

Squirt a few drops of SAE 10W engine oil into the distributor oil cup.

13. Clean Battery Cables and Terminals. Disconnect the battery cables. Wash the battery, including the terminals and the battery carrier, in cold water using a stiff bristle brush. If the battery is extremely dirty, use a baking soda solution. Inspect the battery cables for corrosion, fraying, or breaks. Apply grease to the battery terminals after cleaning. Connect and properly tighten the cable clamps.

14. Clean Positive Crankcase Ventilation System. Remove the crankcase ventilation regulator valve, exhaust tube, and connections. Disassemble the valve. Clean the valve and exhaust tube in clean carburetor solvent and dry them with compressed air. Clean the rubber hose connections with a low volatility petroleum base solvent and dry them with compressed air.

INSTRUMENT CHECKS

Always follow the instructions of the test unit manufacturer when performing instrument checks. All the tests except checking distributor spark advance, can be made in-chassis. Perform the tests in the sequence listed.

15. Check Battery State of Charge. The battery state of charge can be checked by measuring the battery electrolyte solution specific gravity (hydrometer) or by measur-

TABLE 2—Starter Motor Current Draw

Part Number	Normal Engine Cranking Speed (rpm)	Current Draw No Load @ 12 Volts
B6A-11002-A	150-180	110
B7T-11002-A	150-160	80
B8QH-11002-A	140-160	60
B8C-11002-A	140-160	85

ing the voltage of the battery cells on open circuit (no current flow) with a battery charge tester.

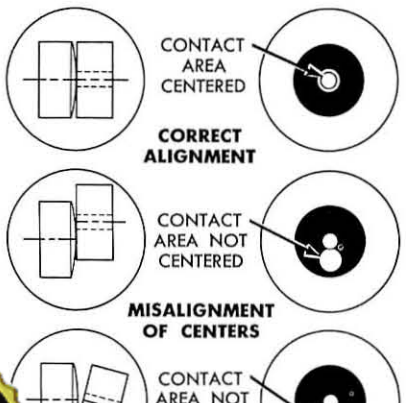
If a hydrometer is used, a specific gravity of 1.275-1.285 indicates a fully charged battery. 1.230-1.240 indicates approximately 60% charge. If the specific gravity varies more than 0.025 between cells, the battery should be replaced.

Refer to Part 12-1 which describes in detail the procedure to be followed.

16. Check Starter Motor Current Draw. Refer to Table 2 for the recommended current draw. A complete description of the testing procedure is covered in Part 12-2.

17. Check Coil Output. The coil tests include coil heat, secondary continuity, and coil capacity. The tests can be made with the coil installed on the engine or on a test set. Perform the tests following the instructions of the test set manufacturer.

18. Perform a Primary Circuit Resistance Test. Check the circuit from the battery to the coil (should be 6.9 volts), from the coil to ground (voltage drop should not exceed 0.1 volt), and check the starting ignition circuit (voltage drop should not exceed 0.1 volt).



A complete description of these tests are covered in Part 2-1.

19. Check and Adjust Breaker Point Dwell. If the contacts are excessively out of alignment, replace the breaker point assembly. Do not attempt to align used breaker points. If it is necessary to install a new breaker point assembly, refer to operation No. 20 "Replace The Breaker Points and Condenser."

Use a dwell meter only to check the gap of used breaker points. The roughness of used breaker points makes an accurate gap reading or setting with a feeler gauge impossible. Check and set the contact dwell for conformance to specification (Part 2-4) by following the instructions of the meter manufacturer. Always clean used points before adjusting.

20. Replace the Breaker Points and Condenser. The breaker points and the condenser can be replaced with the distributor installed in the engine. However, because check and adjust spark advance is part of a major tune-up, and because spark advance can be checked accurately only on a test set, remove the distributor from the engine and install it on a distributor test set at this time.

Remove the breaker point assembly and condenser attaching screws and remove the breaker points and condenser. Position the new condenser in place on the breaker plate and install the attaching screws.

Turn the cam so that the breaker points are closed and align the breaker points to make full face contact (Fig. 11). Make the necessary adjustment by bending the stationary breaker point bracket (Fig. 12). **Do not bend the breaker arm.**

New breaker points can be adjusted with a feeler gauge or a dwell meter.

To make the adjustment with a feeler gauge (Fig. 13):

Rotate the distributor cam until the rubbing block rests on the peak of a cam lobe. Insert the correct blade of a **clean** feeler gauge between the breaker points. If the fit is loose or if there is binding, loosen the stationary point lock screw and adjust the gap. The gap should be set to the larger opening because the rubbing block will wear down slightly while seating to the cam. Apply a light film of high-temperature, nonfiber grease to the cam. **Do not use engine oil to lubricate the distributor cam.**

If a dwell meter is used to adjust new points, set the contact dwell to

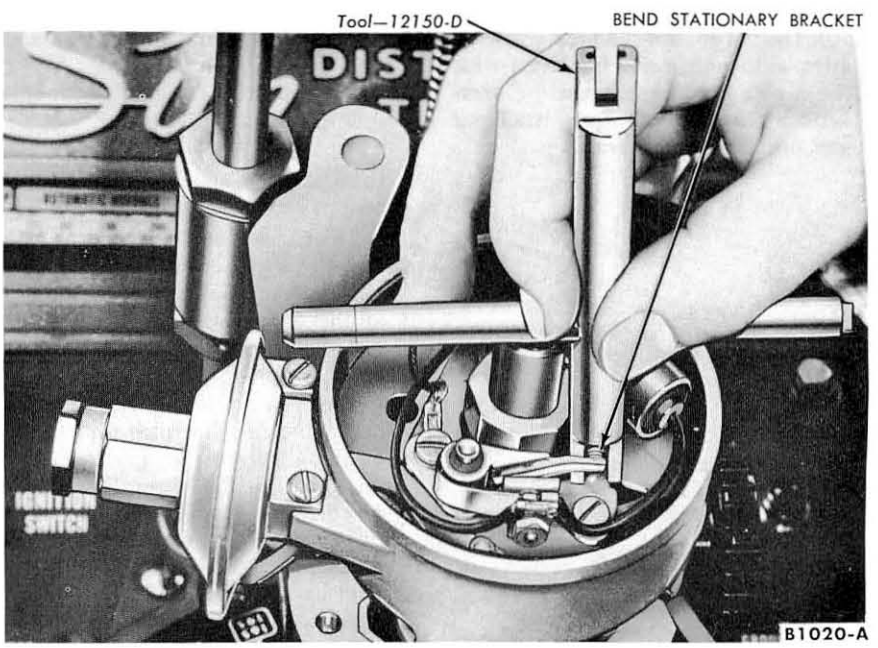


FIG. 12—Aligning Breaker Points

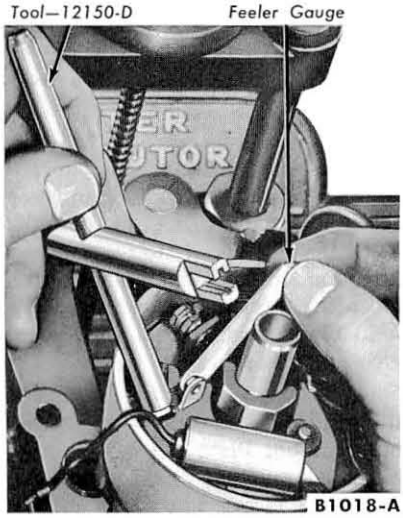


FIG. 13—Adjusting New Breaker Point Gap

the low setting. New points should be set to the low contact because the rubbing block will wear down slightly while seating to the cam.

Leave the distributor on the test set until after Operation No. 21 has been performed.

21. Check and Adjust Distributor Spark Advance. Refer to the procedure for the applicable engine in Part 2-1.

After the spark advance has been checked and adjusted, install the dust cover if applicable and the rotor and install the distributor in the block. Install the distributor cap. Insert each distributor wire in the proper distributor cap socket. Be sure the wires are forced all the way down into their sockets. The No. 1 socket is identified on the cap. Starting at the No. 1 socket, install the wires in the direction of distributor rotation (clockwise on the 223 Six and counterclockwise on V-8 engines) in the firing order (1-5-3-6-2-4 on the 223 Six and 1-5-4-8-6-3-7-2 on all V-8 engines). Push all weather seals into position.

22. Perform a Spark Intensity Test of Each Spark Plug Wire. Check the spark intensity of one wire at a time. Install a terminal adapter in the terminal of the wire to be checked. Hold the adapter approximately 3/16 inch from the exhaust and crank the engine with

TABLE 3—Fuel Pump Pressure and Capacity

Engine	Pressure—psi	Capacity
223 Six and 292 MD V-8	3.5-5.5 @ 500 rpm	1 pint within 30 seconds
292 and 302* HD V-8	3.5-6.5 @ 500 rpm	1 pint within 30 seconds
302** and 332 HD V-8	2 psi @ 11.8-12.3 volts***	1 quart within 40 seconds***

*with mechanical fuel pump
**with electric fuel pump
***3 psi and 1 pint in 15 seconds or less at fuel tank outlet

MECHANICAL FUEL PUMP. Disconnect the fuel line at the carburetor. Install a pressure gauge (0-15 psi) and a petcock between the gauge and the carburetor fuel inlet line. Vent the system, by opening the petcock momentarily, prior to taking a pressure reading. Operate the engine at the specified rpm. After the pressure has stabilized it should be within specifications (Table 3).

Operate the engine at 500 rpm. Open the petcock and expel the fuel into a suitable container. Observe the time required to expel one pint. It should be within specifications (Table 3).

ELECTRIC FUEL PUMP.

Disconnect the fuel line at the carburetor.

Using ¼-inch pipe fittings, install a pressure gauge (0-15 psi), then a ¼-inch gate valve to the carburetor fuel inlet line.

Install a flexible hose in the gate valve so that the fuel can be expelled into a suitable container. Use of smaller than ¼-inch fittings will restrict the fuel flow.

Operate the fuel pump with the primer switch. Adjust the gate valve to obtain the specified pressure (Table 3). Expel the fuel into a suitable container. Engage the primer switch and observe the time required to expel one pint. Refer to Table 3 for the correct specifications.

If the fuel flow is below specified requirements, check the fuel pump at the outlet in the tank. This check will establish whether there is a restriction in the fuel line or the fuel pump is defective. At the fuel tank outlet, the fuel pump pressure and capacity should be within specifications (Table 3).

WHILE ENGINE IS WARMING UP

Place the transmission selector lever in neutral position and set the parking brake. Start the engine and operate it **at 1200 rpm for 30 minutes** to stabilize engine temperatures. While the engine is warming up, perform the following operations:

24. Clean Carburetor Air Cleaner

DRY TYPE. Direct compressed air against the element in the opposite direction of normal air flow, that is, from the inside of the filter out.

Clean the air cleaner body and cover in cleaning solvent, then wipe dry.

Do not install the air cleaner at this time.

OIL BATH. Remove the air cleaner from the carburetor. Remove the cover and drain the oil from the reservoir. Wash all the air cleaner parts in a suitable cleaning solvent. Dry them with compressed air.

Inspect the gasket between the oil reservoir chamber and cleaner body and replace it if necessary.

Saturate the filter element and fill the oil reservoir to the indicated level with the recommended viscosity engine oil (Group 16).

Do not install the air cleaner at this time.

25. Replace Dry-Type Air Cleaner Element. Remove the air cleaner from the carburetor and remove the element from the air cleaner body. Wash the air cleaner body and cover in solvent and wipe them dry. Insert a new filter element in the air cleaner body. Do not install the air cleaner at this time.

26. Check and Adjust Ignition Timing. On a Loadomatic or a dual advance distributor, disconnect the distributor vacuum line.

Connect the timing light high tension lead to the No. 1 spark plug and the other two leads of the timing light to the battery terminals. Do not

TABLE 4—Ignition Timing

Engine	Transmission	Timing Specification
223 Six	Manual Shift Automatic	4° B.T.D.C. 6° B.T.D.C.
292 MD and HD V-8	Manual-Shift Automatic	6° B.T.D.C. 6° B.T.D.C.
302 and 332 HD V-8	Manual-Shift Automatic	8° B.T.D.C. 8° B.T.D.C.

puncture the spark plug wire or moulded cap.

Clean the dirt from the timing marks and, if necessary, chalk the proper mark and the pointer to improve legibility.

Operate the engine at idle speed. Be sure the engine is idling below 550 rpm so that there will be no centrifugal advance on engines with a dual advance distributor or centrifugal advance distributor. The timing light should flash just as the proper mark lines up with the pointer or pin indicating correct timing. The operator's eye should be in line with the center of the damper and the timing pointer. Refer to Table 4 for the correct specifications.

27. Check Generator or Alternator Output. Refer to Table 5 for the recommended output specifications. A complete description of the test procedure is covered in Part 12-2.

TABLE 5—Generator or Alternator Current Output

Part Number	Amperes	Generator rpm
C0TF-10000-J	30	2525
C1TF-10300-D	60	3400

ENGINE OPERATING AT NORMAL TEMPERATURE

28. Adjust Accelerator Pump Link to Seasonal Position. Acceleration requirements in various climates are satisfied by controlling the quantity of fuel discharged by the accelerating pump.

SINGLE BARREL. The pump stroke is controlled by changing the position of the pump link in the throttle lever (Fig. 14). The inner

DUAL AND 4-BARREL. The top hole (No. 1) in the accelerating pump cam (Fig. 15 or 16) is for warm weather (providing minimum pump discharge). The bottom hole (No. 2) in the accelerating pump cam is for extreme cold weather operation (providing the maximum pump discharge).

To change the stroke, install the screw in the desired hole in the cam.

In addition, the accelerating pump lever screw (Fig. 15 or 16) should be properly adjusted as follows:

With the throttle plates in the wide open position, check the clearance between the accelerating pump operating lever adjusting screw head and the pump arm when the pump arm is fully depressed manually. Turn the adjusting screw in to increase the clearance and out to decrease the clearance. One-half turn of the adjusting screw is equal to 0.015 inch.

29. Check and Adjust Engine Idle Speed. Final engine idle speed may be varied to suit the conditions under which the truck is to be operated. Refer to Fig. 14, 15, or 16.

SINGLE-BARREL CARBURETOR. Install a tachometer on the engine.

On a truck with a manual-shift transmission, place the transmission selector lever in neutral position. Turn the idle speed stop screw in a direction to obtain 500-550 rpm. Open the throttle by hand and allow it to close normally. Check the engine idle speed.

On a truck with an automatic transmission, be sure the parking brake is on. Place the transmission selector lever in drive range position. Check the engine idle speed and adjust it to 475-525 rpm.

Leave the tachometer installed until the idle fuel mixture has been adjusted.

DUAL CARBURETOR. Place the transmission selector lever in neutral position and set the parking brake.

Attach a tachometer to the engine.

On a truck with a manual-shift transmission, with the transmission selector lever in neutral position, turn the idle speed stop screw in a direction to obtain 500-550 rpm. Open the throttle by hand and allow it to close normally. Check the engine idle speed.

On a truck with an automatic transmission, the idle speed is adjusted in drive range. Set the parking brake and place the selector lever in

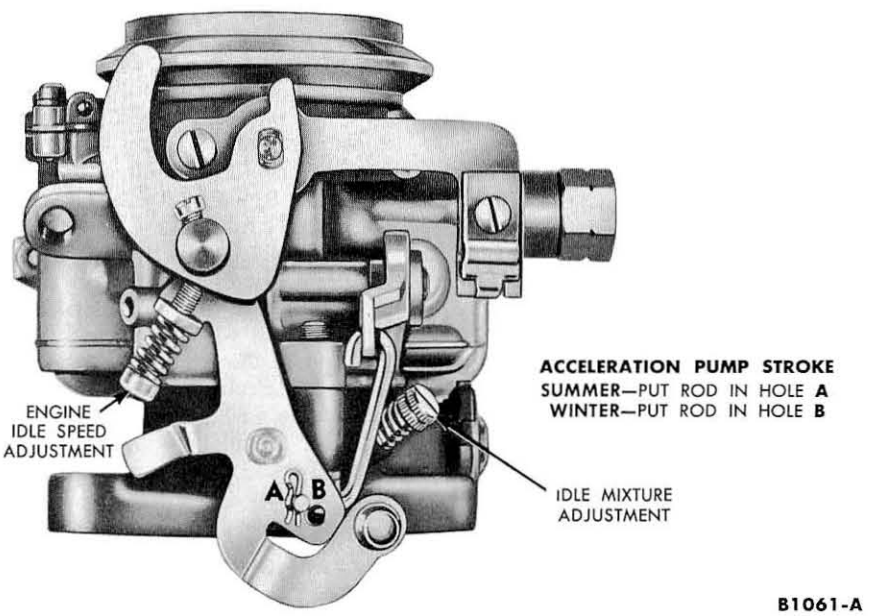


FIG. 14—Single-Barrel Carburetor Adjustments

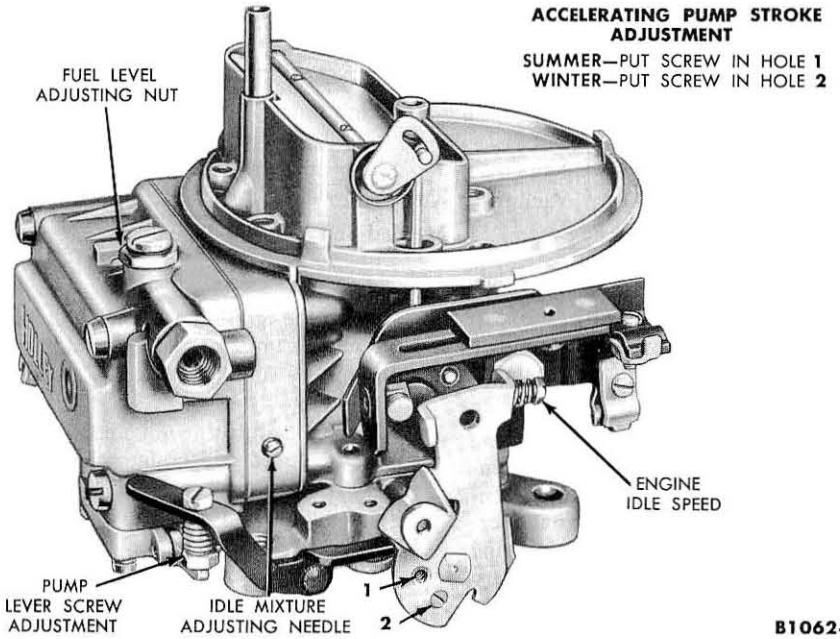


FIG. 15—Dual Carburetor Adjustments

drive range position. Check the engine idle speed. Adjust the engine idle speed to 475-525 rpm. The fast idle speed is automatically adjusted when engine idle speed is correctly adjusted.

4-BARREL CARBURETOR. Turn the idle speed stop screw in a direction to obtain 525-575 rpm. Open the throttle by hand and allow it to close normally. Check the engine idle speed.

After the hot engine idle speed has been adjusted, adjust the fast idle speed, as follows:

With the primary throttle plates closed, measure the clearance between the fast idle cam and the head of the fast idle screw (Fig. 17). The clearance should be 0.010-0.015 inch.

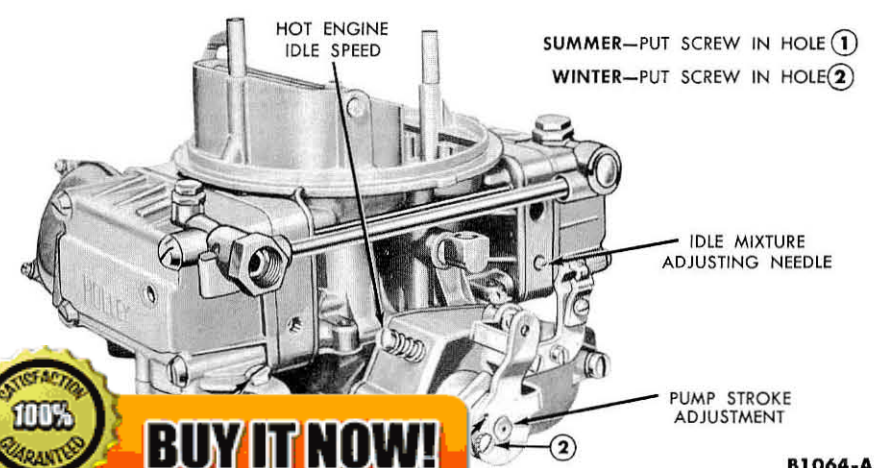
If the clearance is not to specifications, remove the governor housing following the procedure in the carburetor overhaul section (Part 3-2).

Insert a 0.060-inch diameter wire or rod into the hole in the end of the fast idle screw fitting to prevent it from turning.

Turn the fast idle screw the required amount to increase or decrease the clearance. A ¼ turn in or out will alter the clearance by approximately 0.008 inch.

Install the governor housing on the carburetor and check the clearance between the fast idle cam and the head of the screw.

When the clearance is correctly adjusted, install the governor lever, retaining washer and nut. Hook the governor spring to the lever. Install the governor housing cover and the choke operating lever.



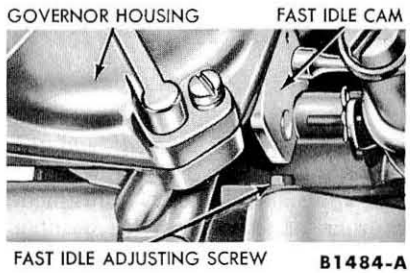


FIG. 17—HD V-8 Fast Idle Speed Adjustment

30. Check and Adjust Idle Fuel Mixture (Refer to Fig. 14, 15, or 16).

1. Make the initial mixture adjustment by turning the needle(s) in until it lightly touches the seat, then back it off 1-1½ turns. **Do not turn the needle against the seat tight enough to groove the point. If the needle is damaged it must be replaced before a proper mixture adjustment can be obtained.**

2. Turn the mixture needle(s) in until the engine begins to run rough from the lean mixture. Turn the needle(s) out until the engine begins to "roll" from the rich mixture. Then turn the needle(s) in until the engine runs smoothly. Always favor a slightly rich mixture rather than a lean mixture.

3. Check the engine idle speed. Remove the tachometer.

31. Check and Adjust Anti-Stall Dashpot Clearance — Fordomatic

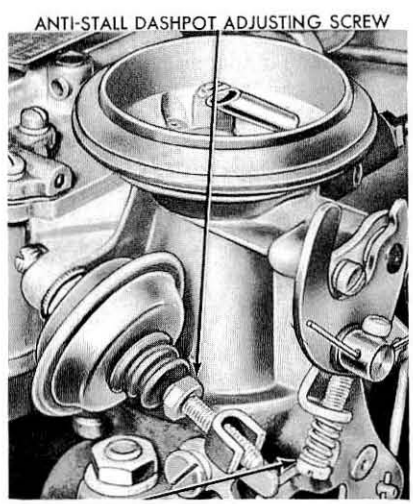


FIG. 18—Single-Barrel Anti-Stall Dashpot Adjustment

and HD Cruise-O-Matic Transmission

223 SIX

1. With the engine idle speed and mixture properly adjusted, and the engine at operating temperature, turn the anti-stall dashpot adjustment screw in or away from the dashpot plunger (Fig. 18).

2. Hold the throttle in the closed position. Depress the plunger with a screw driver blade. Turn the adjustment screw out or toward the plunger until a clearance of 0.060-0.090 inch is obtained between the screw head and the tip of the plunger.

V-8 ENGINES

1. Loosen the anti-stall dashpot lock nut (Fig. 19).

Hold the throttle in the closed position and depress the plunger with a screw driver blade. Turn the dashpot in its bracket in a direction to provide a clearance of 0.060-0.090 inch between the plunger and the throttle lever. Tighten the lock nut after the adjustment is made.

32. Check and Adjust Engine Governed Speed

VELOCITY GOVERNOR. Connect a tachometer to the engine. With the engine at normal operating temperature, operate the engine at wide open throttle and compare the rpm registered with the operating range of the governor (Table 6). The operating range of the governor is stamped on the governor plate.

If the governed speed is within the range, stop the engine and remove the tachometer.

If the governed speed needs to be adjusted, remove the governor seal (Fig. 20). To increase engine rpm, turn the cap counterclockwise. To decrease engine rpm, turn the cap clockwise. When final adjustment is complete, stop the engine, seal the cap, and remove the tachometer.

TABLE 6—Engine Governed Speed

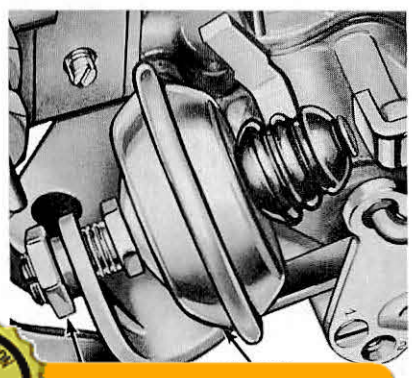
Engine	Type of Governor			
223 Six	Velocity	low range 1800-3000 high range 2800-3800		
292 MD	Velocity	low range 1800-3500 high range 2500-2900		
292, 302 and 332 HD	Vacuum	Automatic	3800*	4000**
		Manual-Shift	3400-3800*	3600-4000**

*load **no load

VACUUM GOVERNOR. If the truck is not equipped with a tachometer, install a tachometer on the engine. With the engine at normal operating temperature, operate the engine at wide open throttle and compare the rpm registered with specifications (Table 6).

If the governed speed is within specifications, stop the engine and remove the tachometer if one was installed for the check.

If the governed speed needs to be adjusted, stop the engine and remove the adjusting hole plug from the controlling unit housing.



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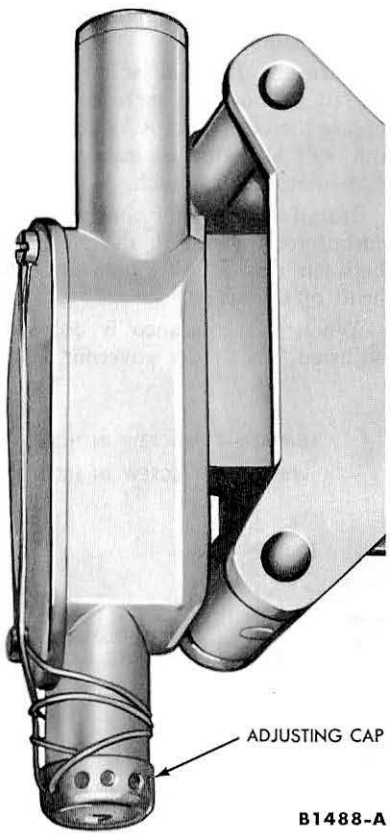


FIG. 20—Velocity Governor Adjustment

With the ignition switch off, crank the engine until the governor adjusting nut is aligned with the adjustment hole.

Turn the adjusting nut clockwise to increase speed and counterclockwise to decrease speed. One full turn of the adjusting screw will change top speed about 150 rpm.

Repeat the above procedure until the proper top speed is reached.

Install the adjusting hole plug and tighten it securely.

Attach a new locking wire and lead seal to the adjusting hole plug and the adjacent fin.

33. Check and Adjust Valve Lash. It is very important that the valve lash be held to the correct specifications because:

If the lash is set too close, the valve will open too early and close too late, resulting in rough engine idle. Burning and warping of the valves will occur also because the valves cannot make firm contact with the seats long enough to cool properly. If the lash is excessive, it will cause the valve to open too late and close too early causing valve bounce. In addition, damage to the camshaft lobe is likely because the

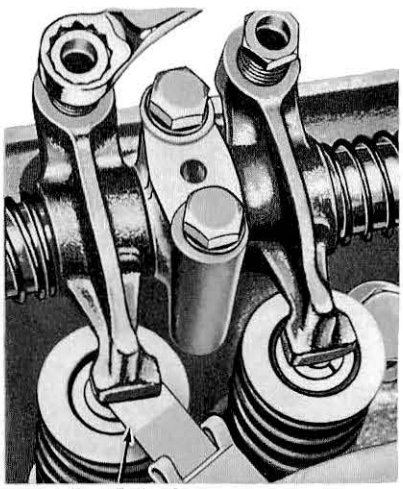


FIG. 21—Valve Lash Adjustment

TABLE 7—Valve Lash Specifications

	Cold		Final (Hot)	
Engine	Intake	Exhaust	Intake	Exhaust
223 Six	0.019	0.019	0.019	0.019
292 MD and HD V-8	0.019	0.019	0.018	0.018
302 and 332 HD V-8	0.020	0.020	0.020	0.020

tappet foot will not follow the pattern of the camshaft lobe causing a shock contact between these two parts.

Be sure the engine is at normal operating temperature before attempting to set the valve lash.

With the engine idling, set the valve lash (Fig. 21) **using a step-type feeler gauge only ("go" and "no go").** The final (hot) intake and exhaust valve lash specifications are listed in Table 7.

For example to obtain the correct setting on the 223 Six, use a step-type feeler gauge of 0.018 inch ("go") and 0.020 inch ("no go"). The "go" step should enter, and the "no go" step should not enter. The resultant setting will be to the required specification (0.019 inch).

ADDITIONAL IN-CHASSIS ENGINE TESTS AND ADJUSTMENTS

CAMSHAFT LOBE LIFT

1. Remove the air cleaner and the valve rocker arm cover(s).

2. Loosen the valve rocker arm adjusting screw.

3. Slide the rocker arm assembly serving the camshaft lobe to be checked to one side. Secure it in this position. To move the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and washers and slide the rocker arms off the shaft.

4. Make sure the push rod is in the tappet socket. Install a dial indicator in such a manner as to have the actuating point of the indicator in the push rod cup and in the same plane as the push rod movement (Fig. 22).

5. Turn the crankshaft damper slowly in the direction of rotation until the tappet is on the base circle of the camshaft lobe. At this point, the push rod will be in its lowest position.

6. Zero the dial indicator. Continue slowly until the push rod is in the fully raised position.

7. Compare the total lift recorded on the indicator with specifications.

8. To check the accuracy of the original indicator reading, continue to rotate the damper until the indicator reads zero.

9. Remove the dial indicator and secure the rocker arm(s). If an end rocker arm was removed, install the rocker arm, washers, and retaining pin.

10. Perform a preliminary valve lash adjustment as necessary.

11. Operate the engine for 30 minutes at approximately 1200 rpm and check and adjust the valve lash.

12. Install the valve rocker arm cover(s) and the air cleaner.

MANIFOLD VACUUM TEST

A manifold vacuum test aids in determining the condition of an engine and also in helping to locate the cause of poor engine performance. To test manifold vacuum:

1. Operate the engine for a minimum of 30 minutes at 1200 rpm.

2. Install an accurate, sensitive vacuum gauge on the manifold vacuum line or on the fitting in the intake manifold.

3. Operate the engine at recom-

TABLE 8—Manifold Vacuum Gauge Readings

Gauge Reading (Inches Hg)	Engine Condition
17 (302 and 332 HD V-8) 18 (223 Six, 292 MD and HD V-8)	Normal.
Low and steady.	Loss of power in all cylinders caused possibly by late ignition or valve timing, or loss of compression due to leakage around the piston rings.
Very low.	Manifold, carburetor, or cylinder head gasket leak.
Needle fluctuates steadily as speed increases.	A partial or complete loss of power in one or more cylinders caused by: a leaking valve; cylinder head or intake manifold gasket leak; a defect in the ignition system; or a weak valve spring.
Gradual drop in reading at engine idle.	Excessive back pressure in the exhaust system.
Intermittent fluctuation.	An occasional loss of power possibly caused by a defect in the ignition system or a sticking valve.
Slow fluctuation or drifting of the needle.	Improper idle mixture adjustment, carburetor or intake manifold gasket leak.

mended idle rpm, with the transmission selector lever in neutral.

4. Check the vacuum reading on the gauge.

TEST CONCLUSIONS

Manifold vacuum is affected by carburetor adjustment, valve timing, the condition of the valves, cylinder compression, and leakage of the intake manifold, carburetor, or cylinder head gaskets.

Because abnormal gauge readings may indicate that more than one of the above factors is at fault, exercise caution in analyzing an abnormal reading. For example, if the vacuum is low, the correction of one item may increase the vacuum enough to indicate that the trouble has been corrected. It is important, therefore, that each cause of an abnormal reading be investigated and further tests conducted where necessary in order to arrive at the correct diagnosis of the trouble.

Table 8 lists various types of readings and their possible causes.

Allowance should be made for the effect of altitude on the gauge reading. The engine vacuum will decrease with an increase in altitude.

PRELIMINARY (COLD) VALVE LASH

If the valve rocker arm shaft assembly has been removed and installed, it will be necessary to make a preliminary (cold) valve lash adjustment before starting the engine. If the adjustment is made for an engine tune-up, follow the final adjustment procedure (page 1-16).

223 SIX. The cylinders are numbered from front to rear 1-2-3-4-5-6 and the valves are arranged from front to rear E-I-I-E-I-E-E-I-E-I-I-E.

1. Turn all the valve adjusting screws until interference is noted. Check the torque required to turn the screw further. If the torque required to turn a screw is less than 3 ft-lbs. (36 in-lbs.), try a new self locking adjusting screw. If this is still unsatisfactory, replace the rocker arm and adjusting screw.

2. Make two chalk marks on the crankshaft damper (Fig. 23). Space the marks approximately 120° apart so that with the timing mark, the damper is divided into three equal parts (120° represents 1/3 of the distance around the damper circumference).

3. Using a remote starter switch, rotate the crankshaft until the No. 1 piston is near TDC at the end of the compression stroke. The No. 1 piston is on TDC at the end of the compression stroke when both valves are closed and the timing mark on the crankshaft damper is in line with the timing pointer.

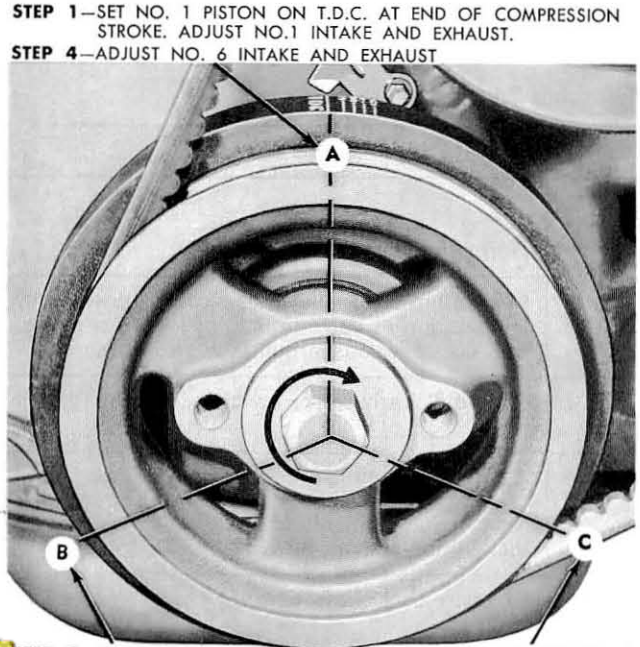
4. Adjust the intake and exhaust valve lash for No. 1 cylinder (Fig. 21). The valve lash setting is listed in Table 7. **Use a step-type feeler gauge ("go" and "no go") to adjust the valves.**

5. Repeat this procedure for the remaining set of valves, turning the crankshaft with a remote starter switch, 1/3 turn at a time, in the direction of rotation, while adjusting the valves in the firing order sequence (1-5-3-6-2-4). This procedure requires two complete turns of the crankshaft.

V-8 ENGINES. The cylinders are numbered from front to rear—right bank, 1-2-3-4; left bank, 5-6-7-8.

1. Follow step 1 under the 223 Six.

2. Make three chalk marks on



...e Lash

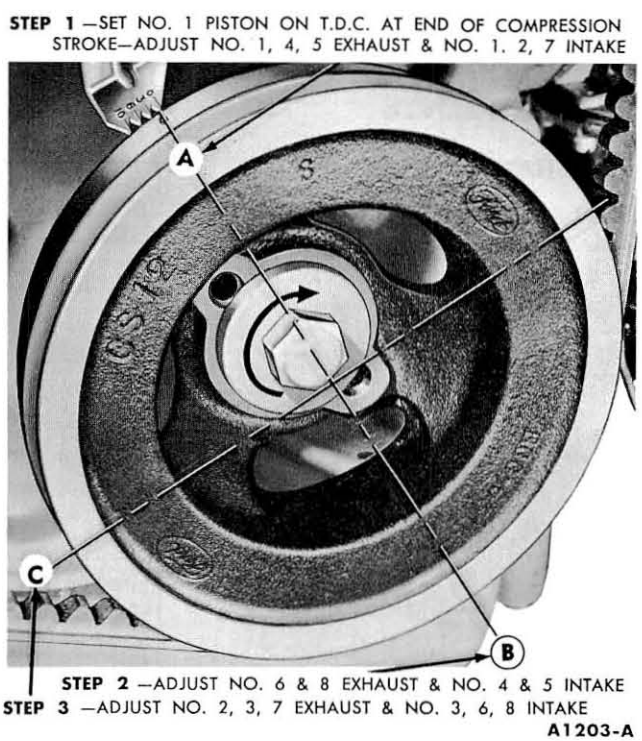


FIG. 24—V-8 Preliminary Valve Lash

the crankshaft damper (Fig. 24). Space the marks approximately 90° apart so that with the timing mark, the damper is divided into four equal parts (90° represents 1/4 of the distance around the damper circumference). Set the intake and exhaust valve lash to specifications. The valve lash settings are listed in Table 7. **Use a step-type feeler gauge ("go" and "no go") to adjust the valves.**

3. Using a remote starter switch, rotate the crankshaft until No. 1 piston is near TDC at the end of the compression stroke. Adjust the following valves:

No. 1 Exhaust	No. 1 Intake
No. 4 Exhaust	No. 2 Intake
No. 5 Exhaust	No. 7 Intake

4. Using a remote starter switch, rotate the crankshaft 180° or ½ turn (this puts No. 4 piston on TDC), then adjust the following valves:

No. 6 Exhaust	No. 4 Intake
No. 8 Exhaust	No. 5 Intake

5. Using a remote starter switch, rotate the crankshaft 270° or ¾ turn from 180° (this puts No. 3 piston on TDC), then adjust the following valves:

No. 2 Exhaust	No. 3 Intake
No. 3 Exhaust	No. 6 Intake
No. 7 Exhaust	No. 8 Intake

3 CLEANING, INSPECTION, AND RECONDITIONING

INTAKE MANIFOLD

Clean the manifold in a suitable solvent, then dry it with compressed air.

Inspect the manifold for cracks, leaks, or other defects that would make it unfit for further service. Replace all studs that are stripped or otherwise damaged. **Remove all filings and foreign matter that may have entered the manifold as a result of repairs.**

EXHAUST MANIFOLD

Inspect the manifold(s) for cracks, leaks, or other defects that would make them unfit for further service.

VALVE ROCKER ARM SHAFT ASSEMBLY

CLEANING AND INSPECTION

Clean all the parts thoroughly. Make sure that all oil passages are open.

Check the clearance between each rocker arm and the shaft by checking the ID of the rocker arm bore and the OD of the shaft. If the clearance between any rocker arm and the shaft exceeds the wear limit, replace the shaft and/or the rocker arm. Inspect the shaft and the rocker arm bore for nicks, scratches, scores, or scuffs.

Inspect the pad at the valve end of the rocker arms for a grooved radius.

Check the rocker arm adjusting screws and the push rod end of the rocker arms for stripped or broken and the ball end of the screw for nicks, scratches

REPAIRS

Dress up minor surface defects on the shaft and in the rocker arm bore with a hone.

If the pad at the valve end of the rocker arms has a grooved radius, replace the rocker arm. **Do not attempt to true this surface by grinding.**

PUSH RODS

INSPECTION

Check the ends of the push rods for nicks, grooves, roughness, or excessive wear.

The push rods can be visually checked for straightness while they are installed in the engine by rotating them with the valve closed. They also can be checked between cup and ball centers with a dial indicator (Fig. 25).

REPAIRS

If the runout exceeds the maximum limit at any point, discard the rod. **Do not attempt to straighten push rods.**

CYLINDER HEADS

CLEANING

With the valves installed to protect the valve seats, remove deposits from the combustion chambers and valve heads with a scraper and a wire brush. **Be careful not to damage the cylinder head gasket surface.** After the valves are removed, clean the valve guide bores with a valve guide cleaning tool. Use cleaning solvent to remove dirt, grease, and other deposits.

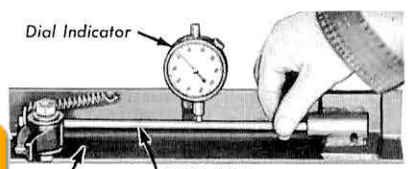


FIG. 25—Push Rod Runout

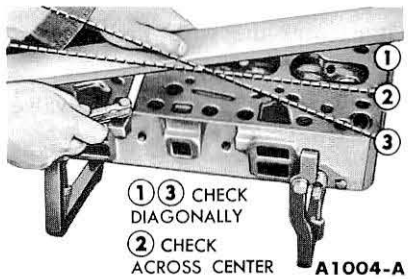


FIG. 26—Cylinder Head Flatness

INSPECTION

Check the cylinder head for cracks, and the gasket surface for burrs and nicks. Replace the head if it is cracked.

Check the valve seat insert for signs of excessive wear, cracks, or looseness (intake and exhaust on 302 and 332 HD V-8 exhaust only on the 292 HD V-8 engine).

Cylinder Head Flatness. Check the flatness of the cylinder head gasket surface (Fig. 26).

Valve Seat Runout. Check the valve seat runout with an accurate gauge (Fig. 27). Follow the instructions of the gauge manufacturer. If the run-

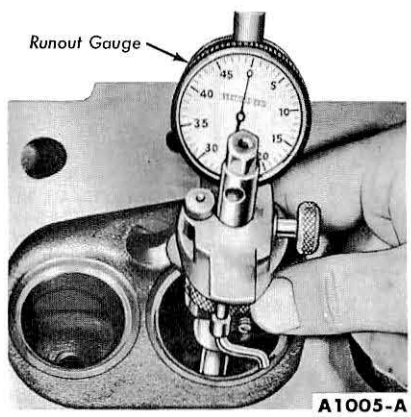


FIG. 27—Valve Seat Runout

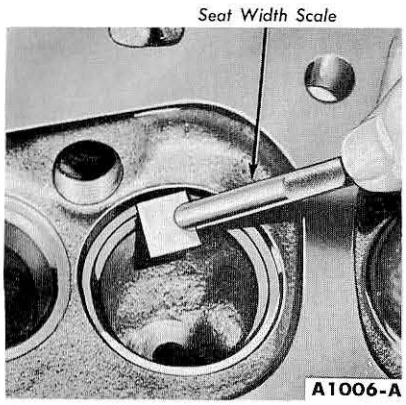


FIG. 28—Valve Seat Width

out exceeds the wear limit, reface the valve and valve seat.

Valve Seat Width. Measure the valve seat width (Fig. 28).

REPAIRS

Replace the head if it is cracked. **Do not plane or grind more than 0.010 inch from the cylinder head gasket surface.** Remove all burrs or scratches with an oil stone.

Reaming Valve Guides. If it becomes necessary to ream a valve guide (Fig. 29) to install a valve with an oversize stem, a reaming kit is available which contains the following reamer and pilot combinations: a 0.003-inch O.S. reamer with a standard diameter pilot; a 0.015-inch O.S. reamer with a 0.003-inch O.S. pilot; and a 0.030-inch reamer with a 0.015-inch O.S. pilot.

When going from a standard size valve to an oversize valve, always use the reamers in sequence. **Reface the valve seat after the valve guide has been reamed.**

Refacing Valve Seats. Refacing of the valve seats should be closely coordinated with the refacing of the valve face so the finished seat will match the valve face and be centered. This is important so that the valve and seat will have a good compression and vacuum tight fit. Be sure that the refacer grinding wheels are properly dressed.

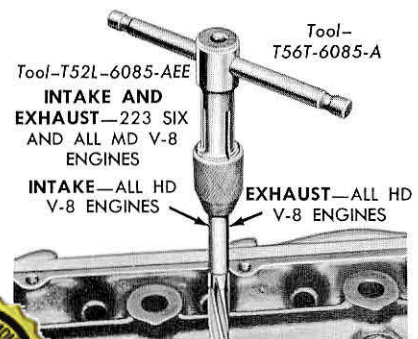
Grind the valve seat to a true 45° angle (Fig. 30). Remove only enough stock to clean up pits, grooves, or to correct the valve seat runout. After the seat is ground, measure the seat width (Fig. 28). Narrow the seat, if necessary to bring it within limits.

If the valve seat width exceeds the maximum limit, remove enough stock from the top edge and/or bottom edge of the seat to reduce the width to specifications (Fig. 30). Use a 60° angle grinding wheel to remove stock from the bottom of the seat (raise the seat). Use a 30° angle wheel to remove stock from the top of the seat (lower the seat).

The finished valve seat should contact the approximate center of the valve face. It is good practice to determine where the valve seat contacts the face. To do this, coat the seat with Prussian blue, then set the valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of the valve face, the contact is satisfactory. If the blue is transferred to the top edge of the valve face, lower the valve seat. If the blue is transferred to the bottom edge of the valve face, raise the valve seat.

Valve Seat Insert Replacement—HD V-8 Engines. Exhaust valve seat inserts are used in the 292 HD V-8. Intake and exhaust valve seat inserts are used in the 302 and 332 HD V-8. To replace the valve insert:

1. Invert the cylinder head.
2. Position a drift in the valve port.
3. Drive the insert out.
4. Counterbore the insert recess to specifications (Fig. 31). Cut slightly below the old counterbore depth to clean up this face (approximately 0.001-0.002 inch).
5. Clean out chips and oil from the recess.
6. Chill the oversize insert and the installation tool in dry ice for ½ hour. **The insert must be installed immediately upon removal from the dry ice. Protect the hands when handling the chilled insert and tool.**
7. Position the insert on the tool with the small radius on the outer edge facing outward.
8. Pilot the driving tool in the valve guide, then drive the insert into the counterbore until it is **fully** seated. Do not peen the area around the insert.
9. Reface the new insert.



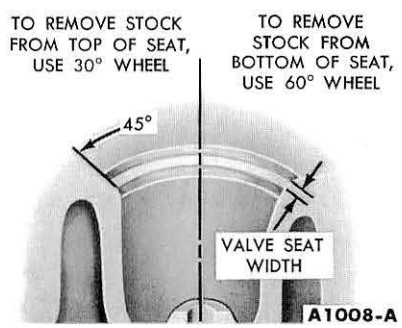


FIG. 30—Valve Seat Refacing

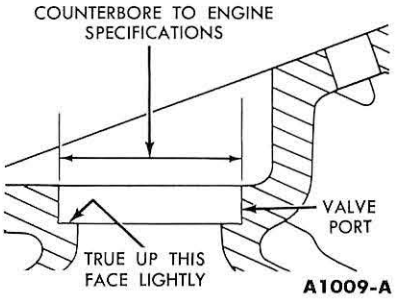


FIG. 31—HD V-8 Counterbore for Oversize Insert

VALVES

CLEANING

Remove all deposits from the valve with a fine wire brush or buffing wheel.

INSPECTION

The critical inspection points and tolerance of the valve are illustrated in Fig. 32.

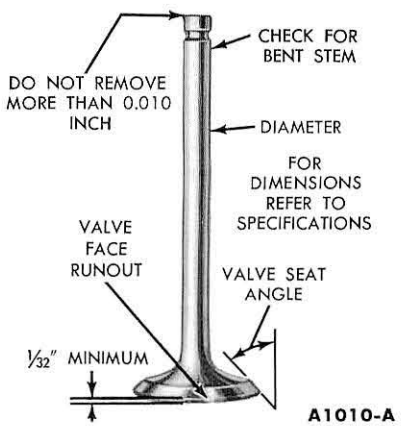


FIG. 32—Critical Valve Tolerances

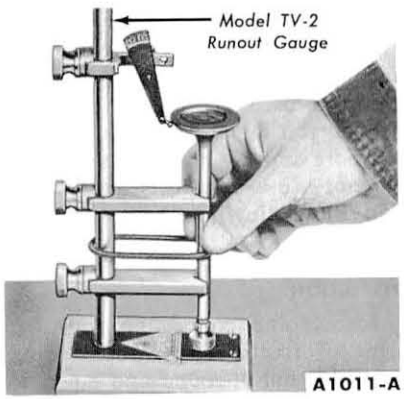


FIG. 33—Valve Face Runout

Inspect the valve face and the edge of the valve head for pits, grooves, scores, or other defects. Inspect the stem for a bent condition and the end of the stem for grooves or scores. Check the valve head for signs of burning or erosion, warpage, and cracking.

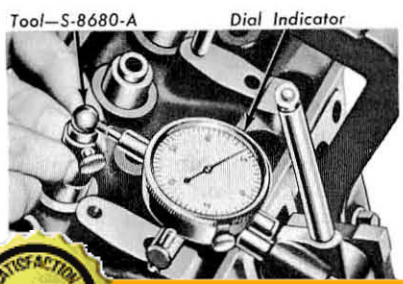
Inspect the valve springs, valve spring retainers, locks, and sleeves for defects.

Valve Face Runout. Check the valve face runout (Fig. 33). It should not exceed the wear limit.

Valve Stem Clearance. Check the valve stem to valve guide clearance of each valve in its respective valve guide with the tool shown in Fig. 34 or its equivalent. Use a flat-end indicator point for most accurate results.

Valve Spring Pressure. Check the valve spring for proper pressure (Fig. 35). Weak valve springs cause poor performance.

Valve Spring Squareness. Check each spring for squareness using a steel square and a surface plate (Fig. 36). Stand the spring and square on end on the surface plate. Slide the spring up to the square. Revolve the spring slowly and observe the space between the top coil of the spring



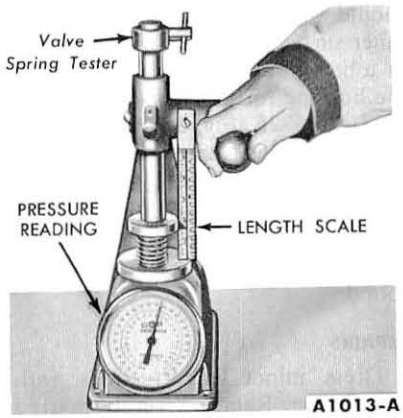


FIG. 35—Valve Spring Pressure

and the square. The out of square limit is 1/16 inch.

REPAIRS

Valve defects, such as, minor pits, grooves, etc. may be removed. Discard valves that are severely damaged, or if the face runout or stem clearance exceed specifications.

Discard any defective part of the valve assembly.

Do not discard sodium cooled valves (exhaust valves of all HD V-8 engines) with other scrap metal in scrap bins. If a sodium cooled valve is accidentally broken and the sodium exposed, it will react violently upon contact with water resulting in fire and explosion due to chemical action. Therefore, these valves should be handled with care and disposed of by being buried in the ground in an area not subjected to excavation, or dropped into deep natural water in a section not subjected to dredging.

Refacing Valves. The valve refacing operation should be closely coordinated with the valve seat refacing operation so that the finished angle of the valve face will match the valve seat. This is important so that the valve and seat will have a good compression tight fit. Be sure that the refacer grinding wheels are properly dressed.

If the valve face runout is excessive and/or to remove pits and grooves, grind the valve to a true 44° angle. Remove only enough stock to correct the runout or to clean up the pits and grooves. If the edge of the valve head is less than 1/32 inch after refacing, replace the valve as it will run too hot in the engine.

Select Fitting Valves. If the valve stem to the valve guide clearance exceeds the wear limit, ream the valve guide for the next oversized valve stem. Valves with oversize stem diameters of 0.003, 0.015, and 0.030 inch are available for service. Refer to "Reaming Valve Guides."

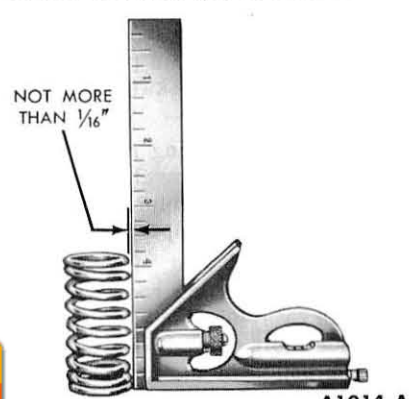


FIG. 36—Valve Spring Squareness

TIMING CHAIN—223 SIX AND 292 V-8

Clean all parts in solvent and dry them with compressed air. Inspect the chain for broken links and the sprockets for cracks, worn or damaged teeth. Replace all the components if any one item needs replacement.

TIMING GEARS—302 AND 332 HD V-8

CLEANING AND INSPECTION

Clean the gears in solvent. Inspect the gear teeth for scores, nicks, etc. Note the condition of the teeth contact pattern.

If the teeth are scored, replace the gears. Replace both gears if either gear needs replacing.

CAMSHAFT

CLEANING AND INSPECTION

Clean the camshaft in solvent and wipe dry. Inspect the camshaft lobes for scoring, and signs of abnormal wear. Lobe wear characteristics may result in pitting in the general area of the nose portion of the lobe. This pitting is not detrimental to the operation of the camshaft, therefore, the camshaft should not be replaced until the camshaft lobe lift loss has exceeded 0.005 inch.

The lift of camshaft lobes can only be accurately checked with the camshaft installed in the engine. Refer to "Camshaft Lobe Lift" on page 1-17.

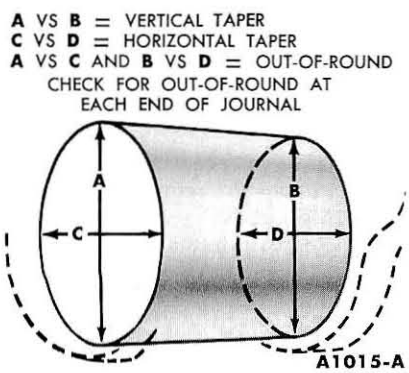


FIG. 37—Crankshaft Journal Measurement

Check the distributor drive gear for broken or chipped teeth.

REPAIRS

Remove light scuffs, scores, or nicks from the camshaft machined surfaces with a smooth oilstone.

CRANKSHAFT

CLEANING

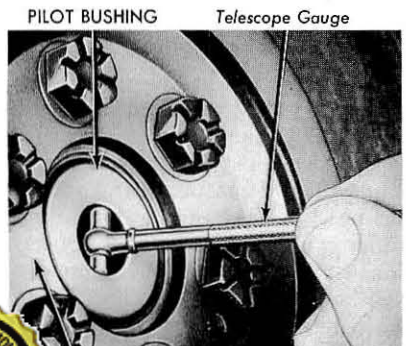
Handle the crankshaft with care to avoid possible fractures or damage to the finished surfaces. Clean the crankshaft with solvent, then blow out all oil passages with compressed air.

INSPECTION

Inspect main and connecting rod journals for cracks, scratches, grooves, or scores.

Measure the diameter of each journal in at least four places to determine out-of-round, taper, or undersize condition (Fig. 37).

On an engine used with a manual shift transmission, check the fit of the clutch pilot bushing in the bore of the crankshaft. The bushing is pressed into the crankshaft and should not be loose. Inspect the inner surface of the bushing for wear or a bell-mouth condition. The ID of the bushing for all engines should be 0.6715-0.6725 (Fig. 38). Replace the bushing if worn or damaged.



Inspect the pilot bearing, when used, for roughness, evidence of overheating or loss of lubricant. Replace if any of these conditions are found.

REPAIRS

Dress minor imperfections with an oilstone. Reface severely marred journals.

If the journals exceed the wear limit, they should be refinished to size for the next undersize bearing.

Refinishing Journals. Refinish the journal to give the proper clearance with the next undersize bearing. If the journal will not "clean up" to give the proper clearance with the maximum undersize bearing available, replace the crankshaft.

Always reproduce the same journal shoulder radius that existed originally. Too small a radius may result in fatigue failure of the crankshaft. Too large a radius will result in bearing failure due to radius ride of the bearing.

After refinishing the journals, chamfer the oil hole, then polish the journal with a No. 320 grit polishing cloth and engine oil. Crocus cloth may also be used as a polishing agent.

CONNECTING RODS

The connecting rods and related parts should be carefully inspected and checked for conformance to specifications. Various forms of engine wear caused by these parts can be readily identified.

A shiny surface on the pin boss side of the piston usually indicates that a connecting rod is bent or the piston pin hole is not in proper relation to the piston skirt and ring grooves.

Abnormal connecting rod bearing wear can be caused by either a bent connecting rod, an improperly machined journal, or a tapered connecting rod bore.

Twisted connecting rods will not create an easily identifiable wear pattern, but badly twisted rods will disturb the action of the entire piston, rings, and connecting rod assembly and may be the cause of excessive oil consumption.

CLEANING

Remove the bearings from the rod and cap. Identify the bearings if they are to be used again. Clean the connecting rod in solvent, including the rod bore and the back of the inserts. **Do not use a caustic cleaning solution.** Blow out all passages with compressed air.

INSPECTION

Inspect the connecting rods for signs of fractures and the bearing bores for out-of-round and taper. If the bore exceeds the maximum limit and/or if the rod is fractured, it should be replaced.

Check the piston pin to connecting rod bushing clearance. Replace the connecting rod if the bushing is so worn that it cannot be reamed or honed for an oversize pin.

Replace defective connecting rod nuts and bolts.

After the connecting rods are assembled to the piston, check the rods for bend or twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. If the bend and/or twist is excessive, the rod should be straightened or replaced.

PISTONS, PINS, AND RINGS

CLEANING

Remove deposits from the piston surfaces. Clean gum or varnish from the piston skirt, piston pins, and rings with solvent. **Do not use a caustic cleaning solution or a wire brush to clean pistons.** Clean the ring grooves with a ring groove cleaner (Fig. 39). Make sure the oil ring slots (or holes) are clean.

INSPECTION

Carefully inspect the pistons for fractures at the ring lands, skirt, and pin bosses, and for scuffed, rough, or scored skirts. If the lower inner portion of the ring grooves have high steps, replace the piston. The step will interfere with ring operation and cause excessive ring side clearance.

Spongy, eroded areas near the edge of the piston top are usually caused by detonation, or pre-ignition. A shiny surface on the thrust surface of the piston, offset from the centerline between the piston pin holes, can be caused by a bent connecting rod. Replace pistons that show signs of excessive wear, wavy ring lands, fractures, and/or damage from detonation or pre-ignition.

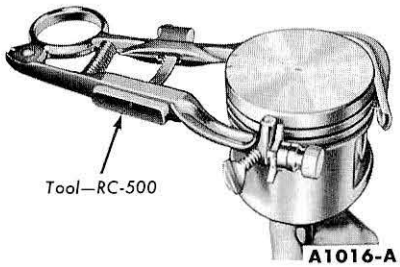


FIG. 39—Cleaning Ring Grooves

Check the piston to cylinder bore clearance with a tension scale and ribbon (covered under "Fitting Pistons") and the ring side clearance (covered under "Fitting Piston Rings").

Replace piston pins showing signs of fracture or etching and/or wear. Check the piston pin fit in the piston and rod.

Replace all rings that are scored, chipped, or cracked. Check the end gap and side clearance. It is good practice to always install new rings when overhauling the engine. **Rings should not be transferred from one piston to another regardless of mileage.**

REPAIRS

Fitting Pistons. Pistons are available for service in standard sizes and 0.020, 0.030, 0.040, and 0.060-inch oversize.

If the clearance is greater than the maximum limit, recheck calculations to be sure that the proper size piston has been selected before trying a new piston.

If the clearance is less than the minimum limit, recheck calculations before trying another piston. If none can be fitted, refinish the cylinder for the next size piston.

When a piston has been fitted, mark it for assembly in the cylinder to which it was fitted.

If the taper and out-of-round conditions of the cylinder bore are within limits, new piston rings will give satisfactory service provided the piston clearance in the cylinder bore is within limits. If the new rings are to be installed in a used cylinder that has not been refinished, remove the cylinder wall "glaze."

To fit a piston:

lculate the size piston to be

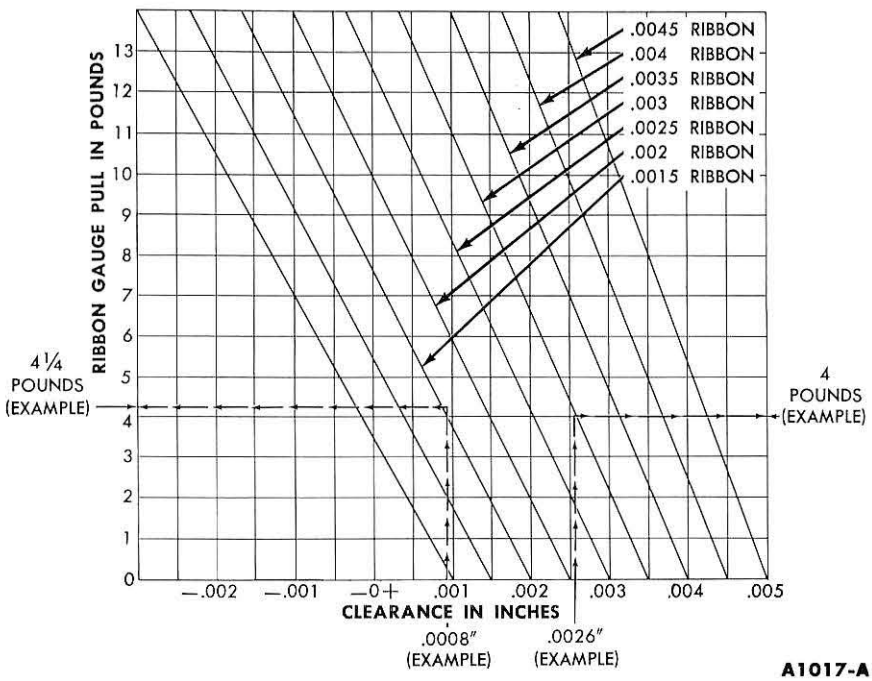


FIG. 40—Piston Clearance Chart

(70°F). **After any refinishing operation, allow the cylinder bore to cool and make sure the piston and bore are clean and dry before the piston fit is checked.**

4. Attach a tension scale to the end of a feeler gauge ribbon that is free of dents or burrs. The feeler ribbon should be ½-inch wide and of one of the recommended thicknesses listed in Fig. 40.

5. Position the ribbon in the cylinder bore so that it extends the entire length of the piston at 90° from the piston pin location.

6. Invert the piston and install it in the bore so that the end of the piston is about 1½ inches below the top of the cylinder block and the piston pin is parallel to the crankshaft axis.

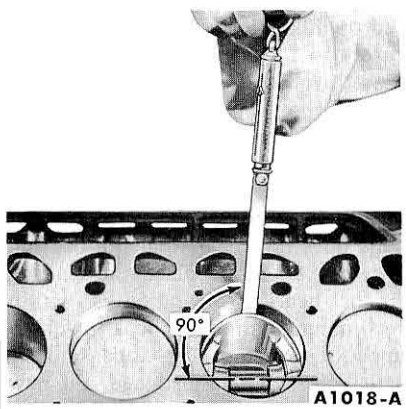


FIG. 41—Checking Piston Fit

7. Hold the piston and slowly pull the scale in a straight line with the ribbon, noting the pull required to remove the feeler ribbon (Fig. 41).

In Fig. 40, the diagonal lines represent feeler ribbons of various thicknesses, the horizontal lines represent the pounds pull, and the vertical lines represent the clearances. To determine the clearance, locate the line representing the pounds pull required to remove the feeler ribbon from the cylinder bore. Follow the horizontal line to the right until it intersects the diagonal line representing the feeler ribbon. Read down the vertical line for the clearance.

Example 1. If a 0.0015-inch feeler ribbon is used and it takes approximately 4¼ pounds pull to remove the feeler ribbon, the clearance is approximately 0.0008 inch. This is determined by locating the pounds pull (4¼) in Fig. 40 and following the line to the right until it intersects with the diagonal line representing the 0.0015-inch feeler ribbon. Read down the vertical line for the clearance (approximately 0.0008 inch).

Example 2. If a 0.003-inch feeler ribbon is used and it takes approximately 9 pounds pull to remove the ribbon, the resultant clearance is approximately 0.0015 inch.

Fitting Piston Rings

1. Select the proper ring set for the size piston to be used.

FIG. 42—Piston Ring Gap

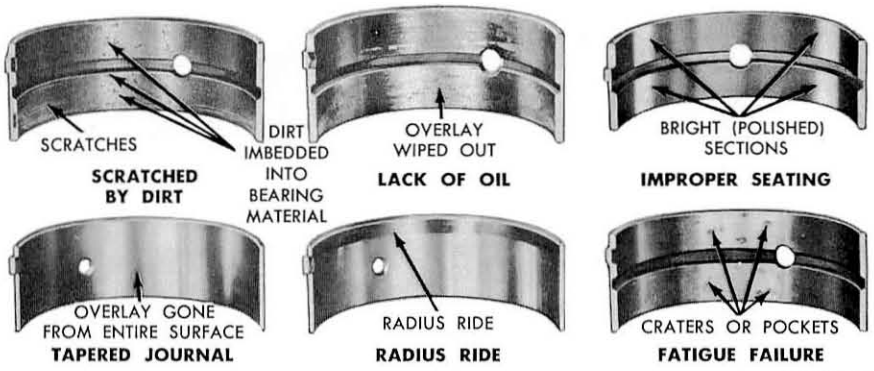


FIG. 44—Typical Bearing Failures

2. Position the ring in the cylinder bore in which it is going to be used.

3. Push the ring down into the bore area where normal ring wear is not encountered.

4. Use the head of a piston to position the ring in the bore so that the ring is square with the cylinder wall. **Use caution to avoid damage to the ring or cylinder bore.**

5. Measure the gap between the ends of the ring with a feeler gauge (Fig. 42). If the ring gap is less than the recommended lower limit, try another ring set.

6. Check the ring side clearance of the compression rings with a feeler gauge inserted between the ring and its lower land (Fig. 43). The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. **If the lower lands have high steps, the piston should be replaced.**

Fitting Piston Pins. The piston pin fit should be a light thumb press fit at normal temperature (70°F). Standard piston pins are color coded green. Pins of 0.001-inch oversize (coded blue) and 0.002-inch oversize (coded yellow) are available.

If the pin hole in the piston must be reamed, use an expansion-type, piloted reamer. Place the reamer in a vise and revolve the piston around the reamer. Set the reamer to the size of the pin bore, then expand the reamer slightly and trial ream the pin bore. Take a light cut. Use a pilot sleeve of the nearest size to maintain alignment of the bores.

Check the hole size, using the new piston pin. If the bore is small, expand the reamer slightly and make another cut. Repeat the procedure until the proper fit is obtained. Check the piston pin for fit in the respective rod bushing. If necessary, ream or hone the bushing to fit the pin.

Install the piston pin in the piston and rod. Install a new retainer at each end of the pin to hold it in place. Spiral the retainers into position with the fingers. Do not use pliers. Make sure the retainers are properly seated in their grooves.

MAIN AND CONNECTING ROD BEARINGS

CLEANING AND INSPECTION

Clean the bearing inserts and caps thoroughly. Inspect each bearing carefully. Bearings that have a scored, chipped, or worn surface should be replaced. Typical examples of bearing failures and their causes are shown in Fig. 44. The copper lead bearing base may be visible through the bearing overlay. This does not mean that the bearing is worn. Do not replace the bearing if the bearing clearance is within recommended limits. Check the clearance of bearings that appear to be satisfactory with Plastigage. Fit new bearings following the recommended procedure (Part 1-2, 1-3, or 1-4).

FLYWHEEL—MANUAL-SHIFT TRANSMISSIONS

INSPECTION

Inspect the flywheel for cracks, heat check, or other defects that would make it unfit for further service. Machine the friction surface of the flywheel if it is scored or worn. If it is necessary to remove more than 0.045 inch of stock from the original thickness, replace the flywheel.

Inspect the ring gear for worn, chipped, or cracked teeth. If the teeth are damaged, replace the ring gear.

With the flywheel installed on the crankshaft, check the flywheel face runout.

FLYWHEEL FACE RUNOUT

Install a dial indicator so that the indicator point bears against the flywheel face (Fig. 45). Turn the flywheel making sure that it is full forward or rearward so that crankshaft end play will not be indicated as flywheel runout.

RING GEAR REPLACEMENT

Heat the defective ring gear with a blow torch on the engine side of

FIG. 45—Flywheel Face Runout

the gear, then knock it off the flywheel. **Do not hit the flywheel when removing the ring gear.**

Heat the new ring gear evenly until the gear expands enough to slip onto the flywheel. Make sure the gear is seated properly against the shoulder. **Do not heat any portion of the gear to a temperature higher than 500°F. If this limit is exceeded, the temper will be removed from the ring gear teeth.**

CYLINDER BLOCK

CLEANING

Thoroughly clean the block in solvent. Remove old gasket material from all machined surfaces. Remove all pipe plugs which seal oil passages, then clean out all the passages. Blow out all passages, bolt holes, etc. with compressed air. Make sure the threads in the cylinder head bolt holes are clean. Dirt in the threads may cause binding and result in a false torque reading. Use a tap to true-up threads and to remove any deposits.

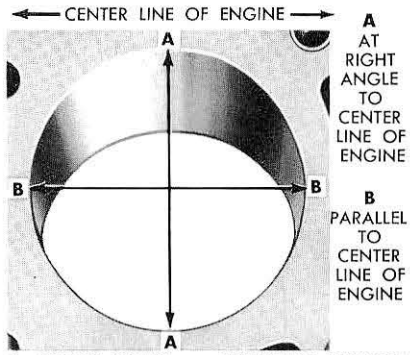
INSPECTION

After the block has been thoroughly cleaned, make a check for cracks. Minute cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25% kerosene and 75% light motor oil. Wipe the part dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If cracks are present, the coating will become discolored at the defective area. Replace the block if it is cracked.

Check all machined gasket surfaces for burrs, nicks, scratches, and scores. Remove minor imperfections with an oil stone. Check the flatness of the cylinder block gasket surface following the procedure and specifications recommended for the cylinder head.

Replace all expansion-type plugs that show evidence of leakage.

Inspect the cylinder walls for scoring, roughness, or other signs of wear. Check the cylinder bore for out-of-round and taper. Measure the bore with an accurate gauge following the instructions of the manufacturer. Measure the diameter of [illegible]inder bore at the top, middle, [illegible]



1. OUT-OF-ROUND = DIFFERENCE BETWEEN **A** AND **B**
2. TAPER = DIFFERENCE BETWEEN THE **A** MEASUREMENT AT TOP OF CYLINDER BORE AND THE **A** MEASUREMENT AT BOTTOM OF CYLINDER BORE **A1025-A**

FIG. 46—Cylinder Bore Out-of-Round and Taper

and/or taper exceed the wear limits.

If the cylinder walls have minor surface imperfections, but the out-of-round and taper are within limits, it may be possible to remove the imperfections by honing the cylinder walls and installing new service piston rings providing the piston clearance is within limits. Use the finest grade of honing stone for this operation.

REPAIRS

Refinishing Cylinder Walls. Honing is recommended for refinishing cylinder walls only when the walls have minor imperfections, such as light scuffs, scratches, etc. The grade of hone to be used is determined by the amount of metal to be removed. Follow the instructions of the hone manufacturer. If coarse stones are used to start the honing operation, leave enough material so that all hone marks can be removed with the finishing hone which is used to obtain the proper piston clearance.

Cylinder walls that are severely marred and/or worn beyond the specified limits should be refinished. Before any cylinder is refinished, all main bearing caps must be in place and tightened to the proper torque so that the crankshaft bearing bores will not become distorted from the refinishing operation.

Refinish only the cylinder or cylinders that require it. **All pistons are the same weight, both standard and oversize; therefore, various sized pistons can be intermixed without upsetting engine balance.**

Refinish the cylinder with the most wear first to determine the maximum oversize. If the cylinder will not clean up when refinished for the maximum oversize piston recommended, replace the block.

Refinish the cylinder to within approximately 0.0015 inch of the required oversize diameter. This will allow enough stock for the final step of honing so the correct surface finish and pattern are obtained. Use clean sharp hones of No. 220-280 grit for this operation.

For the proper use of the refinishing equipment follow the instructions of the manufacturer. Only experienced personnel should be allowed to perform this work.

After the final operation in either of the two refinishing methods described and prior to checking the piston fit, thoroughly wash the cylinder walls with solvent to remove all abrasive particles, then thoroughly dry the walls. Check the piston fit. Mark the pistons to correspond to the cylinders in which they are to be installed. When the refinishing of all cylinders that require it has been completed and all pistons fitted, thoroughly clean the entire block to remove all particles from the bearing bores, oil passages, cylinder head bolt holes, etc. Coat the cylinder walls with oil.

OIL PAN AND OIL PUMPS

OIL PAN

Scrape any dirt or metal particles from the inside of the pan. Scrape all old gasket material from the gasket surface. Wash the pan in a solvent and dry it thoroughly. Be sure all foreign matter is removed from below the baffle plate.

Check the pan for cracks, holes, damaged drain plug threads, and a loose baffle or a damaged gasket surface.

Repair any damage, or replace the pan if repairs cannot be made.

OIL PUMPS

Cleaning. Wash all parts in a solvent and dry them thoroughly. Use a brush to clean the inside of the pump housing and the pressure relief valve chamber. Be sure all dirt and chips are removed.

On the gear-type oil pump, remove old gasket material from the pump body and cover.

Inspection — Rotor-Type. Check the inside of the pump housing and the outer race and rotor for damage or excessive wear.

Check the mating surface of the

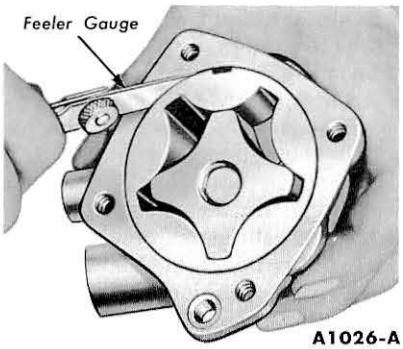


FIG. 47—Outer Race to Housing Clearance

pump cover for wear. If the cover mating surface is worn, scored, or grooved, replace the cover.

Measure the outer race to housing clearance (Fig. 47).

With the rotor assembly installed in the housing, place a straight edge over the rotor assembly and the housing. Measure the clearance between the straight edge and the rotor and outer race (Fig. 48).

The outer race, shaft and rotor are replaceable only as an assembly.

Check the drive shaft to housing bearing clearance by measuring the OD of the shaft and the ID of the housing bearing.

Inspect the relief valve spring for a collapsed or worn condition.

Check the relief valve spring tension. If the spring tension is not within specifications and/or the spring is defective, replace the spring.

Check the relief valve piston for scores and free operation in the bore.

Inspection — Gear-Type. Inspect the pump body and the gear teeth for damage or wear. Check the gear

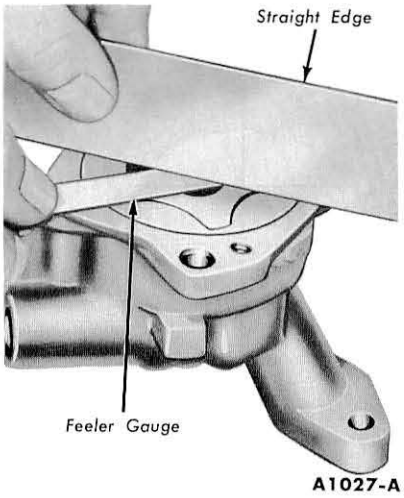


FIG. 48—Rotor End Play

end clearance with a dial indicator or Plastigage. The Plastigage method is as follows:

Position the gasket on the housing, then place the Plastigage on the gears and install the cover. Remove the cover and check the reading.

Check the gears for freedom of rotation. Check the compression of the oil pressure relief valve spring and check the clearance of the relief valve in the valve chamber.

CRANKCASE VENTILATION SYSTEM MAINTENANCE

Refer to Group 16 for the correct mileage interval for maintenance.

BREATHER CAP

The breather cap should be cleaned with a solvent at the proper mileage interval. **Do not oil the mesh screen after cleaning.**

VENT TUBE-TYPE CRANKCASE VENTILATION SYSTEM

223 Six and 292 V-8. The breather cap, located on the oil filler tube, should be cleaned with a solvent at the proper mileage interval.

The ventilation tube seldom requires cleaning except during a high mileage engine overhaul. However, if there is evidence of crankcase pressure, the tube should be checked for excessive sludge and cleaned out.

302 and 332 HD. The breather cap located on the valve push rod cover of the 302 and 332 HD V-8 engines should be serviced as indicated for the 223 Six and 292 MD and HD V-8.

The ventilation tube on these engines contains a filtering element which is serviced as follows:

1. Remove the crankcase ventilation tube lower extension by loosening the retainer bolt and turning the tube to disengage the slot.

2. Remove the vent tube filter with pliers. **Do not attempt to drive it out as this will damage the filter.**

3. Clean the filter in solvent and dry it with compressed air.

4. Install the filter and crankcase ventilation tube lower extension.

POSITIVE CRANKCASE VENTILATION SYSTEM

At the recommended interval, remove the crankcase ventilation regulator valve, exhaust tube, and connections. Clean the valve and exhaust tube in clean carburetor solvent and dry them with compressed air. Clean the rubber hose connections with a low volatile petroleum base solvent and dry them with compressed air.

PART 1-2 223 SIX ENGINE

1 DESCRIPTION

The 223 Six (Figs. 1 and 2) is a 6-cylinder engine with a piston displacement of 223 cubic inches. It has a compression ratio of 8.1:1. The engine is available in the F-100 thru 600, the B-500 and 600, and all P-Series trucks. The patent plate identification symbol for the engine is "J."

MANIFOLDS

A chamber (heat riser) is cast into the intake manifold center section between the carburetor and exhaust manifold. A thermostatically controlled valve is located in the exhaust manifold (Fig. 3). The valve directs exhaust gases into this area to provide the heat necessary to assist in vaporizing the incoming fuel mixture.

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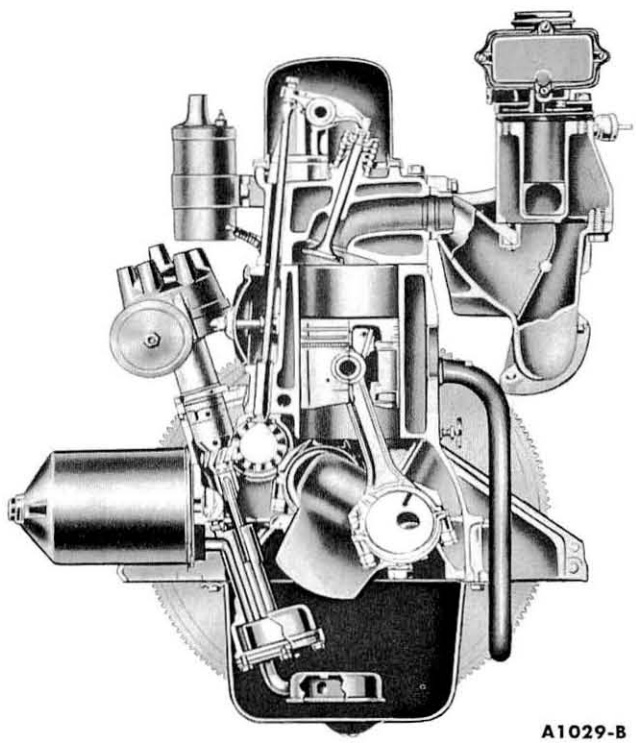

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FIG. 2—223 Six—Sectional

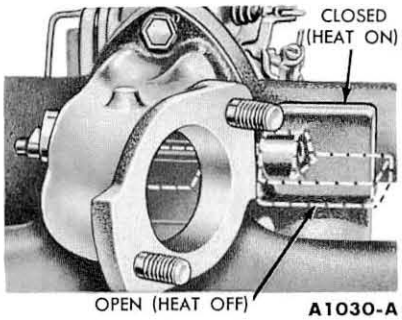


FIG. 3–Exhaust Control Valve

CYLINDER HEAD

The cylinder head carries the valves, valve rocker arm shaft assembly, manifold assembly, ignition coil, and the coolant outlet and thermostat. Valve guides are cast integral in the head. The valves are arranged from front to rear E-I-I-E-I-E-E-I-E-I-I-E.

CYLINDER BLOCK

The cylinders are numbered from 1-6 starting at the front of the engine. The firing order is 1-5-3-6-2-4.

The distributor, located at the right front of the engine, drives the oil pump through an intermediate drive shaft.

The crankshaft is supported by four main bearings. Crankshaft end thrust is controlled by the flanges of the No. 3 main bearing.

The pistons have two compression rings and one oil control ring. The top compression ring is chrome-plated and the lower compression ring is phosphate-coated. The oil control ring assembly consists of a serrated spring and two chrome-plated steel rails.

VALVE TRAIN

The intake and exhaust valve assemblies are the rotating-type. The tappets are the solid steel, mushroom-type. Valve lash is maintained by self-locking adjusting screws.

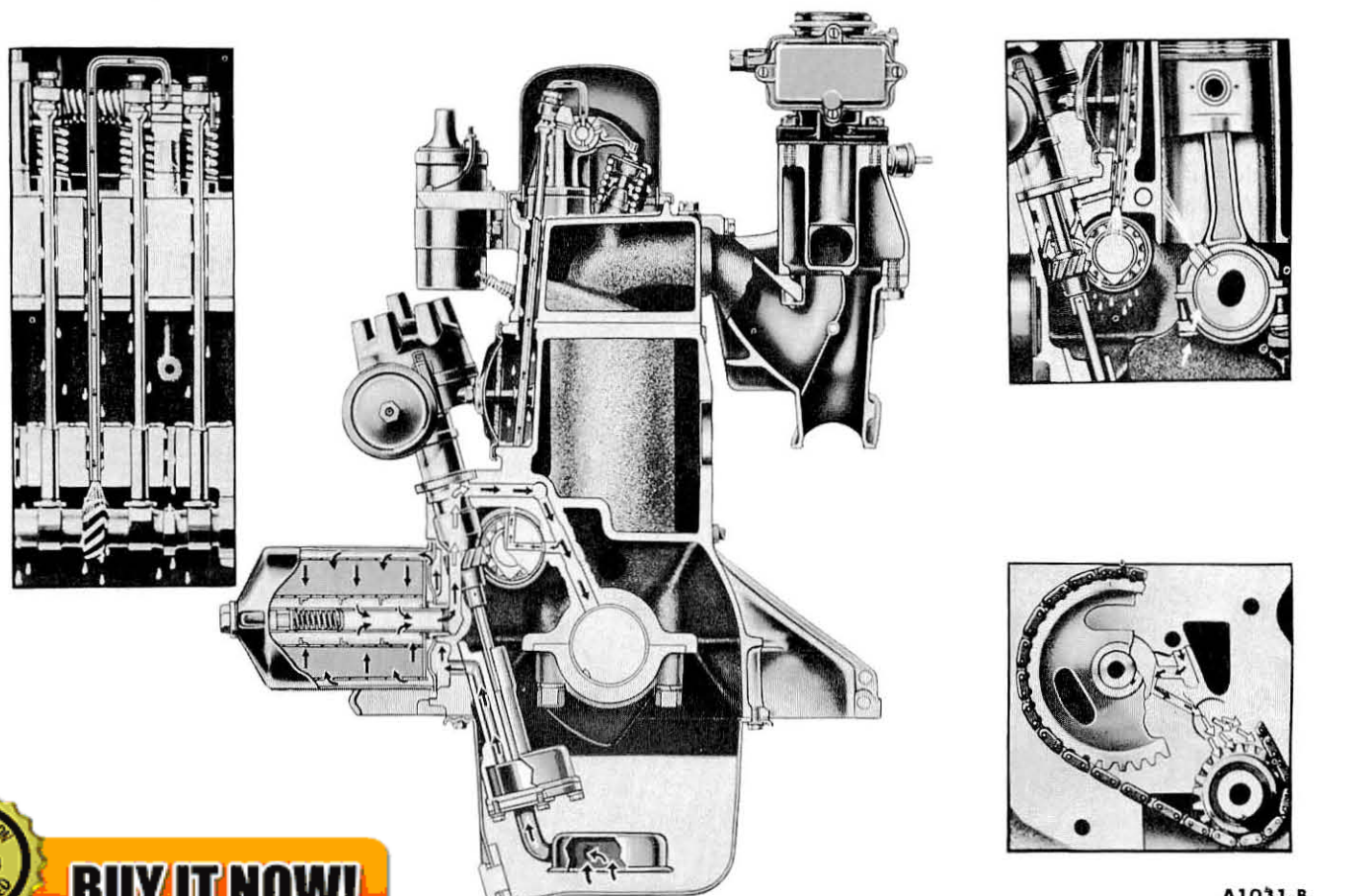
The camshaft is supported by four bearings pressed into the block. It is driven by a sprocket and timing chain in mesh with a sprocket on the crankshaft. Camshaft thrust is controlled by a thrust plate located between the camshaft sprocket and the front journal of the camshaft.

An eccentric, made integral with the camshaft, operates the fuel pump.

LUBRICATION SYSTEM

Oil from the oil pan sump is forced through the pressure feed lubrication system (Fig. 4) by a gear-type oil pump. A spring-loaded relief valve in the pump limits the maximum pressure of the system. Oil relieved by the valve is directed back to the intake side of the pump.

The engine has a full-flow filter which filters the entire output of the pump before the oil enters the engine. A by-pass provides oil to the engine in case the filter element becomes clogged. The by-pass is located in the hollow center bolt of the filter and consists of a spring-loaded valve. When the element is clean and oil will flow through it, the pressure difference between the inner and outer faces of the valve is not great enough to overcome the spring pressure behind the valve. Therefore, no oil flows through the by-pass. When the ele-



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ment is dirty and will not permit a sufficient flow of oil, the pressure acting on the inner face of the valve drops. If the pressure difference between the valve faces is great enough to overcome spring pressure, the valve will open. Oil then by-passes the element, maintaining an emergency supply of oil to the engine.

From the filter, the oil flows into the main oil gallery. The oil gallery supplies oil to all the camshaft and main bearings through a drilled passage in each main bearing web.

The timing chain and sprockets are lubricated through a flat on the No. 1 camshaft bearing.

Oil slingers prevent leakage by directing oil away from the crankshaft front and rear oil seals.

Cylinder walls, pistons, and piston pins are lubricated through a drilled hole in each connecting rod which indexes with a drilled hole in the connecting rod journal of the crankshaft.

Oil under reduced pressure lubricates the valve rocker arm shaft assembly. The oil is fed through a drilled passage in the cylinder block at the No. 3 camshaft bearing which indexes with a hole in the cylinder head. An oil inlet tube directs the oil into the hollow valve rocker arm shaft through the No. 6 valve rocker arm shaft support. The oil from the shaft flows through drilled holes in each rocker arm to lubricate the rocker arm shaft bore and the valve and ball end of the rocker arm. Excess oil spirals down the rotating push rod and assists in lubricating the tappet and push rod seat. An oil outlet tube exhausts excess oil from the rocker shaft to lubricate the distributor lower bushing and distributor drive gear. The oil outlet tube is located at the No. 1 rocker arm support. The oil from each rocker arm drains into the push rod chamber through holes provided in the cylinder head.

The oil in the push rod chamber drains back into the oil pan through an opening at the back of the block.

CRANKCASE VENTILATION

The 223 Six engine is equipped with either a vent tube-type crankcase ventilation system or a positive crankcase ventilation system. In the vent tube-type system, the crankcase vapors are discharged to the atmosphere. In the positive system, the crankcase vapors are returned to the intake manifold.

VENT TUBE-TYPE CRANKCASE VENTILATION SYSTEM

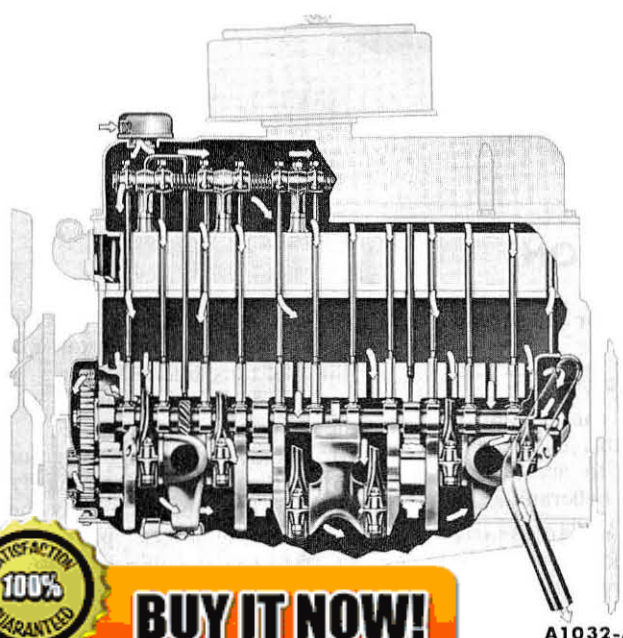
A crankcase ventilation tube is located at the rear of the engine. The forward motion of the truck causes a partial vacuum to be formed at the tube outlet. This vacuum action causes air to be drawn through the engine from the combination oil filler and breather cap located in the front of the valve push rod chamber cover (Fig. 5). The filler cap contains a maze filtering element.

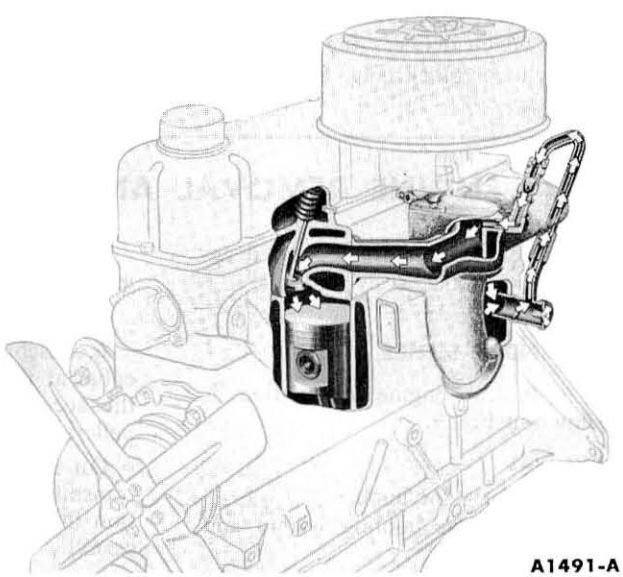
Filtered air from the breather cap flows into the front section of the valve rocker arm shaft chamber. Here the air has a chance to normalize its temperature before contacting contaminating vapors originating in the crankcase. Warm ventilating air minimizes the formation of crankcase sludge.

The ventilating air moves down past the push rods into the crankcase. Air is diverted from the front section of the crankcase through holes in the front of the cylinder block wall to ventilate the timing chain chamber. The air from the crankcase is then directed into the crankcase ventilation tube by the rotating action of the crankshaft.

POSITIVE CRANKCASE VENTILATION SYSTEM

Ventilating air enters the engine in the normal manner through the breather cap and is distributed through the engine in the same manner as in the vent tube-type system. However, instead of the ventilating air being discharged to the atmosphere, it is returned to the intake manifold. The air is returned to the intake manifold through an exhaust tube which extends from the crankcase ventilation outlet in the left side of the cylinder block to a spring-loaded regulator valve (Fig. 6). The





ilation System

FIG. 6—Positive Crankcase Ventilation System

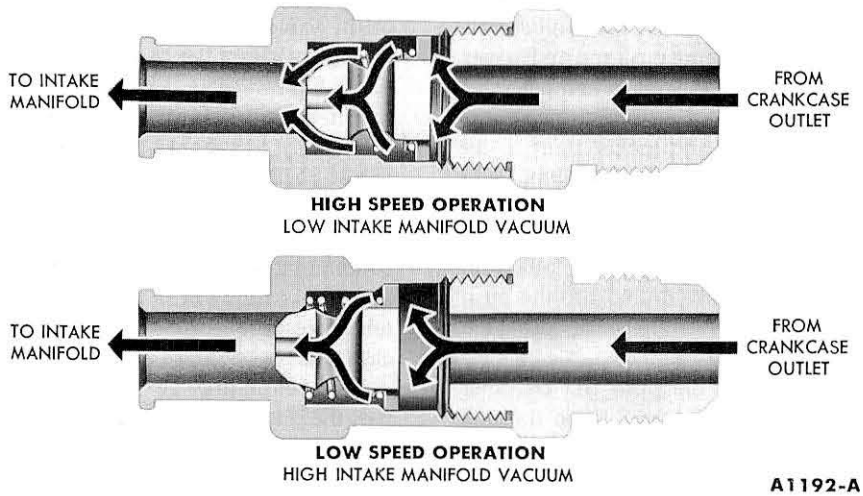


FIG. 7—Positive Crankcase Ventilation Regulator Valve

valve regulates the amount of air to meet changing operating conditions.

During idle, intake manifold vacuum is high. The high vacuum overcomes the tension of the spring pressure and seats the valve (Fig. 7). With the valve in this position, all the ventilating air passes through a calibrated orifice in the valve. With the valve seated, there is minimum ventilation. As engine speed increases and manifold vacuum decreases, the spring forces the valve off its seat and to the full open position. This increases the flow of ventilating air.

COOLING SYSTEM

The coolant is drawn from the bottom of the radiator by the water pump which delivers the coolant to the cylinder block (Fig. 8).

As the coolant enters the block, it travels through cored passages to cool the entire length of each cylinder wall. Upon reaching the rear of the cylinder block, the coolant is directed upward into the cylinder head where it cools the combustion chambers, valves, and valve seats on its return to the front of the engine.

At this point, the coolant flows into the coolant outlet connection, past the thermostat if it is open, into the top of the radiator. If the thermostat is closed, a small portion of the coolant is returned to the water pump for recirculation. The entire system is pressurized to 7 psi.

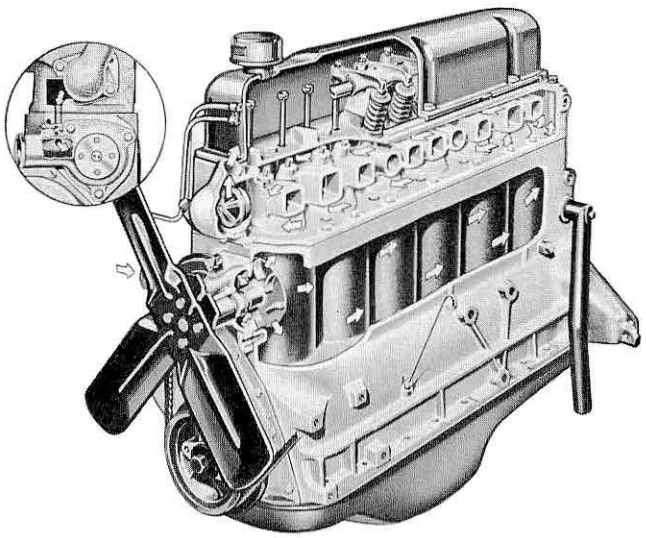


FIG. 8—Cooling System

2 ENGINE REMOVAL AND INSTALLATION

The procedures are separated according to truck body styles.

B- AND F-SERIES

A typical engine installation is shown in Fig. 9.

REMOVAL

1. Remove the hood.

4. Remove the radiator and shroud as an assembly.

5. Remove the air cleaner.

6. Disconnect the choke control cable at the carburetor. Disconnect the accelerator shaft to accelerator bellcrank rod at the bellcrank.

On a truck with an automatic transmission, disconnect the transmission throttle control rod at the bellcrank.

7. Remove the accelerator retracting spring.

8. Disconnect the flexible fuel line at the fuel tank line and install a cap on the fuel tank line.

9. Disconnect the generator wires at the generator.

10. Remove the engine ground strap at the flywheel housing (retained by the upper left flywheel housing to engine rear plate bolt).

11. Remove the upper right and the lower left engine rear plate to flywheel housing retaining bolt.

12. Disconnect the heater hoses at the engine.