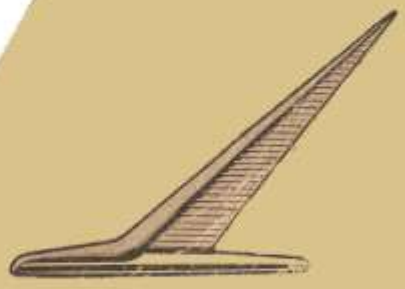
1961 FORD Falcon

SHOP MANUAL



1961

FALCON

SHOP MANUAL

SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY

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FOREWORD

This manual provides information for the proper servicing of the 1961 Falcon. 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.

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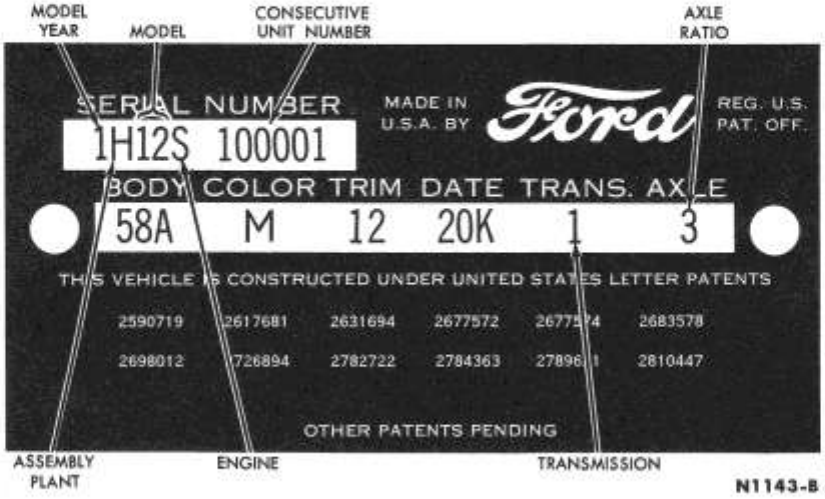
FALCON IDENTIFICATION



Falcon Patent Plate

1 PATENT PLATE

Figure 1 illustrates a Falcon patent plate and its elements. The plate is on the rear face of the left front door inner panel.

MODEL YEAR

The number "1" designates 1961.

ASSEMBLY PLANT

H—Lorain
K—Kansas City
R—San Jose
S—Pilot Plant
T—Metuchen

MODEL

The model code number shows the product line series in the first digit. The second digit shows the body type: an odd number shows a two-door model, while an even number shows a four-door model.

SERIES 10—PASSENGER CARS

11.....2-Door
12.....4-Door

SERIES 20—STATION WAGONS

21.....2-Door
22.....4-Door
27.....Ranchero

ENGINE

S.....6 Cylinder OHV 144 cubic inch
D....6 Cylinder OHV 144 cubic inch (Low compression—84 octane)
U.....6 Cylinder OHV 170 cubic inch

CONSECUTIVE UNIT NUMBER

Each model year, each assembly plant begins with consecutive model numbers 100001 and continues on for each car built.

BODY

58A.....4-Door Sedan
64A.....2-Door Sedan
59A.....2-Door Wagon
66A.....Ranchero
71A.....4-Door Wagon

COLOR

Code	M30J Number	Color	Promotional Name
A	1724	Black	Raven Black
C	1139	Light Turquoise	Aquamarine
D	1361	Light Blue	Starlight Blue
E	1364	Medium Green Metallic	Laurel Green
H	1367	Dark Blue Metallic	Chesapeake Blue
J	1232	Red	Montecarlo Red
K	1369	Bronze Metallic	Algiers Bronze
M	1238	White	Corinthian White
Q	1371	Light Gray Metallic	Silver Gray
R	1372	Medium Blue Metallic	Cambridge Blue
S	1373	Light Green	Mint Green
W	1385	Turquoise Metallic	Garden Turquoise

TRIM

The trim code includes 2 digits.

First Digit	Material Type	Second Digit	Color Scheme
1	Vinyl and Black Stripe Broadcloth	0	Silver or White
2	Vinyl and Black Broadcloth	1	Gray
4	Vinyl and Tweed Broadcloth	2	Blue
5	All Vinyl	3	Green
7	Vinyl and Vinyl	5	Red
		6	Black
		7	Turquoise

DATE

A number signifying the date precedes the month code letter.

Month	CODE First Year	CODE Second Year	Month	CODE First Year	CODE Second Year
January	A	N	July	G	U
February	B	P	August	H	V
March	C	Q	September	J	W
April	D	R	October	K	X
May	E	S	November	L	Y
June	F	T	December	M	Z

TRANSMISSION

1.....Conventional Drive
3.....Fordomatic

AXLE RATIO

3.....3.10
J.....3.50
4.....4.00
5.....3.20

2 OTHER IDENTIFICATION

ENGINE IDENTIFICATION

The engine is coded to show the engine plant and the date of manufacture.

This information is stamped on the top surface of the block near the crankcase breather pipe (front left side).

The first figure identifies the engine plant:

4.....Lima Engine Plant

The second figure indicates the year: "1"—1961.

The next letter indicates the month:

A.....January
B.....February
C.....March
D.....April
E.....May
F.....June
G.....July
H.....August
J.....September
K.....October
L.....November
M.....December

The next figure(s) show(s) the date of the month.

The last letter is an inspector's identification.

RADIO IDENTIFICATION

The radio serial number is on the back of the radio case.

In the illustrative serial number prefix **14MD**, the figure "1" denotes 1961 and the "4" signifies a four-tube radio (with two transistors). The "MD" identifies a Motorola radio manufactured for the Falcon. The remaining six digits are the consecutive unit manufacture number.

1961 FORD FALCON SHOP MANUAL

GROUP 1

ENGINES AND EXHAUST SYSTEM

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PART 1-1 ENGINES

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1 DESCRIPTION

The Falcon 144 and 170 Six engines (Figs. 1, 2, and 3) have the same basic design with a compression ratio of 8.7:1. The 144 Six engine has a piston displacement of 144 cubic inches and the patent plate identification symbol is "S". The 170 Six engine has a piston displacement of 170 cubic inches and the patent plate identification symbol is "U".

MANIFOLDS

Exhaust gases provide the heat necessary to assist in vaporizing the incoming fuel mixture (Fig. 4).

To prevent carburetor icing at the throttle plate, an engine coolant heated spacer is located between the carburetor and the intake manifold (Fig. 4). The coolant flows from the front of the engine through the spacer inlet hose into the carburetor coolant spacer. The coolant circulates through the spacer and flows into the heater inlet hose and into the heater. On cars that do not have a heater, there is no hose connection to the coolant spacer.

CYLINDER HEAD

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

CYLINDER BLOCK

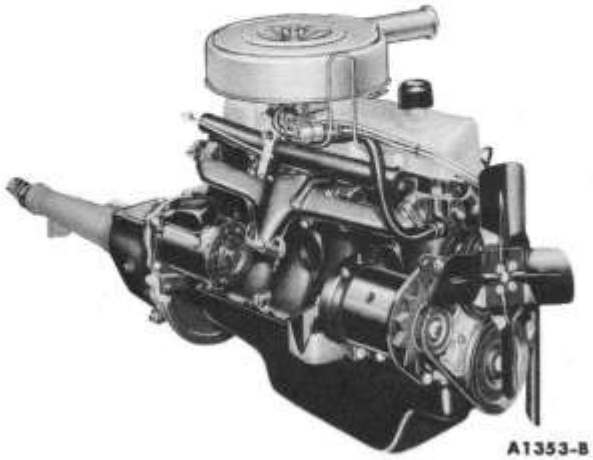
The cylinders are numbered from 1-6 starting at the front of the engine. The firing order is 1-5-3-6-2-4.

The distributor, located on the left 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.

A1352-B

FIG. 1—¾ Left Front View



A1353-B

FIG. 2—¾ Right Front View

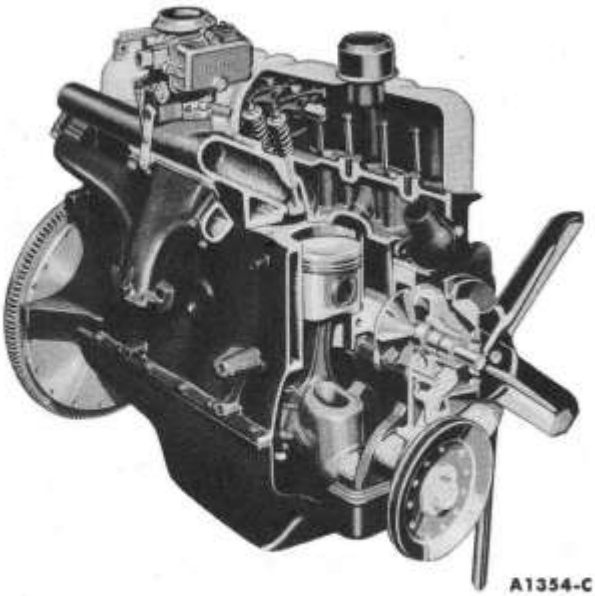


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FIG. 3—Sectional View

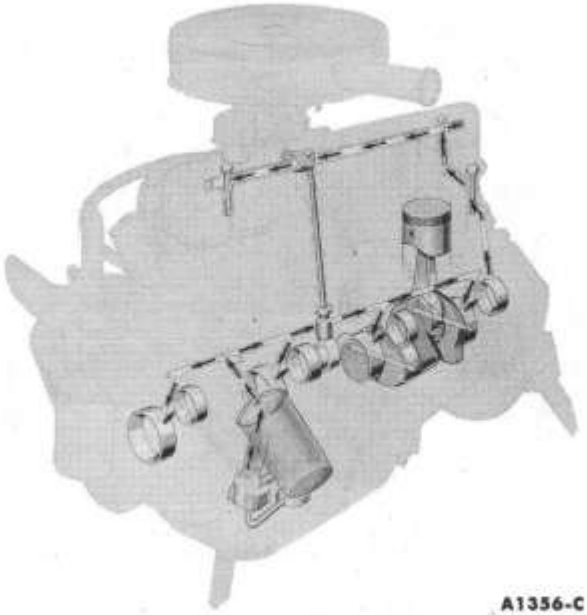

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FIG. 5—Lubrication System

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 push rods are tubular steel with oil cushioned sockets. The tappets are the barrel-type. Valve lash is maintained by self-locking adjusting screws.

The camshaft is supported by four bearings pressed into the block and 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 on the camshaft operates the fuel pump.

LUBRICATION SYSTEM

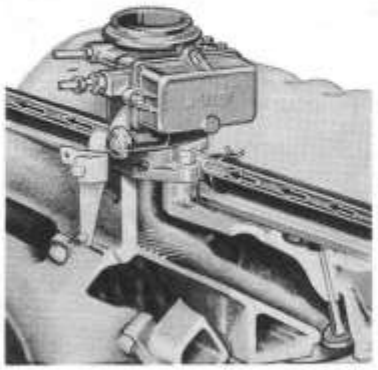
Oil from the oil pan sump is forced through the pressure-type lubrication system (Fig. 5) by a rotor pump. A spring-loaded relief valve in the pump limits the maximum pressure of the system. Oil relieved by the valve is directed back to the intake side of the pump.

All the oil discharged by the pump passes through a full flow-type filter before it enters the engine. The filter has an integral relief valve and mounting gasket. The relief valve permits oil to by-pass the filter if it becomes clogged, thereby maintaining an emergency supply of oil to the engine at all times. An anti-drain back diaphragm prevents a reverse flow of oil when the engine is stopped.

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 splash lubricated from the oil pan.

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



A1355-C

FIG. 4—Water Heated Spacer

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 is fed to the valve rocker arm shaft assembly through a drilled passage in the cylinder block at the No. 4 camshaft bearing which indexes with a hole in the cylinder head. The oil from the shaft flows through drilled holes in each rocker arm to lubricate the valve and the ball end of the rocker arm. The excess oil spirals down the rotating push rod and assists in lubricating the tappet and push rod seat. An oil outlet in the No. 1 rocker arm shaft support, exhausts excess oil from the valve rocker arm shaft. The oil from each rocker arm drains into the push rod chamber through the push rod bore holes in the cylinder head.

The oil in the push rod chamber drains back into the oil pan through cored openings in the block.

CRANKCASE VENTILATION

The engines are 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.

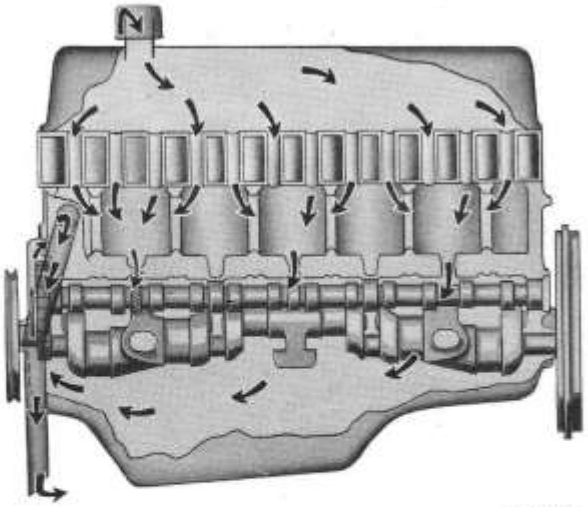


FIG. 6—Vent Tube-Type Crankcase Ventilation System

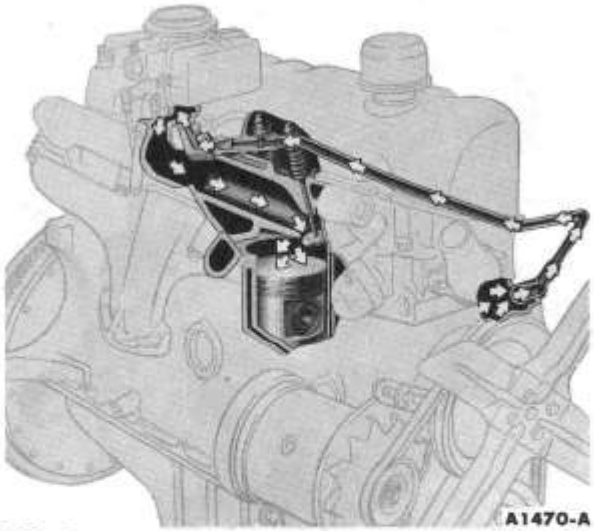


FIG. 7—Positive Crankcase Ventilation System

VENT TUBE-TYPE CRANKCASE VENTILATION SYSTEM

A crankcase ventilation tube is located at the left front of the engine. The forward motion of the car 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. 6). 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 normalizes 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 and 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 assembly installed in the carburetor spacer (Fig. 7). The 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. 8). 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. 9).

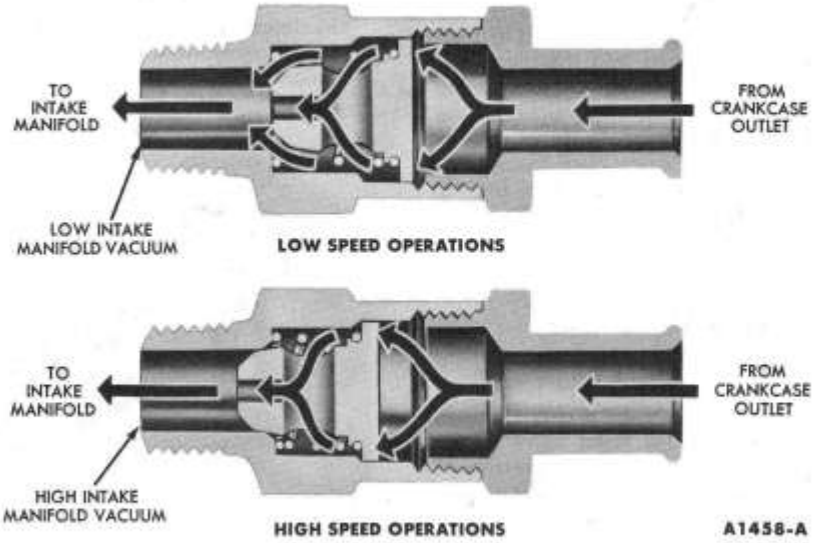


FIG. 8—Positive Crankcase Ventilation Regulator Valve

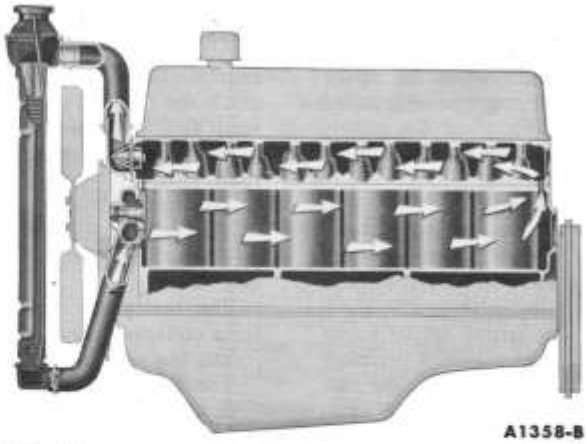


FIG. 9—Cooling System

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, and 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 13-15 psi.

2 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. Therefore, in most cases, the items should be checked 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. These items should all be checked 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 11-2). 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 and inspect the gasket and/or head 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. 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 tension 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

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS NORMALLY, BUT WILL NOT START (Continued)	choke plate closes when the choke knob on the instrument panel is pulled out and that the plate completely 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. 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, such as valves, 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 filter. The fuel pump. The carburetor fuel inlet line for obstructions. The fuel pump flexible inlet line for a collapsed condition. 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 needle and seat assembly, and the float assembly.
ENGINE STARTS, BUT FAILS TO KEEP RUNNING	**FUEL SYSTEM** Idle fuel mixture needle not properly adjusted. Engine idle speed set too low. The choke not operating properly. Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in the fuel lines or fuel filter. Carburetor icing. Fuel pump defective. 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 one spark plug at a time, until all cylinders have been checked. Ground the 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 plug test on the ignition lead of that cylinder. If a good spark does not occur, the trouble is in the secondary circuit of the system. Check the spark plug wire and 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 (page 1-11) test to determine which mechanical component of the engine is at fault. **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.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE RUNS, BUT MISSES (Continued)	**FUEL SYSTEM** Float setting incorrect. Fuel inlet system not operating properly. Dirt or water in fuel lines or carburetor. Restricted fuel filter. **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 1-11) to determine which mechanical component of the engine is at fault. **MISSES AT IDLE ONLY** **FUEL SYSTEM** Idle fuel mixture needle not properly adjusted.	**IGNITION SYSTEM** Excessive play in the distributor shaft. Worn distributor cam. **ENGINE** Perform a compression test (Page 1-11) to determine which mechanical component of the engine is at fault. **MISSES AT HIGH SPEED ONLY** **FUEL SYSTEM** Power valve clogged or damaged. Power valve diaphragm leaking. Low or erratic fuel pump pressure. Fuel inlet system not operating properly. Restricted fuel filter. **COOLING SYSTEM** Engine overheating.
ROUGH ENGINE IDLE	**FUEL SYSTEM** Engine idle speed set too low. Idle fuel mixture needle not properly adjusted. Float setting incorrect. Air leaks between the carburetor and the manifold and/or fittings. Fuel leakage at the carburetor fuel bowl. Idle fuel system air bleeds or fuel passages restricted. Fuel bleeding from the accelerating pump discharge nozzle. **IGNITION SYSTEM** Improperly adjusted or defective breaker points.	Fouled or improperly adjusted spark plugs. Incorrect ignition timing. **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. Defective spark control valve. **FUEL SYSTEM** Inoperative accelerating pump inlet ball check. Inoperative accelerating pump discharge ball check.	Accelerating pump diaphragm defective. Float setting incorrect. Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted. Leaky power valve gasket or accelerating pump diaphragm. Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. Restricted fuel filter. **BRAKES** Improper adjustment.

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ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

POOR ACCELERATION (Continued)	**TRANSMISSION** Clutch slippage (manual-shift transmission). Improper band adjustment (Fordomatic).	Converter One-Way Clutch (Fordomatic). Improper linkage adjustment (Fordomatic).
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. Power valve clogged or damaged. Power valve diaphragm leaking. 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** Restriction in system. **COOLING SYSTEM** Thermostat inoperative or incorrect heat range. Thermostat installed incorrectly. Check the cooling system for internal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **ENGINE** Perform an engine compression test (page 1-11) to determine which mechanical component is at fault. One or more camshaft lobes worn beyond wear limit. **TRANSMISSION** Improper band adjustment (Fordomatic).
EXCESSIVE FUEL CONSUMPTION	Determine the actual fuel consumption with test equipment installed in the car. 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. **ODOMETER** Check calibration. **IGNITION SYSTEM** Check ignition timing.	**ENGINE** Crankcase ventilation regulator valve defective or a restricted tube (Positive Crankcase Ventilation System). **FINAL CHECKS** **FUEL SYSTEM** Check: Fuel pump pressure. Engine idle speed. Idle fuel mixture needle for proper adjustment. Accelerating pump stroke adjustment. Anti-stall dashpot for proper adjustment. Air cleaner for restrictions. Float setting or fuel level. Jet for damage. Power valve operation. Air bleeds for obstructions. Accelerating pump discharge nozzle for siphoning.

CONTINUED ON NEXT PAGE

ENGINE TROUBLE DIAGNOSIS GUIDE (Continued)

EXCESSIVE FUEL CONSUMPTION (Continued)	**IGNITION SYSTEM** Check: Spark plug condition and adjustment. Distributor spark advance operation. **ENGINE** Perform an engine compression test (page 1-11) to determine which mechanical component of the engine is at fault. **COOLING SYSTEM** Check thermostat operation and heat range. **TRANSMISSION** Check band adjustment (Fordomatic).	
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. 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.
LOSS OF COOLANT	**COOLING SYSTEM** Leaking radiator. Loose or damaged hose connections. Water pump leaking. Radiator cap defective. Overheating.	**ENGINE** Cylinder head gasket defective. Cylinder head 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.
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.

3 TUNE-UP

The Tune-Up Schedule (Table 1) is for either an A, B, or C tune-up. Perform all operations in the sequence listed. The recommended mileage interval for an A tune-up is 4,000 miles, for a B tune-up it is 8,000 miles, and for a C tune-up it is 12,000 miles. For a detailed description of an operation procedure, refer to the operation number under "Tune-Up Procedure."

TABLE 1—Tune-Up Schedule

Operation No.	Operation	A	B	C
	ENGINE NOT OPERATING MECHANICAL CHECKS, TESTS, AND ADJUSTMENTS			
1	Clean, adjust, and test spark plugs.	X		
2	Take a compression reading of each cylinder.			X
3	Replace spark plugs.			X
4	Check and adjust the deflection of the drive belts.		X	
5	Clean fuel pump sediment bowl.		X	
6	Replace fuel filter.		X	
7	Check and adjust carburetor fuel level.			X
8	Clean the distributor cap and rotor		X	X
9	Lubricate the distributor cam and the distributor bushing.			X
10	Clean battery cables and terminals.			X
11	Clean positive crankcase ventilation system.		X	
	INSTRUMENT CHECKS			
12	Check battery state of charge.			X
13	Check and adjust breaker point dwell.	X		
14	Check and adjust spark advance.			X
15	Perform a spark intensity test of each spark plug wire.			X
16	Check fuel pump pressure and capacity.			X
	WHILE ENGINE IS WARMING-UP			
17	Clean carburetor air cleaner.		X	
18	Inspect the radiator, hoses, and engine for coolant leaks.			X
19	Check and adjust ignition timing.	X		
	ENGINE OPERATING AT NORMAL TEMPERATURE			
20	Adjust accelerator pump link to seasonal position.	X		
21	Check and adjust engine idle speed.	X		
22	Check and adjust idle fuel mixture.	X		
23	Check and adjust anti-stall dashpot clearance Fordomatic.	X		
24	Check and adjust valve lash.			X

TUNE-UP PROCEDURE

The tune-up is divided into 3 major parts.

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 performed 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.

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 file (Fig. 10). Dress the electrode to secure flat parallel surfaces on both the center and side electrode.

After cleaning, inspect the plug for cracked or broken insulators, badly pitted electrodes, or other signs of failure. Replace as required.

Set the gap of all serviceable or new plugs to 0.032-0.036 inch by

FIG. 10—Cleaning Plug Electrode

FIG. 11—Gapping Spark Plug

bending the ground electrode (Fig. 11).

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.

Install the spark plugs and torque them to 15-20 ft-lbs.

2. Take A Compression Reading Of Each Cylinder. Remove the spark plugs. Remove the coil high tension lead at the distributor cap. Set the throttle plate and choke plate in the wide open position.

Install a compression gauge in the No. 1 cylinder.

Using a remote starter switch, crank the engine several times and record the highest reading registered. 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 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.

Do not install the coil high tension lead at this time.

3. Replace Spark Plugs. Install spark plugs of the correct heat range (Part 2-3). Torque the plugs to 15-20 ft-lbs.

4. 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 gauge manufacturer. Adjust the tension as follows:

Loosen the generator mounting bolts and the adjusting bracket bolt. Move the generator toward or away

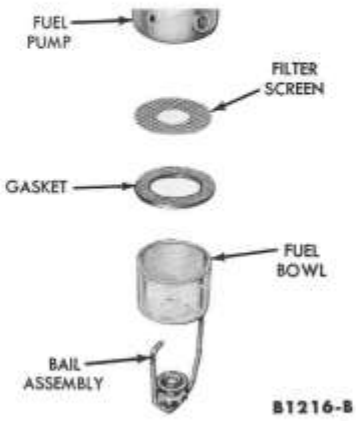


FIG. 12—Sediment Bowl

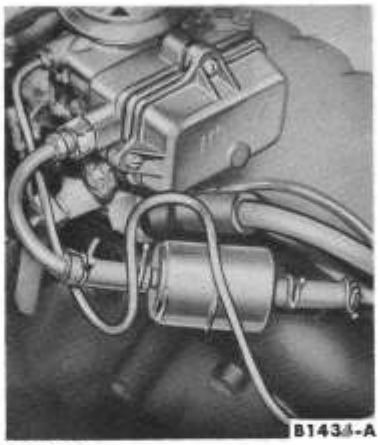


FIG. 13—Fuel Filter Installation

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.

5. Clean Fuel Pump Sediment Bowl. Clean the bowl and magnetic filler (Fig. 12) with cleaning solvent and dry them with compressed air. Replace the gasket if it is defective.

6. Replace Fuel Filter. Slide the clamps closest to the filter away from the filter (Fig. 13). Slide the new filter into the rubber connections and slide the clamps into place. **Be sure the arrow on the filter is pointed toward the outlet of the filter.**

7. Check And Adjust Carburetor Fuel Level. Remove the power valve diaphragm cover and valve assembly.

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. 14).

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. 14). 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.

8. 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.

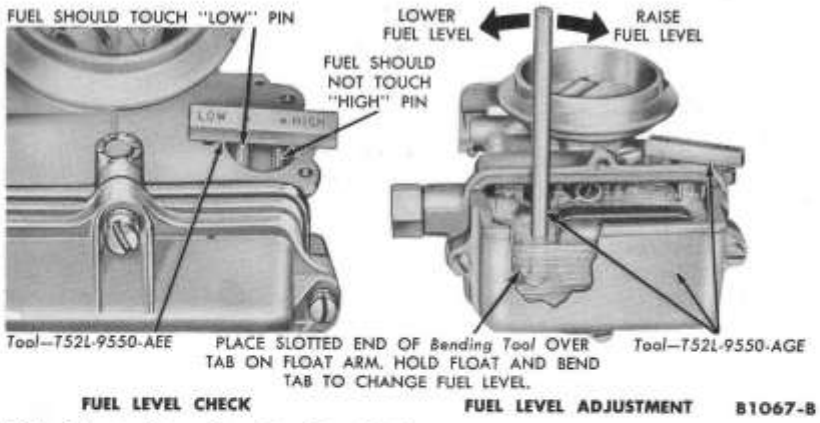


FIG. 14—Fuel Level and Fuel Level Adjustment

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.

9. Lubricate The Distributor Cam And The Distributor Bushing. Apply a light film of high temperature, nonfiber grease to the distributor cam. **Do not use engine oil.**

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

10. Clean Battery Cables And Terminals. Disconnect the battery cables. Wash the battery including the terminals and 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.

11. Clean Positive Crankcase Ventilation System. Remove the crankcase ventilation regulator valve, tubing, and connections. Disassemble the regulator valve. Clean the valve and tubing 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.

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.

12. Check Battery State of Charge. The battery state of charge can be checked by measuring the battery electrolyte solution specific gravity (hydrometer) or by measuring 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 11-1 which describes in detail the procedure to be followed.

13. 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. Install a new breaker point assembly if necessary (Part 2-1).

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 to specification (Part 17) by following the instructions of the meter manufacturer. Always clean used points before adjusting.

14. Check And Adjust Spark Advance. Refer to the procedure in Part 2-1.

After the spark advance has been checked and adjusted, install the rotor and position the distributor in the block so that the rotor is aligned with the mark previously scribed on the distributor body, and the marks on the body and engine block are in alignment. Position the distributor retaining clamp and install the retaining screw. 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) in the firing order. The firing order is 1-5-3-6-2-4.

15. 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 $\frac{3}{16}$ inch from the exhaust manifold and crank the engine with a remote starter switch. The spark should jump the gap regularly.

16. Check Fuel Pump Pressure And Capacity. Disconnect the fuel line at the carburetor. Install a pressure gauge (0-15 psi) and a petcock on the carburetor fuel inlet line (Fig. 15). 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 3.5-5.5 psi.

If the pressure is not to specifications, remove the fuel filter from the system and take another pressure reading.

If the pressure is within specifications with the fuel filter removed, the fuel filter was restricted and a new one should be installed.

If the pressure is not within specifications with the fuel filter removed, the fuel pump is defective.

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 1 pint within 30 seconds.

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:

17. Clean Carburetor Air Cleaner. Direct clean compressed air against

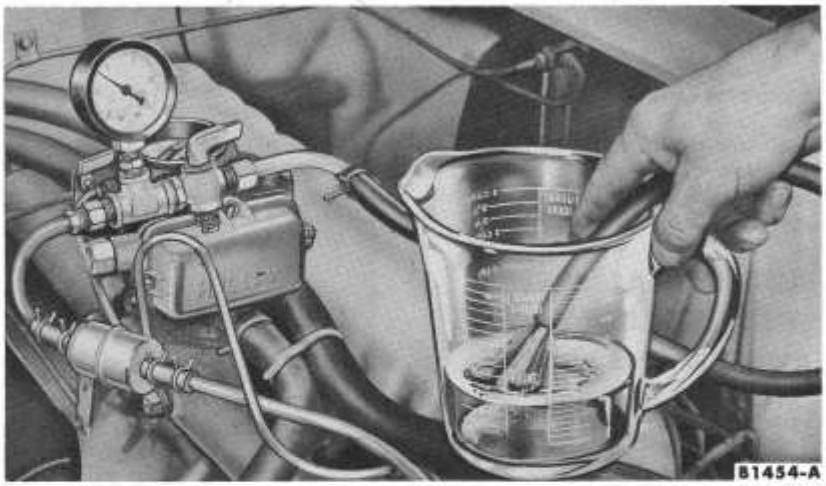


FIG. 15—Fuel Pump Pressure and Capacity Test

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.

18. Inspect the Radiator, Hoses, and Engine for Coolant Leaks. Inspect the radiator hoses for cracks, leaks, and a collapsed condition. Inspect the radiator and engine for external leaks.

Check for internal leakage by operating the engine at fast idle and looking for the formation of bubbles in the radiator. Oil in the radiator may indicate leakage in the engine block or a leak in the automatic transmission oil cooler. Water formation on the oil level dipstick could be an indication of internal leakage.

19. Check and Adjust Ignition Timing. 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 puncture the spark plug wire or moulded cap.

Clean the dirt from the timing marks and the notch on the pulley. If necessary, chalk the proper mark and the notch on the pulley to improve legibility.

Operate the engine at idle speed. The timing light should flash just as the proper mark lines up with the pointer indicating correct timing. The operator's eye should be in line with the center of the pulley and the timing pointer. The timing should be set at 4° BTC on a car with a manual-shift transmission or 2° BTC on a car with an automatic transmission.

ENGINE OPERATING AT NORMAL TEMPERATURE

20. Adjust Accelerator Pump Link To Seasonal Position. Acceleration requirements are satisfied by controlling the quantity of fuel discharged by the accelerating pump.

The pump stroke is controlled by changing the position of the pump link in the throttle lever (Fig. 16). The inner hole (hole closest to the throttle shaft) is for average or hot weather operation. The outer hole is for cold weather operation.

21. Check And Adjust Engine Idle Speed. Final engine idle speed may be varied to suit the conditions under which the car is to be operated. Refer to Fig. 17. **On a car with an air conditioner, operate the air conditioner for 20 minutes before setting the engine idle speed.**

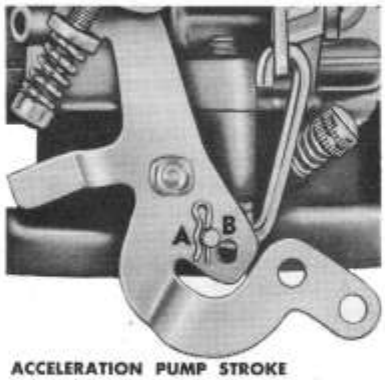


FIG. 16—Accelerating Pump Stroke

On a car with a manual-shift transmission, place the transmission selector lever in neutral position. Turn the idle speed stop screw in a direction to obtain 500-525 rpm. Open the throttle by hand and allow it to close normally. Recheck the engine idle speed.

On a car 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 475-500 rpm. Place the selector lever in neutral, accelerate the engine and let it return to idle. Place the selector lever in drive range and check the engine idle speed.

22. Check and Adjust Idle Fuel Mixture (Refer to Fig. 17). Make the initial mixture adjustment by turning the needle 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.

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

Check the engine idle speed.

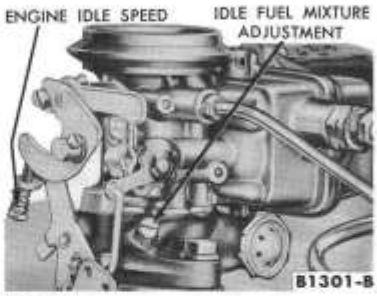


FIG. 17—Idle Adjustments

23. Check And Adjust Anti-Stall Dashpot Clearance—Fordomatic. 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).

FIG. 18—Anti-Stall Dashpot Adjustment

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

24. 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 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. 19) using a step-type feeler gauge only ("go" and "no go").

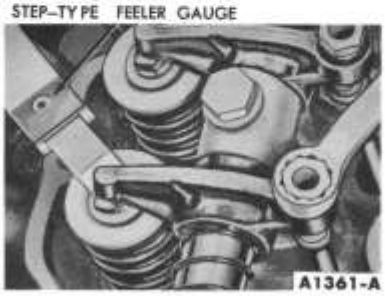


FIG. 19—Valve Lash Adjustment

The final (hot) intake and exhaust valve lash should be 0.016 inch.

To obtain the correct setting, use a step-type feeler gauge of 0.015 inch ("go") and 0.017 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 (0.016 inch).

ADDITIONAL TESTS AND ADJUSTMENTS

CAMSHAFT LOBE LIFT

1. Remove the air cleaner and the valve rocker arm cover.

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

2. 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 socket and in the same plane as the push rod movement (Fig. 20).

3. Turn the crankshaft pulley 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.

4. Zero the dial indicator, then continue to rotate the pulley slowly until the push rod is in the fully raised position.

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

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

7. Remove the dial indicator. Secure the valve rocker arm. If an end valve rocker arm was removed, slide it into position on the shaft and install the spring washer and retaining pin. Perform a preliminary valve lash adjustment as necessary. Operate the engine until normal operating temperature has been reached. Check and adjust the valve lash.

8. Install the valve rocker arm cover 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:

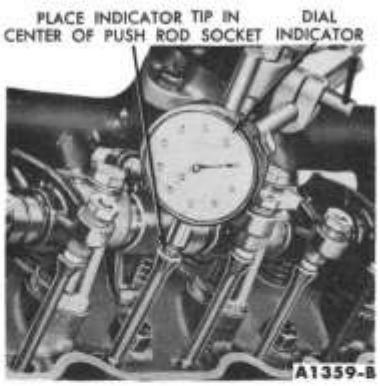


FIG. 20—Camshaft Lobe Lift

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

2. Install an accurate, sensitive vacuum gauge on the fuel pump end of the manifold vacuum line.

3. Operate the engine at the recommended idle rpm.

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 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 so as 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 2 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.

The cylinders are numbered from front to rear, 1-2-3-4-5-6 and the

TABLE 2—Manifold Vacuum Gauge Readings

Gauge Reading	Engine Condition
18 inches.	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 or valves.
Very low.	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 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 gasket leak.

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 pulley (Fig. 21). 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. 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 pulley is in line with the timing pointer.

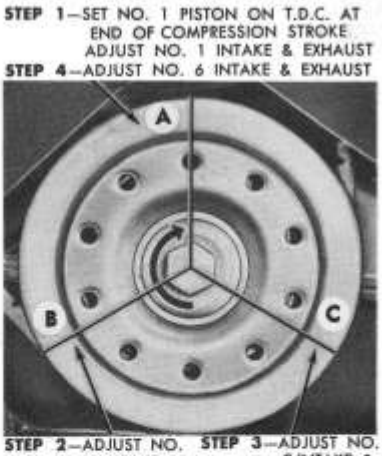


FIG. 21—Preliminary Valve Lash Adjustment

4. Adjust the intake and exhaust valve lash for No. 1 cylinder (Fig. 19). The preliminary (cold) intake and exhaust valve lash is 0.016 inch. **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 ⅓ turn at a time, in the direction of rotation, while adjusting the valves in the firing order sequence.

4 ENGINE REMOVAL AND INSTALLATION

A typical engine installation is shown in Fig. 22.

REMOVAL

1. Remove the hood.

2. Drain the cooling system and the crankcase.

3. Remove the air cleaner. Disconnect the battery ground cable at the cylinder head. Disconnect the radiator upper hose at the water outlet housing and the radiator lower hose at the water pump.

4. Remove the radiator. Remove the drive belt, fan, and pulley.

5. Disconnect the heater hoses at the water pump and the carburetor spacer. Disconnect the generator wires at the generator, the starter cable at the starter, the accelerator rod and the choke control cable at the carburetor.

6. Disconnect the windshield wiper vacuum hose at the vacuum pump. Remove the fuel pump sediment bowl. Disconnect the flexible fuel line at the fuel tank line and plug the fuel tank line.

7. Disconnect the coil primary wire at the coil. Disconnect the oil pressure and the water temperature sending unit wires at the sending units.

8. Remove the starter and dust seal.

On a car with a manual-shift transmission, disconnect the clutch retracting spring. Disconnect the clutch equalizer shaft and arm bracket at the underbody rail and remove the arm bracket and equalizer shaft.

9. Raise the car. Remove the flywheel or converter housing upper retaining bolts through the access holes in the underbody.

10. Disconnect the muffler inlet pipe at the exhaust manifold. Disconnect the engine right and left mount at the underbody bracket. Remove the flywheel or converter housing cover.

On a car with a manual-shift transmission, remove the flywheel housing lower retaining bolts.

On a car with Fordomatic, disconnect the converter from the flywheel.

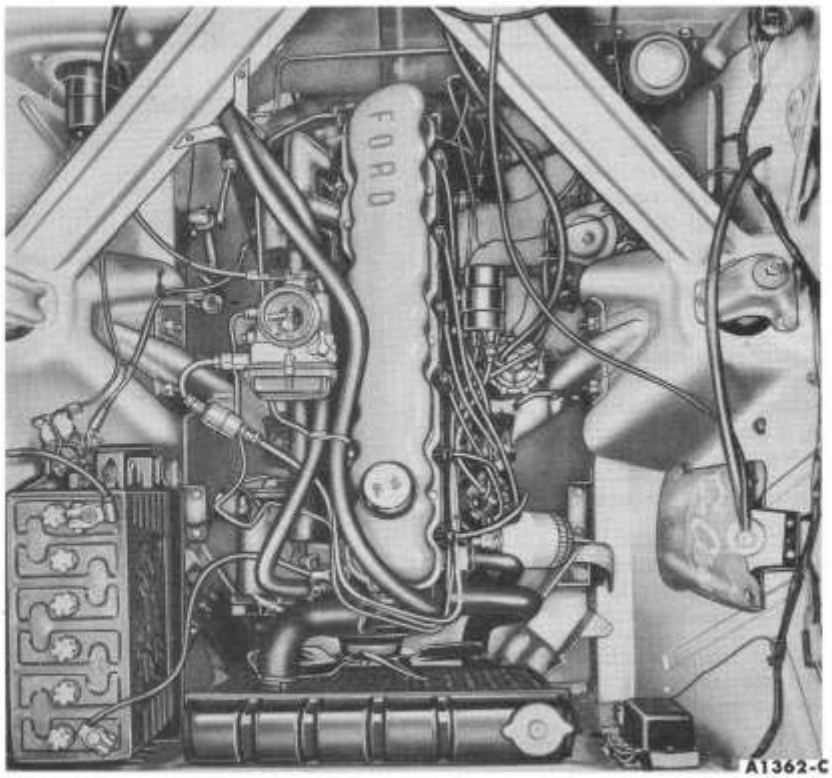


FIG. 22—Engine Installation

Remove the converter housing lower retaining bolts.

11. Lower the car. Support the transmission and flywheel or converter housing with a jack.

12. Attach the engine lifting hook (Fig. 23). Carefully lift the engine out of the engine compartment. Install the engine on a work stand (Fig. 24).

INSTALLATION

1. Install guide pins in the flywheel or converter housing bolt holes in the rear of the engine. Place a new gasket over the studs of the exhaust manifold.

FIG. 23—Engine Lifting Hook

2. Carefully lower the engine into the engine compartment.

3. Make sure the studs on the exhaust manifold are aligned with the holes in the muffler inlet pipe and the guide pins in the block engage the holes in the flywheel housing.

On a car with Fordomatic, start the converter pilot into the crankshaft.

On a car with a manual-shift transmission, start the transmission main drive gear into the clutch disc. It may be necessary to adjust the position of the transmission in relation to the engine if the input shaft will not enter the clutch disc. **If the engine "hangs up" after the shaft enters, turn the crankshaft slowly (transmission in gear) until the shaft splines mesh with the clutch disc splines.**

4. Remove the engine lifting hooks. Install the flywheel or converter housing upper retaining bolts.

5. Remove the jack from the transmission. Raise the car.

6. Remove the guide pin and install the flywheel or converter housing lower retaining bolts.

On a car with Fordomatic, attach the converter to the flywheel and tighten the retaining nuts to specifications.

7. Install the flywheel or converter housing dust cover.

On a car with a manual-shift transmission, install the clutch equalizer shaft and arm bracket. Connect the clutch retracting spring.

8. Install the engine left and right mount to the underbody bracket. Install the sediment bowl on the fuel pump.

9. Remove the plug from the fuel tank line and connect the flexible fuel line to the fuel tank line. Install the exhaust manifold to muffler inlet pipe retaining lockwashers and nuts.

10. Lower the car. Connect the oil pressure and the engine temperature sending unit wires. Connect the coil primary wire. Connect the windshield wiper vacuum hose to the vacuum pump. Connect the accelerator rod. Connect and adjust the choke control cable.

11. Install the starter motor and dust seal. Connect the starter cable. Connect the generator wires. Connect the heater hose at the water pump and carburetor spacer. Connect the battery ground cable.

12. Install the pulley, fan, and drive belt. Adjust the drive belt tension. Install the radiator. Connect the radiator upper and lower hoses. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of engine oil.

13. Install and adjust the hood.

14. Operate the engine at fast idle and check all gaskets and hose connections for leaks.

On a car with Fordomatic, adjust the transmission control linkage.

15. Install the air cleaner.

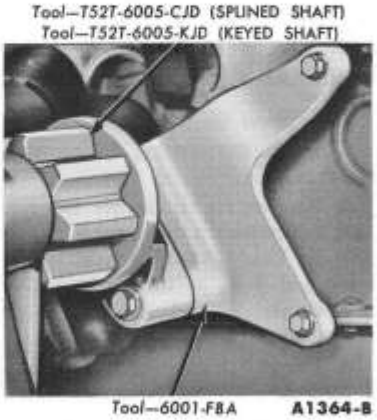


FIG. 24—Engine Work Stand

5 IN-CHASSIS REPAIR OPERATIONS

ENGINE SUPPORTS

ENGINE FRONT SUPPORT

The engine front support is shown in Fig. 25.

1. Remove the engine support to underbody nuts. The nuts must be removed from both supports so that the engine can be raised.

2. Raise the engine slightly with a jack and a wood block placed under the oil pan.

3. Remove the engine support to engine bolts. Remove the support.

4. Place the engine support into position. Install the support to engine bolts.

5. Lower the jack and guide the support studs through the holes in the underbody. Remove the jack and wood block.

6. Install the support to underbody nuts and lockwashers.

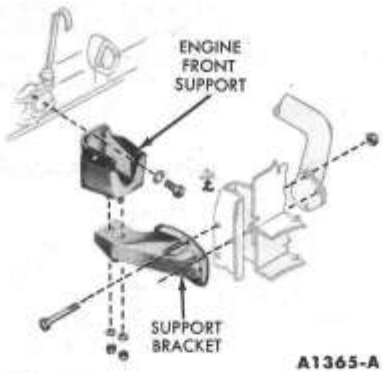


FIG. 25—Engine Front Support

ENGINE REAR SUPPORTS

The engine rear supports are shown in Fig. 26.

Car

1. Remove the support assembly to underbody bolts. Remove the support assembly to insulator bolts and remove the support assembly.

2. Remove the insulator to extension housing bolt and remove the insulator.

3. Install the insulator assembly on the support assembly.

4. Place the assembly in position and install the support assembly to underbody lockwashers and bolts.

5. Install the insulator to extension housing lockwasher and bolt.

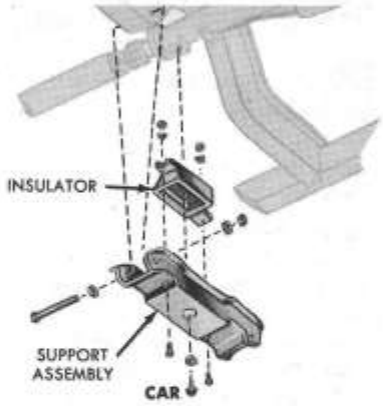
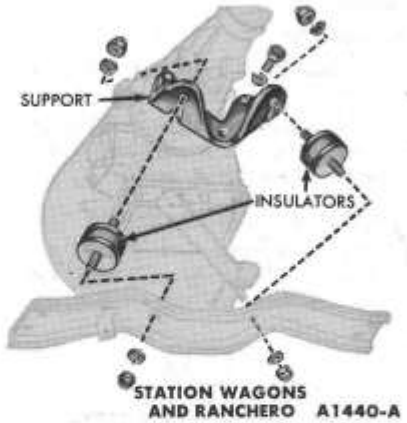


FIG. 26—Engine Rear Support



Station Wagons and Ranchero

1. On a model with a manual-shift transmission, drain the transmission.

2. Remove the insulator nuts and washers.

3. Support the transmission with a floor jack and remove the cross member bolts. Remove the cross member and the insulators.

4. Remove the engine support bolts and lockwashers. Remove the support.

5. Position the engine support and install the bolts and lockwashers.

6. Place the insulators in the cross member mounting holes. Position the cross member to the underbody and install the bolts.

7. Make sure the insulators are seated properly on the cross member, and then install the washers and nuts.

On a model with a manual-shift transmission, fill the transmission.

EXHAUST MANIFOLD

REMOVAL

1. Remove the air cleaner. Disconnect the muffler inlet pipe from the exhaust manifold.

2. Bend the exhaust manifold retaining bolt lock tabs back and remove the retaining bolts. Remove the exhaust manifold.

INSTALLATION

1. Place a new exhaust manifold to muffler inlet pipe gasket over the studs of the exhaust manifold.

2. Place the exhaust manifold into position on the muffler inlet pipe and against the block. Install the exhaust manifold to block retaining bolts and tab washers. Torque the retaining bolts to 24-30 ft-lbs. Lock the bolts by bending one tab of the washer over a flat on the bolt.

3. Install the muffler inlet pipe to exhaust manifold lockwashers and nuts. Torque the nuts to 24-30 ft-lbs. Install the air cleaner.

CLEANING AND INSPECTION

Scrape the old gasket material from the flanges of the muffler inlet pipe and from the exhaust manifold inlet pipe flange. Inspect the manifold for cracks, leaks, or other defects that would make it unfit for further service.

REGULATOR VALVE—POSITIVE CRANKCASE VENTILATION SYSTEM

REMOVAL

1. Remove the crankcase ventilation exhaust tube by disconnecting the exhaust tube from the crankcase ventilation outlet and from the regulator valve assembly (Fig. 27).

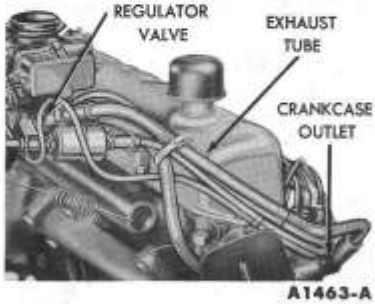


FIG. 27—Regulator Valve and Exhaust Tube

2. Remove the regulator valve assembly from the fitting in the carburetor spacer.

INSTALLATION

1. Install the regulator valve assembly in the carburetor spacer.

2. Connect the exhaust tube to the regulator valve assembly and to the crankcase ventilation outlet.

REGULATOR VALVE DISASSEMBLY

Place the large hex end of the regulator valve body in a vise. Remove the connector, valve, and spring.

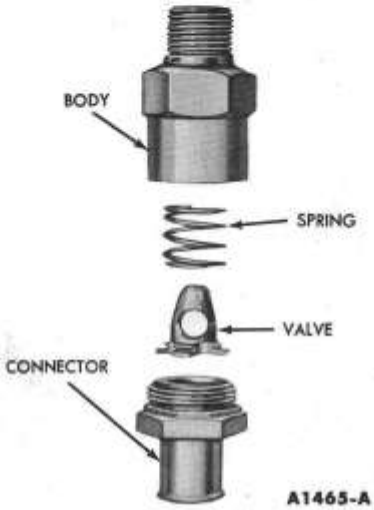


FIG. 28—Regulator Valve Assembly

CLEANING

Clean the valve parts and tubing in clean carburetor solvent and dry with compressed air. Clean the rubber hose connections with a low volatility petroleum base solvent and dry with compressed air.

REGULATOR VALVE ASSEMBLY

Position the spring and valve inside the regulator valve body (Fig. 28). Install the regulator valve connector.

VALVE ROCKER ARM SHAFT ASSEMBLY

REMOVAL

1. Operate the engine until normal operating temperature has been reached. Remove the valve rocker arm cover and discard the gasket.

2. Loosen all the valve rocker arm adjusting screws two turns at a time in sequence, to remove the valve spring load from the rocker arms. Remove the valve rocker arm shaft assembly (Fig. 29).

FIG. 29—Valve Rocker Arm Shaft Removal

INSTALLATION

1. Apply Lubriplate to both ends of the push rods and to the valve stem tip.

2. Position the valve rocker arm shaft assembly on the head.

3. Tighten all the valve rocker arm shaft retaining bolts two turns at a time in sequence. Torque the bolts to 30-35 ft-lbs.

4. Perform a preliminary valve lash adjustment (page 1-14).

5. Clean the valve rocker arm cover. Coat one side of a new valve rocker arm cover gasket with oil resistant sealer. Lay the cemented side of the gasket in place in the cover (Fig. 30). Install the cover, making sure that the gasket seats evenly around the head. The cover is tightened in two steps. First torque the retaining bolts to 3-5 ft-lbs. Two minutes after the initial tightening, torque the bolts to the same specification.

DISASSEMBLY

1. Remove the pin and spring washer from each end of the valve rocker arm shaft.

2. Slide the valve rocker arms, springs, and supports off the shaft. Be sure to identify the parts.

3. If it is necessary to remove the plugs from each end of the shaft, drill or pierce the plug on one end. Use a steel rod to knock out the plug on the opposite end. Working from the open end, knock out the remaining plug.

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 bore for nicks, scratches, scores, or scuffs. Dress up minor surface defects with a hone.

FIG. 30—Valve Rocker Arm Cover Gasket Installation

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

ASSEMBLY

1. Lubricate all parts with engine oil. Apply Lubriplate to the valve and push rod ends of the rocker arm.

2. If the plugs were removed from the ends of the shaft, use a blunt tool or large diameter pin punch and install a plug, cup side out, in each end of the shaft.

3. Install the spring washer and pin on one end of the shaft.

4. Install the valve rocker arms, supports, and springs in the order shown in Fig. 31. **Be sure the oil holes in the shaft are facing downward.** Complete the assembly by installing the remaining spring washer and pin.

CYLINDER HEAD AND VALVES

CYLINDER HEAD REMOVAL

1. Operate the engine until normal operating temperature has been reached. Drain the cooling system. Remove the air cleaner. Disconnect the battery cable at the cylinder head.

2. Disconnect the muffler inlet pipe at the exhaust manifold. Pull the muffler inlet pipe down. Remove the gasket.

3. Disconnect the accelerator rod retracting spring. Disconnect the choke control cable and the accelerator rod at the carburetor.

4. Disconnect the fuel inlet line and the distributor vacuum line at the carburetor. Disconnect the vacuum line at the carburetor spacer.

5. Disconnect the carburetor spacer outlet line at the spacer. Disconnect the radiator upper hose at the coolant outlet elbow. Disconnect the heater hoses at the water pump and at the cylinder head.

6. Disconnect the distributor vacuum line at the distributor. Disconnect the carburetor fuel inlet line and the vacuum line at the fuel pump.

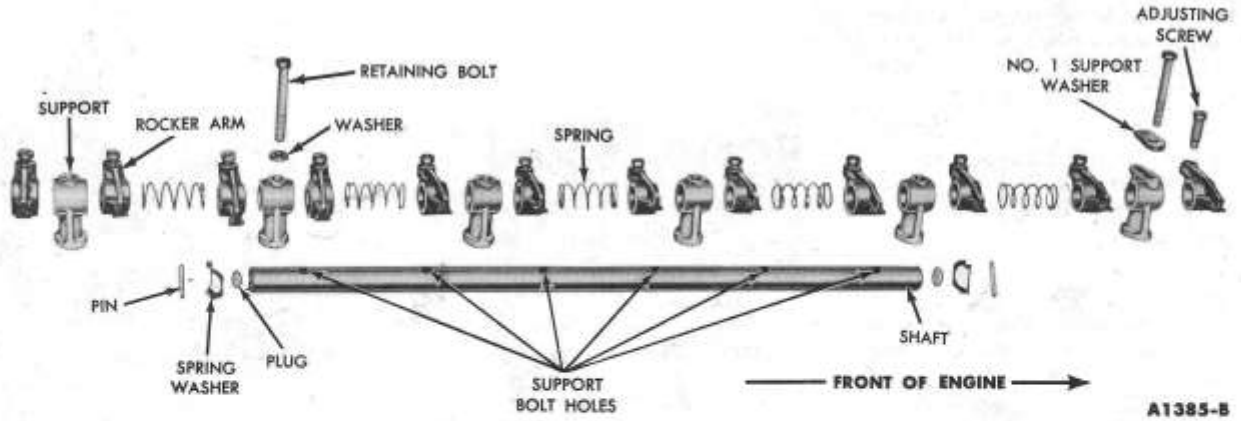


FIG. 31—Valve Rocker Arm Shaft Assembly

Remove the three lines as an assembly.

On an engine with positive crankcase ventilation, disconnect the exhaust tube at the regulator valve and crankcase outlet. Remove the regulator valve. Disconnect the vacuum line at the regulator valve fitting and fuel pump.

7. Disconnect the spark plug wires at the spark plugs and the temperature sending unit wire at the sending unit.

8. Remove the valve rocker arm cover.

9. Remove the valve rocker arm shaft assembly. Remove the valve push rods in sequence (Fig. 32).

FIG. 32—Valve Push Rod Removal

10. Remove one cylinder head bolt from each end of the head at opposite corners and install the cylinder head guide studs (Fig. 33). Remove the remaining cylinder head bolts and remove the cylinder head. **Do not pry between the cylinder head and block as the gasket surfaces may become damaged.**

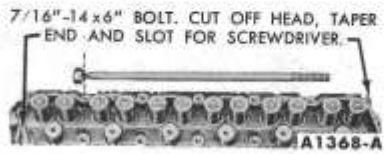


FIG. 33—Cylinder Head Guide Studs

CYLINDER HEAD INSTALLATION

1. Clean the head and block gasket surfaces. If the cylinder head was removed for a gasket change, check the flatness of the cylinder head and block.

2. Apply cylinder head gasket sealer to both sides of a new gasket. Use the brush furnished to spread the sealer evenly over the entire gasket surface. Position the gasket over the guide studs on the cylinder block.

3. Install a new gasket on the flange of the muffler inlet pipe.

4. Lift the cylinder head over the guides and slide it down carefully, guiding the exhaust manifold studs into the muffler inlet pipe.

5. Coat the threads of the end bolts for the right side of the cylinder head with a small amount of water resistant sealer. Install, but do not tighten, two bolts at opposite ends of the head to hold the head and gasket in position. Remove the guides, then install the remaining bolts.

6. The cylinder head bolts are tightened in three progressive steps. Torque all the bolts in sequence (Fig. 34) to 55 ft-lbs, then to 65 ft-lbs, and finally to 75 ft-lbs. **After the cylinder head bolts have been tightened to specifications, the bolts should not be disturbed.**

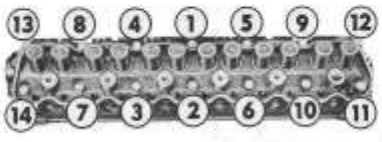


FIG. 34—Cylinder Head Bolt Tightening Sequence

7. Apply Lubriplate to both ends of the push rods. Install the push rods in their original bores, positioning the lower end of the rods into the tappet sockets. Apply Lubriplate to the valve stem tips and to the rocker arm pads.

8. Install the valve rocker arm shaft assembly following steps 2 and 3 under "Valve Rocker Arm Shaft Installation."

9. Perform a preliminary (cold) valve lash adjustment (page 1-14).

10. Install the muffler inlet pipe lockwashers and retaining nuts.

11. Connect the radiator upper hose at the coolant outlet elbow. Connect the heater inlet and outlet hoses at the water pump. Connect the carburetor spacer outlet line at the spacer.

12. Position the distributor vacuum line, the carburetor fuel inlet line, and the vacuum line on the engine. Connect the fuel inlet line and the distributor vacuum line at the carburetor. Connect the vacuum line at the carburetor spacer. Connect the battery cable to the cylinder head.

On an engine with positive crankcase ventilation, position and connect the vacuum line at the regulator valve fitting and fuel pump. Clean the regulator valve parts, exhaust tube, and rubber hose connections. Install the regulator valve. Position and connect the exhaust tube at the regulator valve and crankcase outlet.

13. Connect the accelerator rod retracting spring. Connect the choke control cable and the accelerator rod at the carburetor. Adjust the choke control cable.

14. Connect the distributor vacu-

um line at the distributor. Connect the carburetor fuel inlet line at the fuel filter and the intake manifold vacuum line at the fuel pump.

15. Connect the temperature sending unit wire at the sending unit. Connect the spark plug wires. **Be sure the wires are forced all the way down into their sockets.**

16. Fill and bleed the cooling system. Start the engine and operate it for a **minimum of 30 minutes at 1200 rpm** to stabilize engine temperatures. Check for coolant and oil leaks. Adjust the engine idle speed and the idle fuel mixture. Check the valve lash with the engine idling and adjust the lash if necessary using a step-type gauge (Page 1-14).

17. Install the valve rocker arm cover following step 5 under "Valve Rocker Arm Installation" on page 1-18. Install the air cleaner.

CYLINDER HEAD DISASSEMBLY

1. Install the cylinder head holding fixtures (Fig. 35). Remove deposits from the combustion chambers and valve heads with a scraper and a wire brush before removing the valves. **Be careful not to scratch the cylinder head gasket surface.**

FIG. 35—Cylinder Head Holding Fixtures

2. Compress the valve springs (Fig. 36). Remove the valve retainer locks and release the spring.

3. Remove the sleeve, spring retainer, stem seal, and valve. Discard the valve stem seals. Identify all valve parts.

CYLINDER HEAD CLEANING

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.

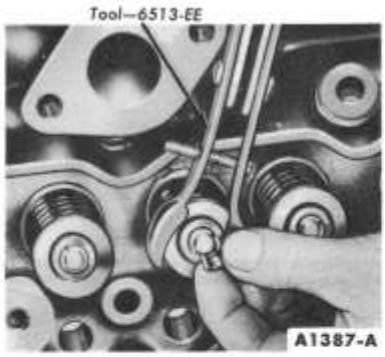


FIG. 36—Compressing Valve Spring

Check the cylinder head for cracks, and the gasket surface for burrs and nicks. 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.

CYLINDER HEAD INSPECTION

Cylinder Head Flatness. Check the flatness of the cylinder head gasket surface (Fig. 37).

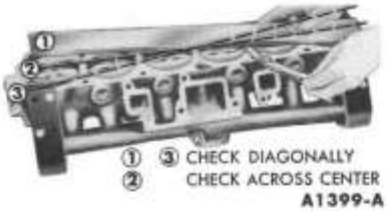


FIG. 37—Cylinder Head Flatness

Valve Seat Runout. Check the valve seat runout with an accurate gauge (Fig. 38). Follow the instructions of the gauge manufacturer.

Valve Seat Width. Measure the valve seat width (Fig. 39).

Reaming Valve Guides. If it becomes necessary to ream a valve guide (Fig. 40) 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. **Always**

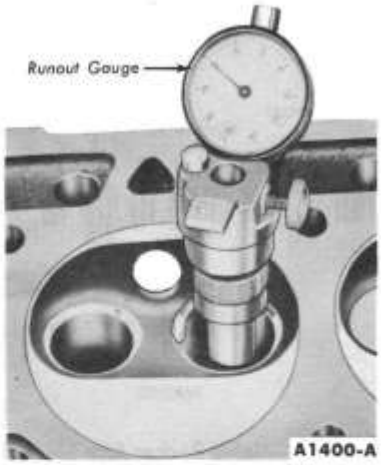


FIG. 38—Valve Seat Runout

FIG. 39—Valve Seat Width

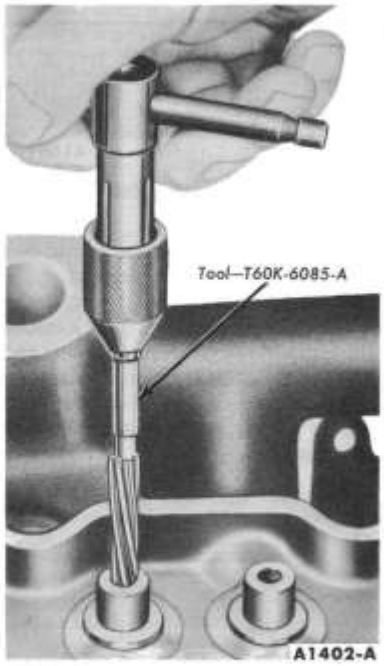


FIG. 40—Reaming Valve Guides

reface the valve seat after the valve guide has been reamed.

Refacing Valve Seats. Refacing of the valve seats should be closely coordinated with 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 tight fit. Be sure that the refacer grinding wheels are properly dressed.

Grind the valve seats to a true 45° angle (Fig. 41). Remove only enough stock to clean up pits, grooves, or to correct the valve seat runout. After the seat has been refaced, measure the seat width (Fig. 39). 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. 41).

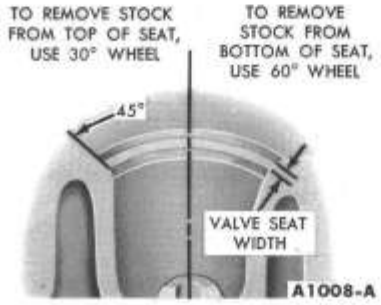


FIG. 41—Valve Seat Refacing

Use a 30° angle grinding wheel to remove stock from the top of the seats (raise the seats) and use a 60° angle wheel to remove stock from the bottom of the seats (lower the seats).

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.

VALVES

Cleaning. Remove all deposits from the valve with a fine wire brush or buffing wheel. The critical inspection points and tolerances of the valves are illustrated in Fig. 42.

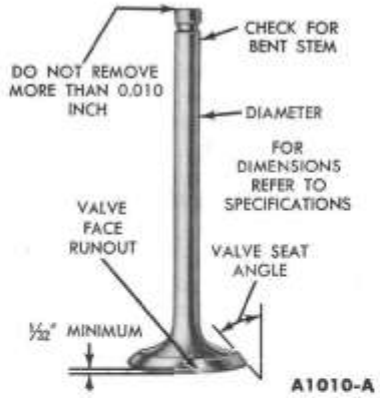


FIG. 42—Critical Valve Tolerances

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. Defects, such as minor pits, grooves, etc., may be removed. Discard valves that are severely damaged.

Inspect the valve springs, valve spring retainers, locks, and sleeves for defects. Discard any defective parts.

INSPECTION

Valve Face Runout. Check the valve face runout (Fig. 43). It should not exceed the wear limit.

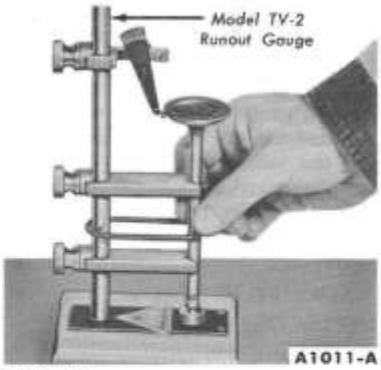


FIG. 43—Valve Face Runout

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. 44 or its equivalent.

If the clearance exceeds the wear limit, try a new valve.

Valve Spring Pressure. Check the spring for proper pressure (Fig. 45). Weak valve springs cause poor engine performance; therefore, if the pressure of any spring approaches the wear limit, replace the spring.

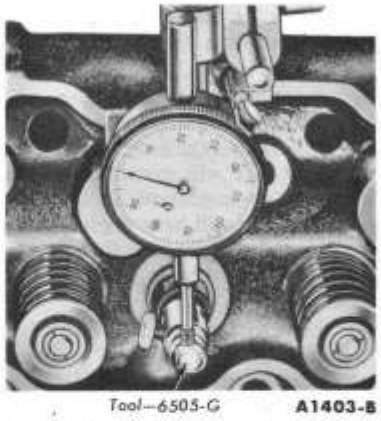


FIG. 44—Valve Stem Clearance

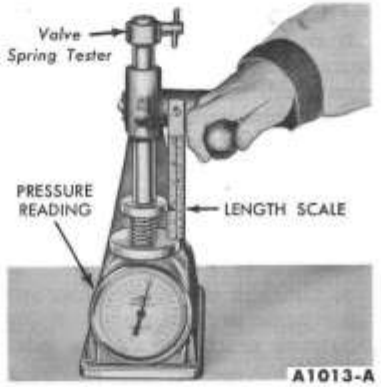


FIG. 45—Valve Spring Pressure

Valve Spring Squareness. Check each spring for squareness using a steel square and a surface plate (Fig. 46). 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 and

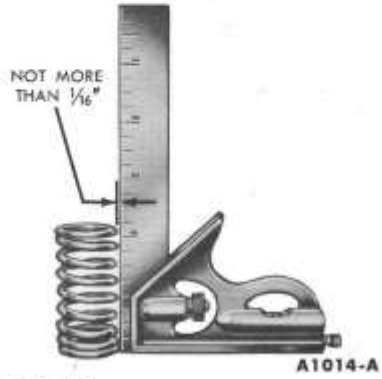


FIG. 46—Valve Spring Squareness

the square. If the spring is out of square more than 1/16 inch, replace it.

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, reface the valves 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 grinding, replace the valve as the valve will run too hot in the engine.

SELECT FITTING VALVES

If the valve stem to valve guide clearance exceeds the wear limit, ream the valve guide for the next oversize 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" on page 1-20.

CYLINDER HEAD ASSEMBLY

1. Lubricate the valve guides and valve stems with engine oil. Apply Lubriplate to the tip of the valve stems.

2. Install each valve (Fig. 47) in the valve guide from which it was removed or to which it was fitted. Install a new stem seal on the valve.

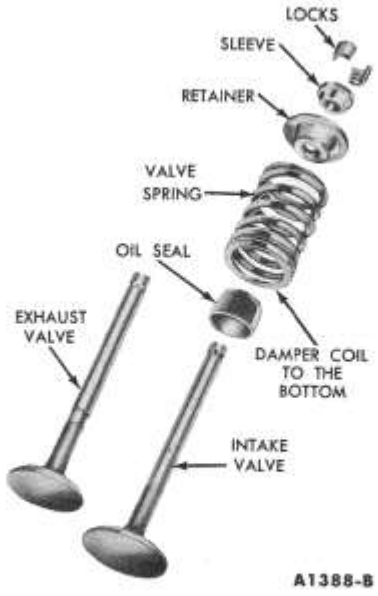


FIG. 47—Valve Assembly

3. Install the valve spring assembly over the valve. **Be sure the damper coil is down.** Install the spring retainer and sleeve.

4. Compress the spring and install the retainer locks (Fig. 36).

5. Measure the assembled height of the valve spring from the surface of the cylinder head spring pad to the underside of the spring retainer with dividers (Fig. 48).

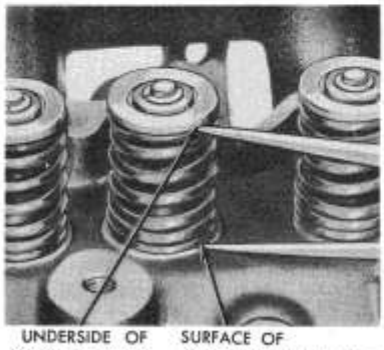


FIG. 48—Valve Spring Assembled Height

6. Check the dividers against a scale. If the assembled height is greater than 1 3/64 inches, install the necessary 0.030-inch thick spacer(s) between the cylinder head spring pad and the valve spring to bring the assembled height to the recommended dimension of 1 1/16-1 3/64 inches. **Do not install spacers unless necessary. Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which could lead to spring breakage and worn camshaft lobes.**

VALVE STEM SEAL REPLACEMENT

1. Operate the engine until normal operating temperature has been reached. Remove the air cleaner and the valve rocker arm cover. Remove the applicable spark plug.

2. Crank the engine until the applicable cylinder is on TDC after the compression stroke. Be sure that both valves are closed.

3. Loosen the valve rocker arm adjusting screw to remove the valve spring load. Remove the valve push rod.

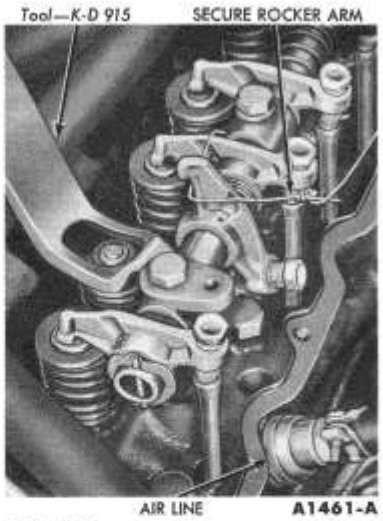


FIG. 49—Compressing Valve Spring

4. Install an air line with an adapter in the spark plug hole.

5. Push the rocker arm to one side and secure it in this position (Fig. 49). To move the rocker arm on either end of the shaft, it will be necessary to remove the retaining pin and spring washer and slide the rocker arm off the shaft.

6. Turn on the air supply. Using the valve spring compression tool shown in Fig. 49, compress the valve and remove the valve spring retainer locks, the sleeve, spring retainer, and the valve spring.

7. Remove the valve stem seal (Fig. 50).

8. Install a new valve stem seal. Place the spring in position over the valve. **Be sure the damper coil is down.** Install the spring retainer and sleeve. Compress the valve spring and install the valve spring retainer locks.

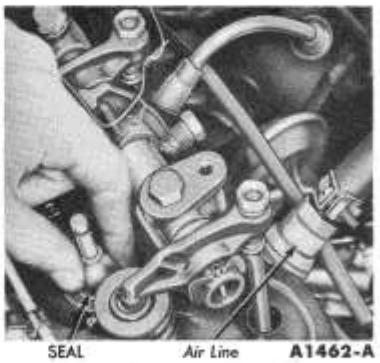


FIG. 50—Valve Stem Seal Removal

9. Apply Lubriplate to both ends of the push rod, the valve and push rod end of the rocker arm, and the valve stem tip. Install the push rod making sure the lower end of the rod is positioned in the tappet push rod cup.

10. Remove the wire securing the valve rocker arm and slide the rocker arm into position. If an end valve rocker arm was removed, slide it into position on the shaft and install the spring washer and retaining pin. Turn off the air and remove the air line and adapter. Install the spark plug and spark plug wire.

11. Perform a preliminary valve lash on the applicable valve. Operate the engine until normal operating temperature has been reached and perform a final valve lash adjustment.

12. Install the valve rocker arm cover following step 5 under "Valve Rocker Arm Installation" on page 1-18. Install the air cleaner.

CYLINDER FRONT COVER AND TIMING CHAIN

REMOVAL

1. Drain the cooling system and the crankcase. Disconnect the radiator upper hose at the coolant outlet elbow and the radiator lower hose at the water pump.

2. Remove the radiator. Remove the drive belt, fan and pulley, and the crankshaft pulley.

3. Remove the cylinder front cover and gasket (the crankcase ventilation tube bracket is retained by one cylinder front cover bolt). Remove the crankshaft front oil slinger.

4. Establish a reference point on the block and measure from this point to the chain. Rotate the crankshaft in the opposite direction to take up the slack on the right side of the chain. Force the left side of the chain out with the fingers and measure the distance between the reference point and the chain. The deflection is the difference between the two measurements. If the deflection exceeds ½ inch, replace the timing chain and sprockets.

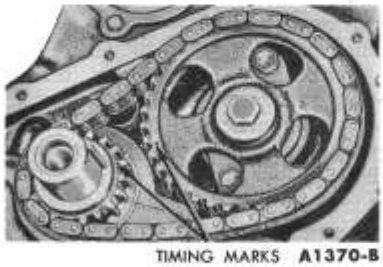


FIG. 51—Aligning Timing Marks

FIG. 52—Timing Chain and Sprockets Removal

5. Crank the engine until the timing marks are aligned as shown in Fig. 51. Remove the camshaft sprocket retaining bolt and washer. Slide both sprockets and timing chain forward and remove them as an assembly (Fig. 52).

6. Remove the oil pan and related parts (page 1-31).

INSTALLATION

1. Position the sprockets and timing chain on the camshaft and crankshaft. Be sure the timing marks on the sprockets and chain are positioned as shown in Fig. 51. Install the camshaft sprocket cap screw and washer. Install the oil slinger so that the timing pointer on the slinger is aligned with the camshaft timing mark.

2. Clean the cylinder front cover and the gasket surface of the cylinder block. Apply sealer to a new cylinder front cover gasket and position the gasket on the cylinder front cover. Install the cylinder front cover using the tool shown in Fig. 53 (the crankcase ventilation tube bracket is retained by one cylinder front cover bolt). Torque the retaining bolts to 6-9 ft-lbs. Install the crankshaft pulley.

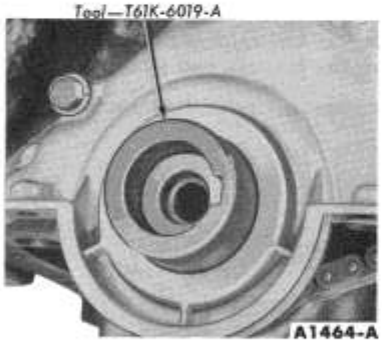


FIG. 53—Cylinder Front Cover Alignment

3. Install the oil pan and related parts (page 1-31).

4. Install the fan, pulley, and drive belt. Adjust the drive belt.

5. Install the radiator. Connect the radiator upper and lower hoses.

6. Fill and bleed the cooling system. Fill the crankcase with the proper quantity and grade of engine oil.

7. Start the engine and check the ignition timing. Adjust the ignition timing if necessary. Operate the engine at fast idle and check all hose connections and gaskets for leaks.

CLEANING AND INSPECTION

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

FRONT OIL SEAL REPLACEMENT

1. Drive out the old seal with a pin punch. Clean out the recess in the cover.

2. Coat a new seal with grease and install the seal (Fig. 54). Drive the seal in until it is fully seated in the recess. Check the seal after installation to be sure the spring is properly positioned in the seal.

CAMSHAFT

The camshaft and related parts are shown in Fig. 55.

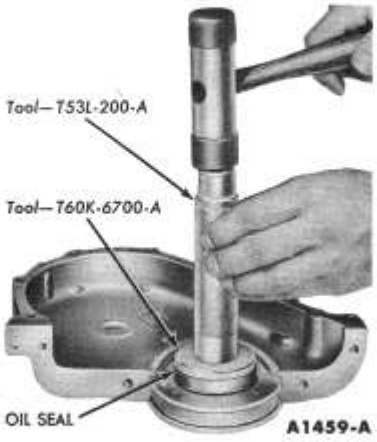


FIG. 54—Crankshaft Front Oil Seal Replacement

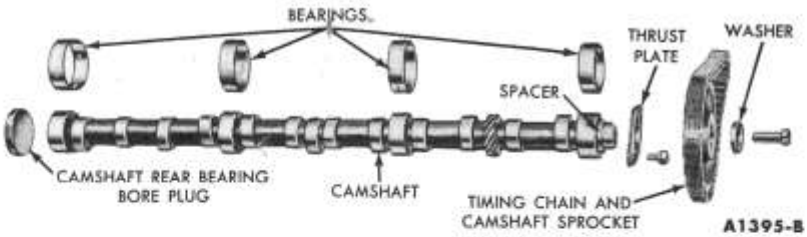


FIG. 55—Camshaft and Related Parts

REMOVAL

1. Drain the cooling system and the crankcase. Remove the air cleaner. Disconnect the battery cable at the cylinder head.

2. Disconnect the radiator hoses at the coolant outlet elbow and the water pump. Remove the radiator. Remove the grille.

3. Disconnect the accelerator rod retracting spring. Disconnect the choke control cable and the accelerator rod at the carburetor.

4. Disconnect the fuel inlet line and the distributor vacuum line at the carburetor. Disconnect the vacuum line at the carburetor spacer.

5. Disconnect the carburetor spacer outlet line at the carburetor spacer. Disconnect the heater hose at the water pump and at the cylinder head.

6. Disconnect the muffler inlet pipe at the exhaust manifold. Pull the muffler inlet pipe down. Remove the gasket.

7. Disconnect the distributor vacuum line at the distributor. Disconnect the carburetor fuel inlet line and the vacuum line at the fuel pump. Remove the three lines as an assembly. Disconnect the windshield wiper vacuum line at the fuel pump.

On an engine with positive crankcase ventilation, disconnect the exhaust tube at the regulator valve and crankcase outlet. Remove the regulator valve. Disconnect the vacuum line at the regulator valve fitting and fuel pump.

8. Disconnect the spark plug wires at the spark plugs and the coil high tension lead at the coil. Remove the distributor cap and spark plug wires as an assembly. Disconnect the primary wire at the coil and remove it from the retaining clip on the cylinder head.

9. Disconnect the engine temperature sending unit wire at the sending unit. Disconnect the flexible fuel line at the fuel tank line and plug the line. Remove the distributor, the fuel pump, and the oil filter.

10. Remove the valve rocker arm cover. Follow steps 9 and 10 under "Cylinder Head Removal" (page 1-19) and remove the cylinder head.

11. Using a magnet, remove the tappets and keep them in order so that they can be installed in their original location (Fig. 56).

12. Remove the drive belt, fan and pulley, and the crankshaft pulley.

13. Remove the oil level dipstick. Remove the oil pan (page 1-31). Remove the oil pump and inlet tube assembly.

14. Remove the cylinder front cover and gasket (the crankcase ventilation tube bracket is retained by one cylinder front cover bolt).

15. Push the camshaft toward the rear of the engine. Install a dial indicator so that the indicator point is on the camshaft sprocket cap screw (Fig. 57). Zero the dial indicator. Position a large screw driver between the camshaft sprocket and the block. Pull the camshaft forward and release it. Compare the dial indicator reading with specifications. If the end play is excessive, replace the thrust plate.

16. Remove the dial indicator. Remove the timing chain and sprockets following steps 4 and 5 under "Cylinder Front Cover and Timing Chain Removal" on page 1-23.

17. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. **Use caution to avoid damaging the journals and lobes.**

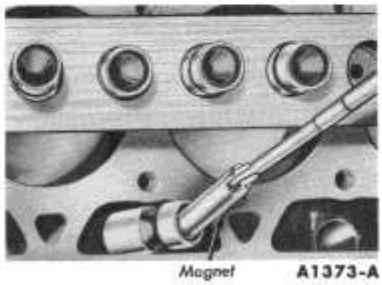


FIG. 56—Valve Tappet Removal

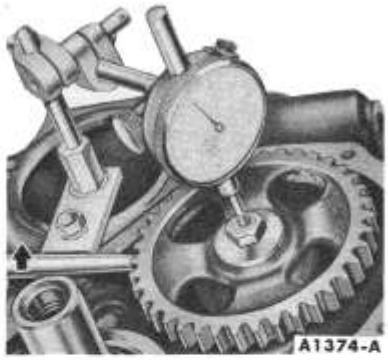


FIG. 57—Camshaft End Play

INSTALLATION

1. Oil the camshaft and apply Lubriplate to all the camshaft lobes. Carefully slide the camshaft through the bearings.

2. Install the thrust plate and torque the retaining screws to 12-15 ft-lbs. Replace the crankshaft front oil seal (page 1-23).

3. Follow steps 1 and 2 under "Cylinder Front Cover and Timing Chain Installation" (page 1-23) and install the sprockets and timing chain, oil slinger, the cylinder front cover, and the crankshaft pulley.

4. Clean the oil pump inlet tube screen, and the oil pan and block gasket surfaces. Install the oil pump inlet tube, oil pump, and the oil pan and related parts (page 1-31). Install the oil level dipstick.

5. Install the fan and fan pulley, and drive belt. Adjust the belt tension. Install the radiator and the grille.

6. Dip the tappet foot in Lubriplate. Coat the remainder of each valve tappet with engine oil. Install the tappets in their original bores.

7. Install the cylinder head, push rods, and the valve rocker arm shaft assembly (including a preliminary valve lash adjustment) by following steps 1 through 9 under "Cylinder Head Installation" (page 1-19).

8. Using a new gasket, install the fuel pump and connect the flexible fuel line. Install the oil filter.

9. Position the distributor in the block with the rotor at the No. 1 firing position and the breaker points open. Install the distributor hold down clamp.

10. Connect the engine temperature sending unit wire. Connect the coil primary wire. Install the distributor cap. Connect the spark plug wires and the coil high tension lead.

11. Install the distributor vacuum line, the carburetor fuel inlet line, and the vacuum line. Connect the windshield vacuum line.

On an engine with positive crankcase ventilation, position and connect the vacuum line at the regulator valve fitting and fuel pump. Clean the regulator valve parts, exhaust tube, and rubber hose connections. Install the regulator valve. Position and connect the exhaust tube at the regulator valve and crankcase outlet.

12. Using a new gasket, install the muffler inlet pipe, lockwashers, and retaining nuts.

13. Connect the radiator upper and lower hoses. Connect the heater hoses at the water pump and the coolant outlet elbow. Connect the carburetor spacer hose at the carburetor spacer.

14. Connect the accelerator rod retracting spring. Connect the choke control cable and the accelerator rod at the carburetor. Adjust the choke control cable. Connect the battery cable at the cylinder head.

15. Fill and bleed the cooling system. Fill the crankcase.

16. Start the engine and check and adjust the ignition timing. **Operate the engine for a minimum of 30 minutes at 1200 rpm** to stabilize engine temperatures. Check for coolant and oil leaks. Adjust the engine idle speed and the idle fuel mixture. Check the valve lash with the engine idling and adjust the lash if necessary using a step-type gauge (page 1-14).

On a car with Fordomatic, adjust the transmission control linkage.

17. Install the valve rocker arm cover following step 5 under "Valve Rocker Arm Installation" on page 1-18. Install the air cleaner.

CLEANING AND INSPECTION

Clean the camshaft in solvent and wipe it dry. Inspect the camshaft lobes for scoring, and signs of abnormal wear. Lobe wear 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 lobe lift loss has exceeded 0.005 inch.

The lift of camshaft lobes can be accurately checked only with the camshaft installed in the engine. Refer to "Camshaft Lobe Lift" (page 1-14).

Check the distributor drive gear for broken or chipped teeth.

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

CAMSHAFT REAR BEARING BORE PLUG REPLACEMENT

1. On a car with a manual-shift transmission, slide the transmission to the rear and remove the clutch pressure plate and disc following the procedure in Part 5-1.

On a car with Fordomatic, remove the transmission and converter housing following the procedure in Part 6-4.

2. Remove the flywheel retaining bolts and remove the flywheel.

3. Drill a ½-inch hole in the camshaft rear bearing bore plug and use tool T58L-101-A to remove the plug.

4. Clean out the plug bore recess thoroughly.

5. Coat the flange of a new plug with water resistant sealer and install it with the flange facing out (Fig. 88).

6. Install the flywheel.

On a car with a manual-shift transmission, install the clutch pressure plate and disc and install the transmission following the procedure in Part 5-1.

On a car with Fordomatic, install the transmission and converter housing following the procedure in Part 6-4.

VALVE TAPPET REPLACEMENT

1. Remove the cylinder head and related parts following the procedure under "Cylinder Head Removal" (page 1-18).

2. Using a magnet, remove and install one tappet at a time (Fig. 56). Apply Lubriplate to each tappet foot and coat the remainder of the tappet with engine oil before installation.

3. After the tappets are installed, install the cylinder head and related parts following the procedure under "Cylinder Head Installation" (page 1-19).

CRANKSHAFT LOWER REAR OIL SEAL REPLACEMENT

The upper oil seal in the block cannot be replaced with the crankshaft installed. To replace the lower rear oil seal:

1. Remove the oil pan and related parts (page 1-31).

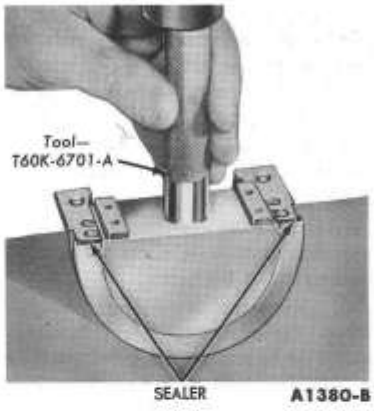


FIG. 58—Seal To Rear Bearing Cap Installation

2. Remove the rear main bearing cap. Remove and discard the rear seal.

3. Clean the rear journal oil seal groove. Install a new rear journal oil seal in the rear main bearing cap (Fig. 58). After installation, cut the ends of the seals flush.

4. Apply a thin coating of oil resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 58). **Do not apply sealer to the area forward of the oil slinger groove.** Install the rear main bearing cap. Torque the cap bolts to 65-75 ft-lbs.

5. Install the oil pan and related parts (page 1-31).

MAIN AND CONNECTING ROD BEARING REPLACEMENT

The main and connecting rod bearing inserts are selective fit. **Do not file or lap bearing caps or use bearing shims to obtain the proper bearing clearance.**

Selective fit bearings are available for service in standard sizes only. Standard bearings are divided into two sizes and are identified by a daub of red or blue paint. Refer to the Parts Catalog for the available sizes. **Red marked bearings increase the clearance; blue marked bearings decrease the clearance.** Undersized bearings, which are not selective fit, are available for use on journals that have been refinished.

MAIN BEARING

1. Drain the crankcase. Remove the oil level dipstick. Remove the oil pan and related parts (page 1-31).

2. Remove the oil pump inlet tube assembly and the oil pump (page 1-32).

3. Replace one bearing at a time, leaving the other bearings securely fastened. Remove the main bearing cap to which new bearings are to be installed.

4. Insert the upper bearing removal tool (tool 6331) in the oil hole in the crankshaft.

5. Rotate the crankshaft in the direction of engine rotation to force the bearing out of the block.

6. Clean the crankshaft journal. **When replacing standard bearings with new bearings, it is good practice to first try to obtain the proper clearance with two blue bearing halves.**

7. To install the upper main bearing, place the plain end of the bearing over the shaft on the locking tang side of the block. Using tool 6331 in the oil hole in the crankshaft, rotate the crankshaft in the opposite direction of engine rotation until the bearing seats itself. Remove the tool.

8. Replace the cap bearing.

9. Support the crankshaft so that its weight will not compress the Plastigage and provide an erroneous reading. Position a jack so that it will bear against the counterweight adjoining the bearing which is being checked.

10. Place a piece of Plastigage on the bearing surface the full width of the bearing cap and about ¼ inch off center (Fig. 59).

11. Install the cap and torque the bolts to 65-75 ft-lbs. **Do not turn the crankshaft while the Plastigage is in place.**

12. Remove the cap. Using the Plastigage scale, check the width of the Plastigage. When checking the width of the Plastigage, check at the widest point in order to get the minimum clearance. Check at the narrowest point in order to get the maximum clearance. The difference between the two readings is the taper.

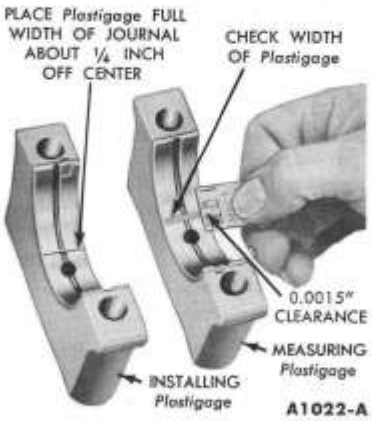


FIG. 59—Installing and Measuring Plastigage—Engine Installed

13. If the clearance is less than the specified limits, try two red bearing halves or a combination of red and blue depending upon the condition. If the standard bearings do not bring the clearance within the desired limits, refinish the crankshaft journal, then install undersize bearings.

14. After the bearing has been fitted, apply a light coat of engine oil to the journal and bearings, then install the bearing cap. Torque the cap bolts to 65-75 ft-lbs.

15. Repeat the procedure for the remaining bearings that require replacement.

16. If the rear main bearing is replaced, replace the lower oil seal in the rear main bearing cap as outlined under "Crankshaft Lower Rear Oil Seal Replacement" (page 1-25). The upper oil seal in the block cannot be replaced with the crankshaft installed.

17. If the thrust bearing cap (No. 3 main bearing) has been removed, install it as follows:

Install the thrust bearing cap with the bolts finger-tight. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 80). Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 80). This will align the thrust surfaces of both halves of the bearing. Retain the forward pressure on the crankshaft. Torque the cap bolts to 65-75 ft-lbs (Fig. 80).

18. Clean the oil pump inlet tube screen. Install the oil pump and the inlet tube assembly (page 1-32).

19. Position the oil pan gaskets on the oil pan. Position the oil pan front seal on the cylinder front cover. Position the oil pan rear seal on the rear main bearing cap. Install the oil pan and related parts (page 1-31). Install the oil level dipstick.

20. Fill the crankcase. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil leaks.

21. Check and adjust the ignition timing.

CONNECTING ROD BEARING

1. Follow steps 1 and 2 under "Main Bearing Replacement".

2. Turn the crankshaft until the connecting rod to which new bearings are to be fitted is down. Remove the connecting rod cap. Remove the bearing inserts from the rod and cap.

3. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure.

4. Clean the crankshaft journal. **When replacing standard bearings with new bearings, it is good practice to first try to obtain the proper clearance with two blue bearing halves.**

5. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slot provided.

6. Pull the connecting rod assembly down firmly on the crankshaft journal.

7. Place a piece of Plastigage on the lower bearing surface, the full width of the cap and about ¼ inch off center.

8. Install the cap and torque the connecting rod nuts to 19-24 ft-lbs. **Do not turn the crankshaft while the Plastigage is in place.**

9. Refer to steps 12 and 13 under "Main Bearing Replacement."

10. After the bearing has been fitted, clean and apply a light coat of engine oil to the journal and bearings. Install the connecting rod cap.

11. Repeat the procedure for the remaining connecting rods that require new bearings.

12. Follow steps 18 thru 21 under "Main Bearing Replacement."

PISTONS AND CONNECTING RODS

REMOVAL

1. Operate the engine until normal operating temperature has been reached. Drain the cooling system and the crankcase.

2. Refer to "Cylinder Head Removal" (page 1-18) and remove the cylinder head and related parts.

3. Remove the oil pan and related parts (page 1-31). Remove the oil pump inlet tube and the oil pump.

4. Turn the crankshaft until the piston to be removed is at the bottom of its travel and place a cloth on the piston head to collect the cuttings. Remove any ridge and/or deposits from the upper end of the cylinder bores. Remove the cylinder ridge

with a ridge cutter. Follow the instructions furnished by the tool manufacturer. **Never cut into the ring travel area in excess of 1/32 inch when removing ridges.**

5. Make sure all the connecting rod caps are marked so that they can be installed in their original locations. Remove the connecting rod cap.

6. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a hammer. Avoid damage to the crankpin or the cylinder wall when removing the piston and rod.

INSTALLATION

1. Clean the oil pump inlet tube screen, and the oil pan and block gasket surfaces.

2. Oil the piston rings, pistons, and cylinder walls with light engine oil.

3. Be sure to install the pistons in the same cylinders from which they were removed, or to which they were fitted. The connecting rod and bearing caps are numbered from 1 to 6 beginning at the front of the engine. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever transposed from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder number.

4. Make sure the ring gaps are properly spaced around the circumference of the piston. Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Fig. 60). Be sure to guide the connecting rods to avoid damaging the crankshaft journals. **Install the piston with the notch in the piston head toward the front of the engine.**

5. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement."

6. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

7. Turn the crankshaft throw to the bottom of its stroke, then push the piston all the way down until the connecting rod bearing seats on the crankshaft journal. Install the connecting rod cap. Torque the nuts to 19-24 ft.-lbs.

8. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each crankshaft journal (Fig. 61).

9. Install the oil pump and the oil pump inlet tube (page 1-32). Install the oil pan and related parts (page 1-31).

10. Refer to "Cylinder Head Installation" (page 1-19) and install the cylinder head and related parts.

11. Fill and bleed the cooling system. Fill the crankcase.

12. Start the engine and check for oil pressure. Operate the engine at fast idle and check for oil and coolant leaks.

13. Check and adjust the ignition timing.

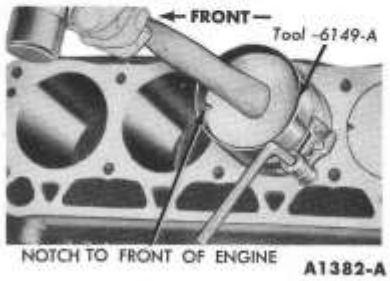


FIG. 60—Piston Installation

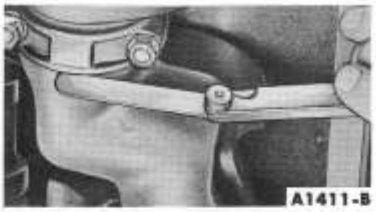


FIG. 61—Connecting Rod Side Clearance

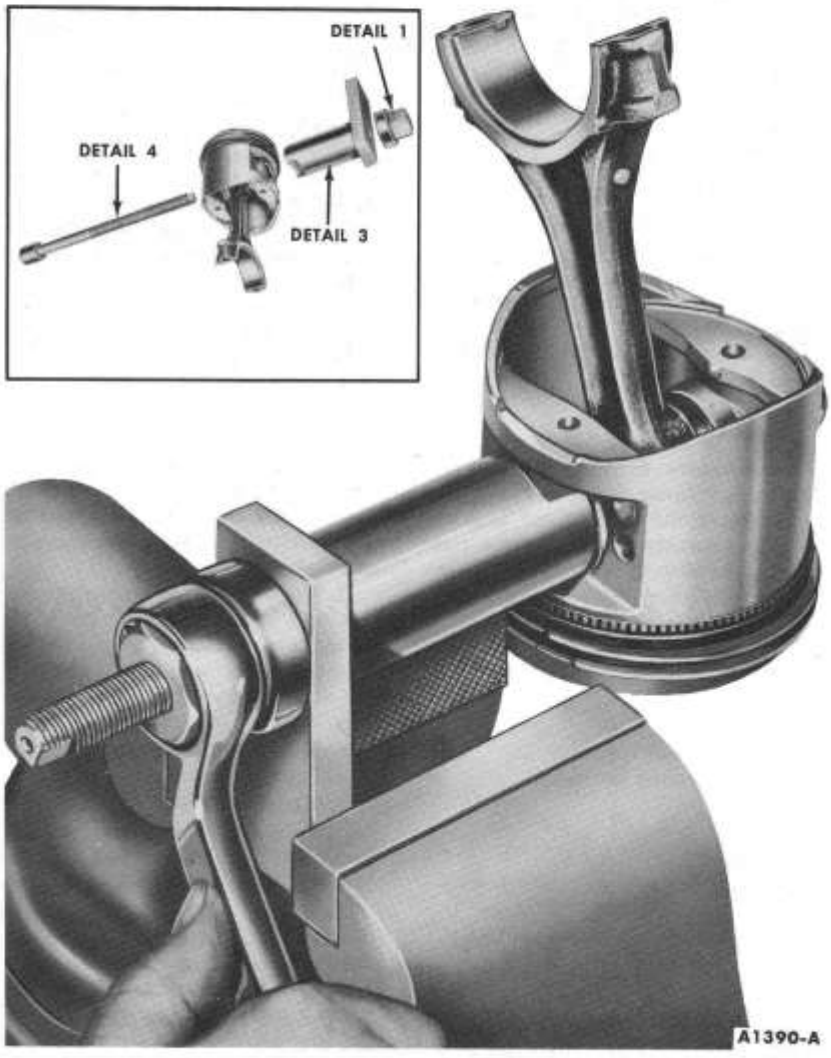


FIG. 62—Piston Pin Removal

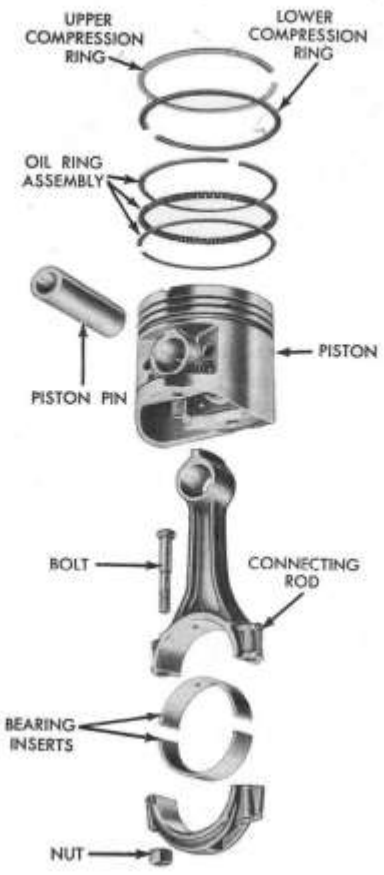


FIG. 63—Piston, Connecting Rod, and Related Parts

DISASSEMBLY

1. Remove the bearing inserts from the connecting rod and cap.
2. Mark the pistons and pins to assure assembly with the same rod and installation in the same cylinders from which they were removed.
3. Remove the piston pin from the piston and connecting rod. (Fig. 62). Remove the piston rings.

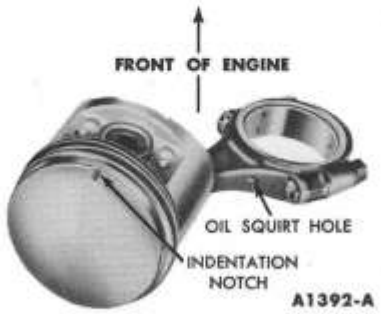


FIG. 64—Piston and Connecting Rod Assembly

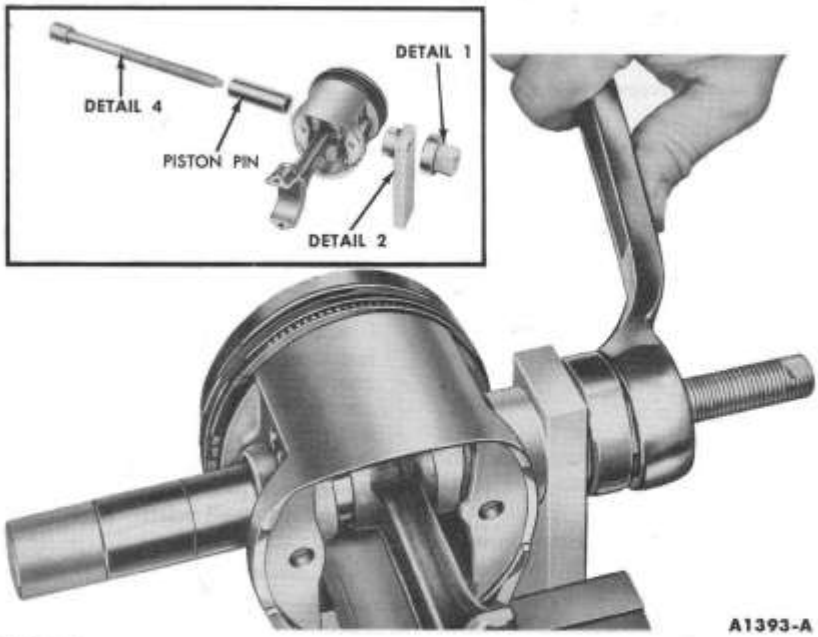


FIG. 65—Piston Pin Installation

ASSEMBLY

The piston, connecting rod, and related parts are shown in Fig. 63. **Check the fit of a new piston in the cylinder bore before assembling the piston and piston pin to the connecting rod.**

The piston pin bore of a connecting rod must be within the limits of 0.9107-0.9112 inch. The diameter of the piston pin must be within the limits of 0.9120-0.9123 inch.

1. Apply a light coat of engine oil to all parts. **Assemble the piston to the connecting rod with the oil squirt hole in the connecting rod and the indentation in the piston positioned as shown in Fig. 64.**
2. Start the piston pin in the piston and connecting rod. Draw the piston pin through the piston and connecting rod until the end of the pin seats in Detail 2 (Fig. 65).
3. Follow the instructions contained on the piston ring package and install the piston rings.
4. Check the ring side clearance of the compression rings with a feeler gauge following step 6 under "Fitting Piston Ring" (page 1-30).
5. Be sure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts may distort the bearing and cause a failure. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.

CONNECTING ROD CLEANING AND INSPECTION

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 crankpin, 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.

Clean the connecting rod in solvent, including the connecting rod bore and the back of the inserts. **Do not use a caustic cleaning solution.** Blow out all passages with compressed air.

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

Check the ID of the connecting rod piston pin bore and the OD of

the piston pin. Replace the connecting rod if the pin bore is not within specifications. Replace the piston pin if the pin is not within specifications.

Replace defective connecting rod nuts and bolts.

After the connecting rods are assembled to the piston, check them 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 connecting rod should be straightened or replaced.

PISTON, PIN, AND RING CLEANING AND INSPECTION

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. 66). Make sure the oil ring slots (or holes) are clean.

Carefully inspect the pistons for fractures at the ring lands, skirts, 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 top of the piston are usually caused by detonation, or preignition. 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 preignition.

Check the piston to cylinder bore clearance with a tension scale and ribbon and the ring side clearance.

Replace piston pins showing signs of fracture or etching and/or wear.

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.**

FITTING PISTONS

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

The piston to cylinder bore clearance should be 0.0018-0.0036 inch.

If the clearance is greater than the maximum limit, recheck calculations to be sure that the proper size piston has been selected, check for a damaged piston, then try 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:

1. Calculate the size piston to be used by taking a cylinder bore check (Fig. 87).

2. Select the proper size piston to provide the desired clearance.

3. Make sure the piston and cylinder block are at room temperature (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 shown in Fig. 67.

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. 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. 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. 68).

In Fig. 67, the diagonal lines represent feeler ribbons of various thick-

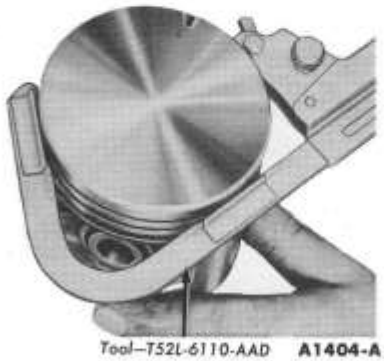


FIG. 66—Ring Groove Cleaner

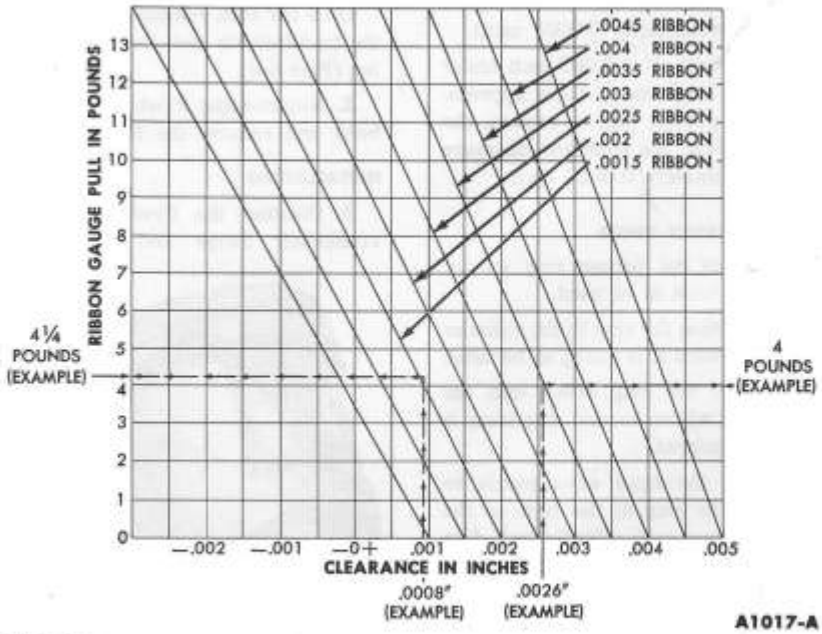


FIG. 67—Piston Clearance Chart

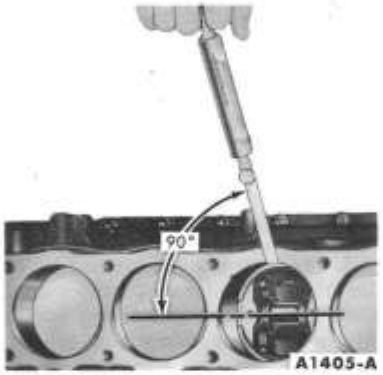


FIG. 68—Piston Fit

nesses, 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. 67 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 4-pounds pull to remove the feeler ribbon, the resultant clearance is approximately 0.0026 inch.

FITTING PISTON RINGS

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

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 the ring is square with 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

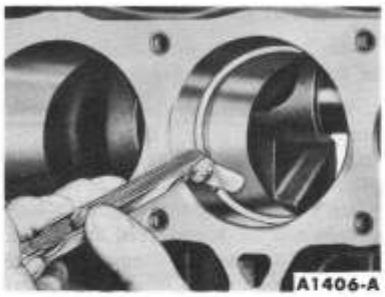


FIG. 69—Piston Ring Gap

(Fig. 69). 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. 70). 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.**

FLYWHEEL

REMOVAL

1. On a manual-shift transmission, disconnect the transmission from the engine and slide it to the rear and remove the clutch pressure plate and disc following the procedure in Part 5-1.

On a car with Fordomatic, remove the transmission and converter housing (Part 6-4).

2. Remove the flywheel retaining bolts and remove the flywheel.

INSTALLATION

1. Position the flywheel on the crankshaft flange and install the retaining bolts. Torque the bolts in sequence across from each other to 75-85 ft-lbs.

FIG. 70—Ring Side Clearance

2. On a manual-shift transmission, install the clutch pressure plate and disc and install the transmission following the procedure in Part 5-1.

On a car with Fordomatic, install the converter housing and transmission following the procedure in Part 6-4.

FLYWHEEL—MANUAL-SHIFT TRANSMISSION

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. 71). Turn the flywheel making sure that it is full forward or rearward so that crankshaft end play will not be indicated as flywheel runout.

If the runout exceeds the maximum limit, remove the flywheel and check for burrs between the flywheel and the face of the crankshaft mounting flange. If no burrs exist, check the runout of the crankshaft mounting flange. Replace the flywheel or machine the crankshaft flywheel face if the mounting flange runout is excessive.

FIG. 71—Flywheel Face Runout

Ring Gear Replacement. Heat the defective ring gear with a blow torch on the engine side of 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.**

CLUTCH PILOT BUSHING REPLACEMENT

REMOVAL

1. Disconnect the transmission from the engine and slide it to the rear as outlined in Group 5 "Manual-Shift Transmission."
2. Remove the pressure plate and cover assembly and the clutch disc as outlined in Part 5-1.
3. Using tools T59L-100-B and T58L-101-A, remove the pilot bushing (Fig. 86).

INSTALLATION

1. Coat the pilot bushing bore in the crankshaft with a small quantity of wheel bearing lubricant. **Avoid using too much lubricant as it may be thrown onto the clutch disc when the clutch revolves.**
2. Using tool T52T-12175-AJD, install the pilot bushing (Fig. 88).
3. Install the clutch disc and the pressure plate and cover assembly as outlined in Part 5-1.
4. Connect the transmission to the engine as outlined in Group 5 (Manual-Shift Transmission).

OIL FILTER REPLACEMENT

1. Place a drip pan under the filter. Unscrew the filter from the adapter fitting.
2. Coat the gasket on the filter with oil. Place the filter in position on the adapter fitting. Hand tighten the filter until the gasket contacts the adapter face, then advance it ½ turn.
3. Operate the engine at fast idle, and check for oil leaks. If oil leaks are evident, perform the necessary repairs to correct the leakage. Check the oil level and fill the crankcase if necessary.

OIL PAN

REMOVAL

1. Drain the crankcase. Remove the oil level dipstick.

On a car with a manual-shift transmission, remove the clutch retracting spring.

2. Remove the cross member retaining nuts and remove the cross member.
3. Remove the stabilizer bar to underbody retaining nuts and pull the stabilizer bar downward.
4. Remove the oil pan retaining bolts and crank the engine as required to obtain clearance and remove the oil pan.
5. Remove the oil pump inlet tube and screen assembly.

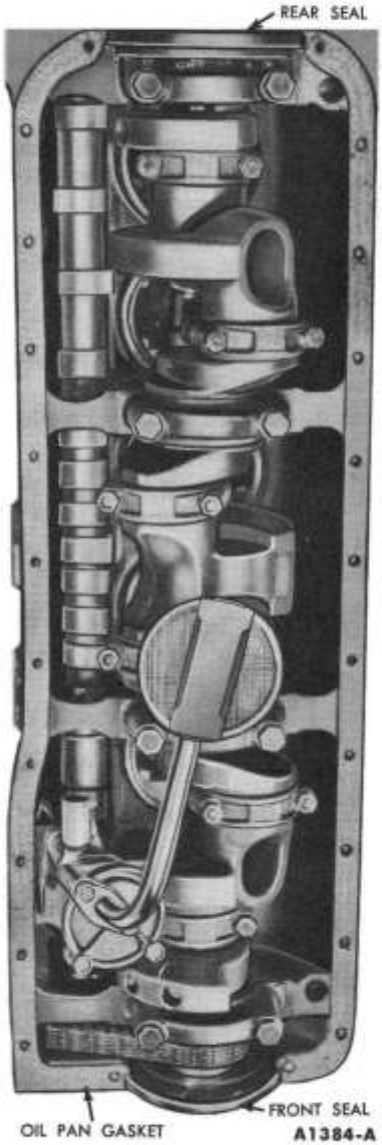


FIG. 72—Oil Pan Gasket and Seals Installed

CLEANING AND INSPECTION

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, a loose baffle, and a nicked or warped gasket surface.

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

INSTALLATION

1. Clean and install the oil pump inlet tube and screen assembly.
2. Clean the gasket surfaces of the block and oil pan. The oil pan has a two-piece gasket. Coat the block surface and the oil pan gasket surface with sealer. Position the oil pan gaskets on the cylinder block (Fig. 72).
3. Position the oil pan front seal on the cylinder front cover (Fig. 72). **Be sure the tabs on the seal are over the oil pan gasket.**
4. Position the oil pan rear seal on the rear main bearing cap (Fig. 72). **Be sure the tabs on the seal are over the oil pan gasket.**
5. Hold the oil pan in place against the block and install a bolt, finger-tight, on each side of the oil pan. Install the remaining bolts. Torque the bolts from the center outward in each direction to 7-9 ft-lbs.
6. Position the stabilizer bar to the underbody and install the retaining nuts.
7. Position the cross member and install the retaining nuts.

On a car with a manual-shift transmission, install the clutch retracting spring.

8. Install the oil level dipstick. Fill the crankcase with the proper grade and quantity of engine oil. Operate the engine and check for oil leaks.

OIL PUMP

REMOVAL

1. Remove the oil pan and related parts as outlined under "Oil Pan Removal."

2. Remove the oil pump inlet tube and screen assembly.

3. Remove the oil pump retaining bolts and remove the oil pump and gasket.

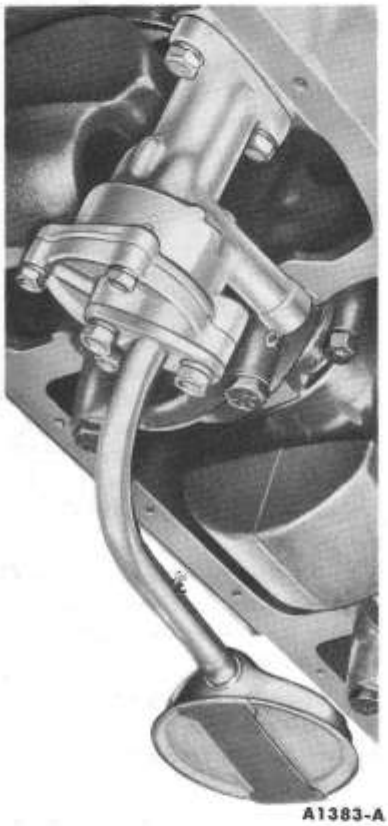


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FIG. 73—Oil Pump Inlet Tube Installed

INSTALLATION

1. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.

2. Using a new gasket, install the oil pump.

3. Clean and install the oil pump inlet tube and screen assembly (Fig. 73).

4. Install the oil pan and related parts as outlined under "Oil Pan Installation."

DISASSEMBLY

1. Remove the oil inlet tube from the oil pump and remove the gasket.

2. Remove the cover retaining screws, then remove the cover. Remove the inner rotor and shaft assembly, then remove the outer race.

3. Insert a self-threading sheet metal screw of the proper diameter into the oil pressure relief valve chamber cap and pull the cap out of the chamber. Remove the spring and plunger.

CLEANING AND INSPECTION

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.

Check the inside of the pump housing and the outer race and rotor for damage or excessive wear.

Check the mating surface of the 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. 74).

With the rotor assembly installed

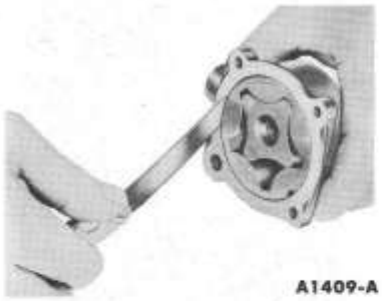

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FIG. 74—Outer Race To Housing Clearance

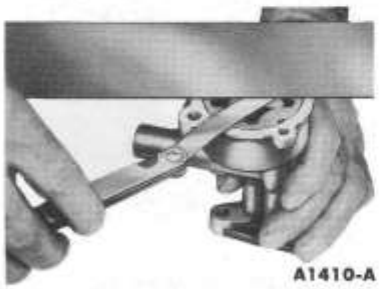

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FIG. 75—Rotor End Play

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. 75).

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.

ASSEMBLY

The oil pump assembly is shown in Fig. 76.

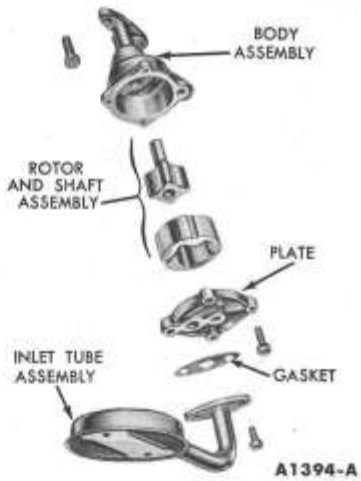

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FIG. 76—Oil Pump Assembly

1. Oil all parts thoroughly.

2. Install the oil pressure relief valve plunger, spring, and a new cap.

3. Install the outer race, and the inner rotor and shaft assembly. **The inner rotor and shaft, and the outer race are serviced as an assembly. One part should not be replaced without replacing the other.** Install the cover and torque the cover retaining screws to 6-9 ft-lbs.

4. Position a new gasket and the oil inlet tube on the oil pump and install the retaining bolts.

6 WORK STAND REPAIR OPERATIONS

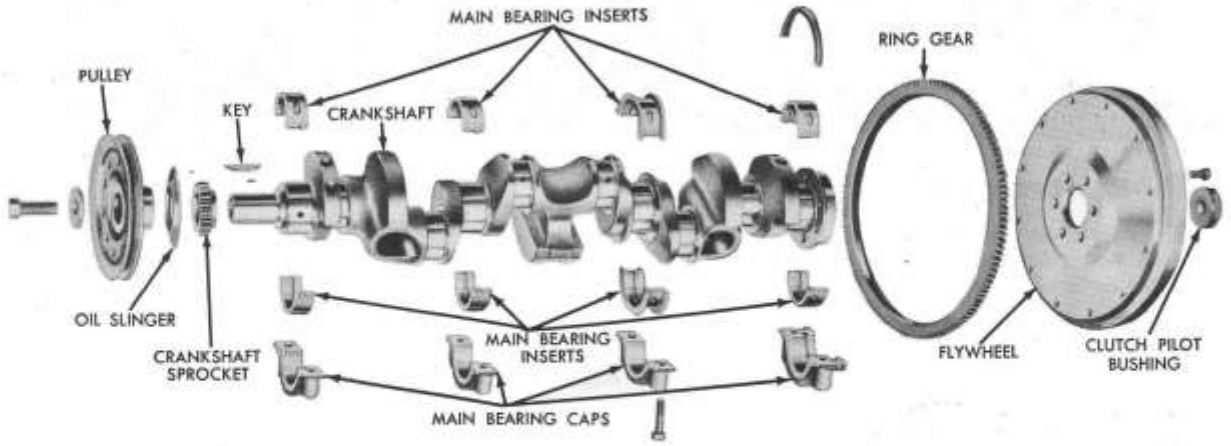

FIG. 77—Crankshaft and Related Parts

To perform the operations in this section, it will be necessary to remove the engine from the car and install it on a work stand (page 1-15).

CRANKSHAFT

REMOVAL

The crankshaft and related parts are shown in Fig. 77.

1. Loosen the generator adjusting bolts and remove the fan belt. Remove the oil level dipstick.

On a car with the vent tube-type crankcase ventilation system, remove the crankcase ventilation tube.

2. Remove the crankshaft pulley retaining bolt and washer. Remove the crankshaft pulley.

3. Remove the cylinder front cover and gasket.

4. Remove the oil slinger. Check the timing chain deflection, then remove the timing chain and sprockets by following steps 4 and 5 under "Cylinder Front Cover and Timing Chain Removal" on page 1-23.

5. Invert the engine on the work stand. Remove the flywheel. Remove the oil pan and gasket. Remove the oil pump.

6. Make sure all bearing caps (main and connecting rod) are marked so that they can be installed in their original locations. Turn the crankshaft until the connecting rod from which the cap is being removed is down. Remove the connecting rod cap. Push the connecting rod and piston assembly up in the cylinder.

7. Remove the main bearing caps.

8. Carefully lift the crankshaft out of the block so that the thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

INSTALLATION

1. Remove the rear journal oil seal from the block and rear main bearing cap.

2. Remove the main bearing inserts from the block and bearing caps.

3. Remove the connecting rod bearing inserts from the connecting rods and caps.

4. Clean the rear journal oil seal grooves. Install a new rear journal oil seal in the block (Fig. 78) and rear main bearing cap (Fig. 58). After installation, cut the ends of the seals flush.

5. Apply a thin coating of oil resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 58). **Do not apply sealer to the area forward of the oil slinger groove.**

6. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing inserts and bearing bores are clean. Foreign material under the inserts may distort the bearing and cause a failure.

7. Place the upper main bearing inserts in position in the bores with the tang fitting in the slot provided.

8. Install the lower main bearing inserts in the bearing caps.

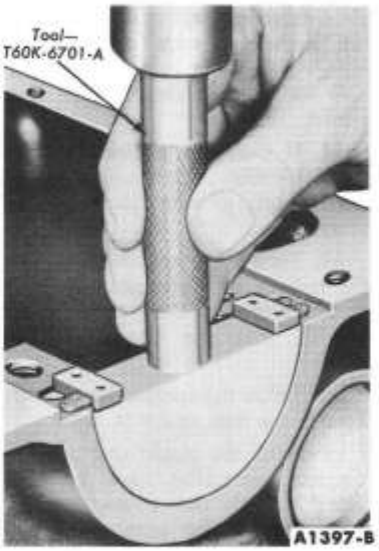

FIG. 78—Rear Oil Seal To Block Installation

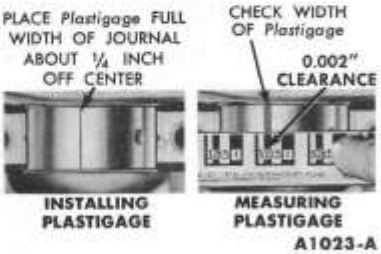

FIG. 79—Installing and Measuring Plastigage—Engine Removed

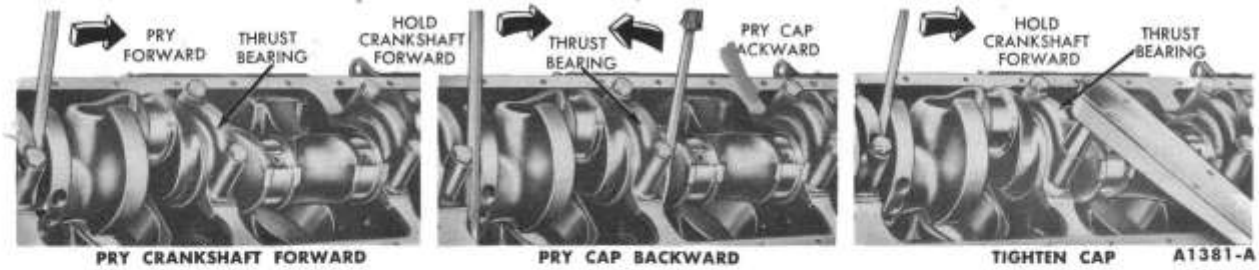

FIG. 80—Thrust Bearing Alignment

9. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**

10. Check the clearance of each main bearing. Place a piece of Plastigage on the crankshaft journal the full width of the journal and about ¼ inch off center (Fig. 79). Follow steps 11 thru 13 under "Main Bearing Replacement" (page 1-26).

11. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install all the bearing caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original locations.** Torque the bearing cap bolts to 65-75 ft-lbs.

12. Install the thrust bearing cap with the bolts finger-tight.

13. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 80).

14. Hold the crankshaft forward and pry the thrust bearing cap to the rear (Fig. 80). This will align the thrust surfaces of both halves of the bearing.

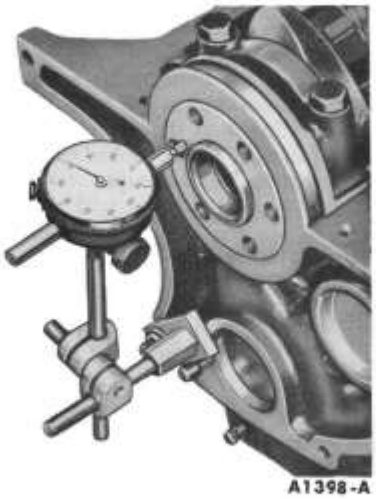

FIG. 81—Crankshaft End Play

15. Retain the forward pressure on the crankshaft. Torque the cap bolts to 65-75 ft-lbs (Fig. 80).

16. Force the crankshaft toward the rear of the engine.

17. Install a dial indicator so that the contact point rests against the crankshaft flange and the indicator axis is parallel to the crankshaft axis (Fig. 81).

18. Zero the dial indicator. Push the crankshaft forward and note the reading on the dial.

19. If the end play exceeds the wear limit, replace the thrust bearing. If the end play is less than the minimum limit, inspect the thrust bearing faces for scratches, burrs, nicks, or dirt. If the thrust faces are not defective or dirty, they probably were not aligned properly. Install the thrust bearing and align the faces following the recommended procedure (steps 12, 13, 14, and 15). Check the end play.

20. Install new bearing inserts in the connecting rods and caps. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement" on page 1-26.

21. If the bearing clearances are to specifications, apply a light coat of engine oil to the journals and bearings.

22. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the rod bearing seats on the crankshaft journal.

23. Install the connecting rod cap. Torque the nuts to 19-24 ft-lbs.

24. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each connecting rod crankshaft journal (Fig. 61).

25. Clean the oil pan, oil pump, and oil pump screen.

26. Install the oil pump following steps 1, 2, and 3 under "Oil Pump Installation" (page 1-32). Install the oil pan following steps 2 thru 5 (page 1-31).

27. Position the flywheel on the crankshaft. Install and torque the retaining bolts to 75-85 ft-lbs.

On a flywheel for a manual-shift transmission, use tool 7563 to locate the clutch disc. Install the pressure plate.

28. Turn the engine on the work stand so that the front end is up.

29. Install the timing chain and sprockets, cylinder front cover and crankshaft pulley, following steps 1 and 2 under "Cylinder Front Cover and Timing Chain Installation" on page 1-23.

30. Turn the engine on the work stand so that the engine is in the normal position. Install the oil level dipstick. Install and adjust the drive belt.

31. Remove the engine from the work stand and install it in the car (page 1-16).

CLEANING AND INSPECTION

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.

Inspect main and connecting rod journals for cracks, scratches, grooves, or scores. Dress minor imperfections with an oilstone. Refinish severely marred journals.

Measure the diameter of each journal in at least four places to determine out-of-round, taper, or undersize condition (Fig. 82).

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

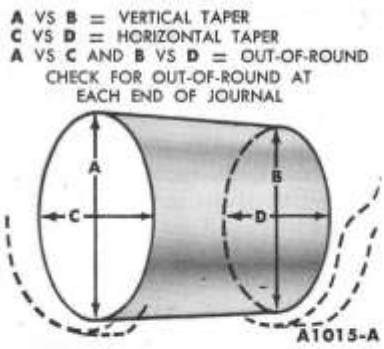

FIG. 82—Crankshaft Journal Measurement

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 will 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 holes, then polish the journal with a No. 320 grit polishing cloth and engine oil. Crocus cloth may be used also as a polishing agent.

CAMSHAFT BEARING REPLACEMENT

The bearings are available pre-finished to size and require no reaming for standard and 0.015-inch undersize journal diameters.

1. Remove the flywheel and the camshaft. Remove the rear bearing bore plug (Fig. 83).

2. Remove the camshaft bearings (Fig. 85).

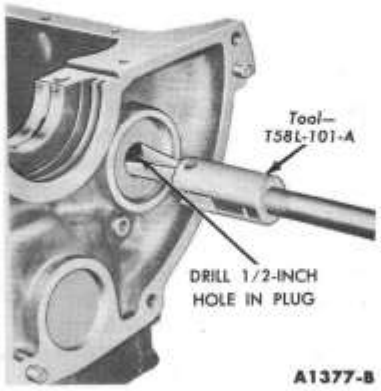

FIG. 83—Camshaft Rear Bore Plug Removal

3. Position the bearings in the bearing bore and press them into place (Fig. 85). **No. 1 camshaft bearing must be pressed in 0.100-0.140 inch below the front face of the bearing bore. Press the remaining bearings in sufficiently to align the oil supply holes. The No. 4 bearing has two oil holes.**

4. Clean the camshaft rear bearing bore plug recess thoroughly. Install a new plug (Fig. 84).

5. Install the camshaft and related parts.

6. Install the engine in the car.

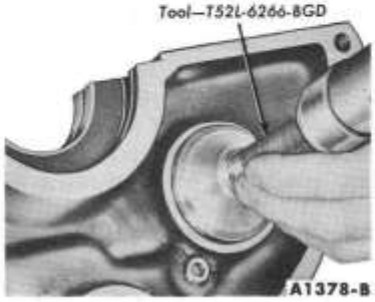

FIG. 84—Camshaft Rear Bore Plug Installation

ENGINE DISASSEMBLY

1. Disconnect the distributor vacuum line and the fuel inlet line at the carburetor. Disconnect the vacuum line at the carburetor spacer.

2. Disconnect the vacuum line at the fuel pump and the carburetor fuel inlet line at the fuel filter. Disconnect the distributor vacuum line at the distributor. Remove the fuel inlet line, distributor vacuum line, and the intake manifold vacuum line as an assembly.

On an engine with positive crankcase ventilation, disconnect the exhaust tube at the regulator valve and crankcase outlet. Remove the regulator valve. Disconnect the vacuum line at the regulator valve fitting and fuel pump.

3. Remove the carburetor and gasket. Remove the exhaust manifold.

4. Remove the coil. Remove the distributor cap and spark plug wires as an assembly. Remove the distributor, fuel pump, and oil filter. Remove the spark plugs.

5. Remove the valve rocker arm cover. Loosen all valve rocker arm adjusting screws to remove the valve spring load from the rocker arms. Remove the valve rocker arm shaft assembly (Fig. 29).

6. Remove the valve push rods in sequence and identify them so they can be installed in their original positions (Fig. 32). Using a magnet, remove the valve tappets in sequence (Fig. 56).

7. Remove all cylinder head bolts. Install the cylinder head guide studs (Fig. 33). Lift the cylinder head assembly off the engine. **Do not pry between the head and block as the gasket surfaces may become damaged.**

On a flywheel for a manual-shift transmission, mark the pressure plate cover so that it can be replaced in the same position. Remove the clutch pressure plate and cover assembly.

8. Remove the flywheel. Remove the clutch pilot bushing.

9. Remove the oil pan. Discard the gasket and seals.

10. Remove the oil pump and inlet tube assembly. Discard the oil pump gasket.

11. Loosen the generator mounting bolts and disconnect the generator adjusting arm at the water pump. Remove the drive belt.

12. Remove the fan and pulley, the generator, the water pump, and the crankshaft pulley.

13. Remove the cylinder front cover. Discard the gasket. Remove the crankshaft front oil slinger. Check the camshaft end play by following step 15 under "Camshaft Removal" page 1-24. Check timing chain deflection by following step 4 under "Cylinder Front Cover Removal" page 1-23.

14. Remove the camshaft sprocket retaining bolt and washer. Slide both sprockets and the timing chain forward and remove them as an assembly (Fig. 52).

15. Remove any ridges and/or deposits from the upper end of the cylinder bores. Remove the cylinder ridge with a ridge cutter. Follow the instructions furnished by the tool manufacturer. **Never cut into the ring travel area in excess of 1/32 inch when removing ridges.**

16. **Make sure all bearing caps (main and connecting rod) are marked so they can be installed in their original locations.** Turn the crankshaft until the connecting rod being removed is down. Remove the connecting rod cap.

17. Push the connecting rod and piston assembly out the top of the cylinder with the handle end of a

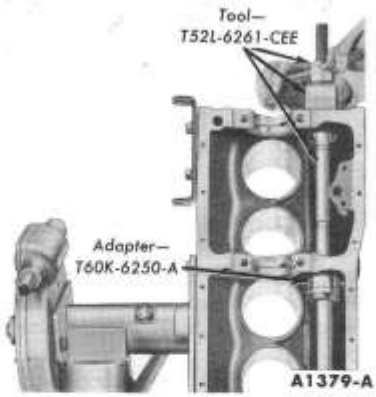

FIG. 85–Camshaft Bearing Removal or Installation

hammer. **Avoid damage to the crankpin or the cylinder wall when removing the piston and rod.**

18. Remove the bearing inserts from the connecting rods and caps. Remove the main bearing caps. Remove the clutch pilot bushing (Fig. 86).

19. Carefully lift the crankshaft out of the cylinder block so that the thrust bearing surfaces are not damaged. **Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.**

20. Remove the rear journal oil seal from the block and rear main bearing cap. Remove the main bearing inserts from the block and bearing caps.

21. Remove the camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. **Use caution to avoid damaging the journals and lobes.**

22. Remove the camshaft rear bearing bore plug.

23. Remove the camshaft bearings (Fig. 85).

CYLINDER BLOCK

CLEANING AND INSPECTION

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.

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 each cylinder bore at the top, middle, and bottom with the gauge placed at right angles and parallel to the centerline of the engine (Fig. 87).

Refinish cylinders that are deeply scored and/or when out-of-round 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.

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 the hone marks can be removed with the finishing hone which is used to obtain the proper piston clearance.

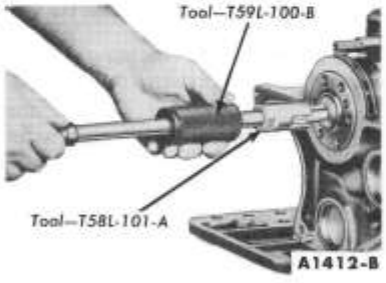

FIG. 86–Clutch Pilot Bushing Removal

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 by 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.

ASSEMBLY

1. Install the camshaft bearings and rear bore plug by following steps 3 and 4 under "Camshaft Bearing Replacement" (page 1-35).

2. The camshaft and related parts are shown in Fig. 55. Oil the camshaft and apply Lubriplate to all camshaft lobes. Carefully slide the camshaft through the bearings.

3. Install the thrust plate. Torque the retaining screws to 12-15 ft-lbs.

4. The crankshaft and related parts are shown in Fig. 77. Be sure that the rear journal oil seal grooves are clean. Install a new rear journal oil seal in the block (Fig. 78) and rear main bearing cap (Fig. 58). After installation, cut the ends of the seals flush.

5. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. Be sure the bearing bores are clean. Place the upper main bearing inserts in position in the bore with the tang fitting in the slot provided.

6. Install the lower main bearing inserts in the bearing caps.

7. Carefully lower the crankshaft into place. **Be careful not to damage the bearing surfaces.**

8. Check the clearance of each main bearing following steps 10 thru 13 under "Main Bearing Replacement" (page 1-26). In step 10, place the Plastigage on the crankshaft journal instead of in the bearing cap (Fig. 79).

9. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install all the bearing caps, except the thrust bearing cap (No. 3 bearing). **Be sure that the main bearing caps are installed in their original locations.** Torque the bearing cap bolts to 65-75 ft-lbs.

10. Install the thrust bearing cap by following steps 12 thru 15 under "Crankshaft Installation" (page 1-34).

11. Check the crankshaft end play by following steps 17 thru 19 under "Crankshaft Installation (page 1-34). Install the clutch pilot bushing (Fig. 88).

12. Turn the engine on the work stand so that the front end is up.

13. Oil the piston rings, pistons, and cylinder walls with light engine oil.

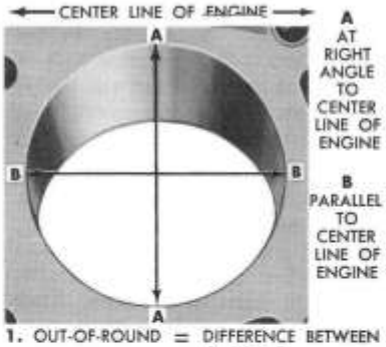

FIG. 87—Cylinder Block Bore Check

14. Be sure to install the pistons in the same cylinders from which they were removed, or to which they were fitted. The connecting rod and bearing cap are numbered from 1 to 6 beginning at the front of the engine. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever transposed from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder number.

15. Make sure the ring gaps are properly spaced around the circumference of the piston.

16. Install a piston ring compressor on the piston and push the piston in with a hammer handle until it is slightly below the top of the cylinder (Fig. 60). Be sure to guide the connecting rods to avoid damaging the crankshaft journals. **Install the piston with the notch in the piston head toward the front of the engine.**

17. Check the clearance of each bearing following the procedure under "Connecting Rod Bearing Replacement" (page 1-26).

18. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings.

19. Turn the crankshaft throw to the bottom of its stroke. Push the piston all the way down until the connecting rod bearing seats on the crankshaft journal.

20. Install the connecting rod cap. Torque the nuts to 19-24 ft-lbs.

21. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each crankshaft journal (Fig. 61).

22. Lubricate the timing chain and sprockets with engine oil. Place the keys in position in the slots on the crankshaft and camshaft.

23. Position the sprockets and timing chain on the camshaft and crankshaft. Be sure the timing marks on the sprockets and chain are positioned as shown in Fig. 51.

24. Install the camshaft sprocket cap screw and washer. Install the oil slinger.

25. Install a new crankshaft front oil seal (page 1-23).

26. Clean the cylinder front cover and the gasket surface of the cylinder block.

27. Coat the gasket surface of the block and the cover with sealer. Position a new gasket on the block.

28. Using tool T61K-6019-A, install the cylinder front cover on the block. Torque the screws to 6-9 ft-lbs.

29. Line up the crankshaft pulley keyway with the key on the crankshaft.

30. Install the crankshaft pulley.

31. Install the water pump, generator, fan pulley, and fan. Install and adjust the drive belt.

32. Prime the oil pump by filling either the inlet or outlet port with engine oil. Rotate the pump shaft to distribute the oil within the pump body.

33. Using a new gasket, install the oil pump. Clean and install the oil inlet tube assembly.

34. Make sure the gasket surfaces of the block and oil pan are clean.

35. Coat the block surface and oil pan gasket surface with sealer and position the gasket on the block (Fig. 72).

36. Install the oil pan front seal on the cylinder front cover and the oil pan rear seal on the rear main bearing cap (Fig. 72). **Be sure the tabs on the seals are over the oil pan gasket.**

37. Position the oil pan on the block. Install the retaining screws. Torque the screws from the center outward in each direction to 7-9 ft-lbs.

38. Install the clutch pilot bushing (Fig. 88). Position the flywheel on the crankcase and install the retain-

ing bolts. Torque the bolts to 75-85 ft-lbs.

On a flywheel for a manual-shift transmission, use tool 7563 to locate the clutch disc. Install the pressure plate. Torque the retaining bolts to specifications.

39. Cement a new gasket to the valve push rod cover (Fig. 30). Install the cover. Install the oil level dip stick.

40. Using a new gasket, install the fuel pump.

41. Position the distributor and intermediate drive shaft into the block with the rotor at the No. 1 firing position and the breaker points open. Install the hold down clamp. **Make sure the oil pump intermediate drive shaft is properly seated in the oil pump. It may be necessary to reposition the intermediate shaft in order to engage it in the oil pump.**

42. Install the oil filter assembly.

43. Dip the tappet foot in Lubriplate. Coat the remainder of each valve tappet with engine oil. Install the tappets in their original bores.

44. Clean the head and block gasket surfaces.

45. Inspect the head for any damage and repair as necessary.

46. Apply cylinder head gasket sealer to both sides of a new gasket. Position the gasket over the guide studs on the cylinder block.

47. Lift the cylinder head over the guides and slide it down carefully. Before installing the cylinder head bolts, coat the threads of the end bolts for the right side of the cylinder head with a small amount of water resistant sealer. Install, but do not tighten, two bolts at opposite ends of the head to hold the head and gasket in position. Remove the guides, then install the remaining bolts.

48. The cylinder head bolts are torqued in three progressive steps. Follow the sequence shown in Fig. 34. Torque the bolts to 55 ft-lbs, then torque them to 65 ft-lbs. Finally, torque the bolts to 75 ft-lbs. **After the cylinder head bolts have been torqued to specifications, the bolts should not be disturbed.**

49. Apply Lubriplate to both ends of the push rods. Install the push rods in their proper sequence, positioning the lower end of the rods in the tappet sockets.

50. Apply Lubriplate to the valve tips and the rocker arm pads. Position the valve rocker arm shaft assembly on the head. **Be sure the oil holes in the shaft are facing downward.**

51. Torque all the valve rocker arm shaft retaining bolts to specifications.

52. Perform a preliminary valve lash adjustment (page 1-14). The final valve lash adjustment is made with the engine installed in the car.

53. Install the spark plugs. Install the distributor cap and spark plug wire assembly. Connect the spark plug wires. Install the coil on the block and connect the coil high tension lead.

54. Position the exhaust manifold on the cylinder head. Install the tab washers and bolts. Torque the bolts to 13-18 ft-lbs. Lock the bolts by bending one tab of the washer over a flat on the bolt.

55. Position the carburetor gasket on the spacer. Install the carburetor.

56. Install the carburetor fuel inlet line, the manifold vacuum line and the distributor vacuum line.

On an engine with positive crankcase ventilation, position and connect the vacuum line at the regulator valve fitting and fuel pump. Clean the regulator valve parts, exhaust tube, and rubber hose connections. Install the regulator valve. Position and connect the exhaust tube at the regulator valve and crankcase outlet.

57. Install the engine in the car (page 1-16).

58. Check the ignition timing and adjust if necessary. Adjust the engine idle fuel mixture and idle speed.

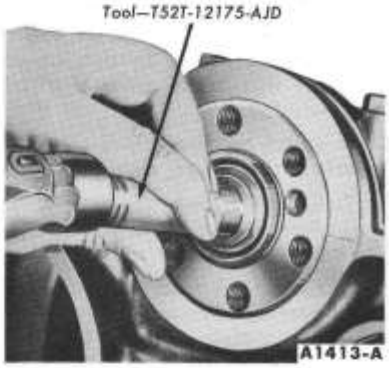

FIG. 88—Clutch Pilot Bushing Installation

7 CRANKCASE VENTILATION SYSTEM MAINTENANCE

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

BREATHER CAP

The breather cap located on the oil filler tube should be cleaned with a solvent at the proper mileage interval.

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 volatility petroleum base solvent and dry them with compressed air.

VENT TUBE-TYPE CRANKCASE VENTILATION SYSTEM

The road draft 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 if necessary.

PART 1-2 EXHAUST SYSTEM

A single exhaust system (Fig. 1) is used on all Falcons. The system consists of a muffler inlet pipe, muffler, and a muffler outlet pipe.

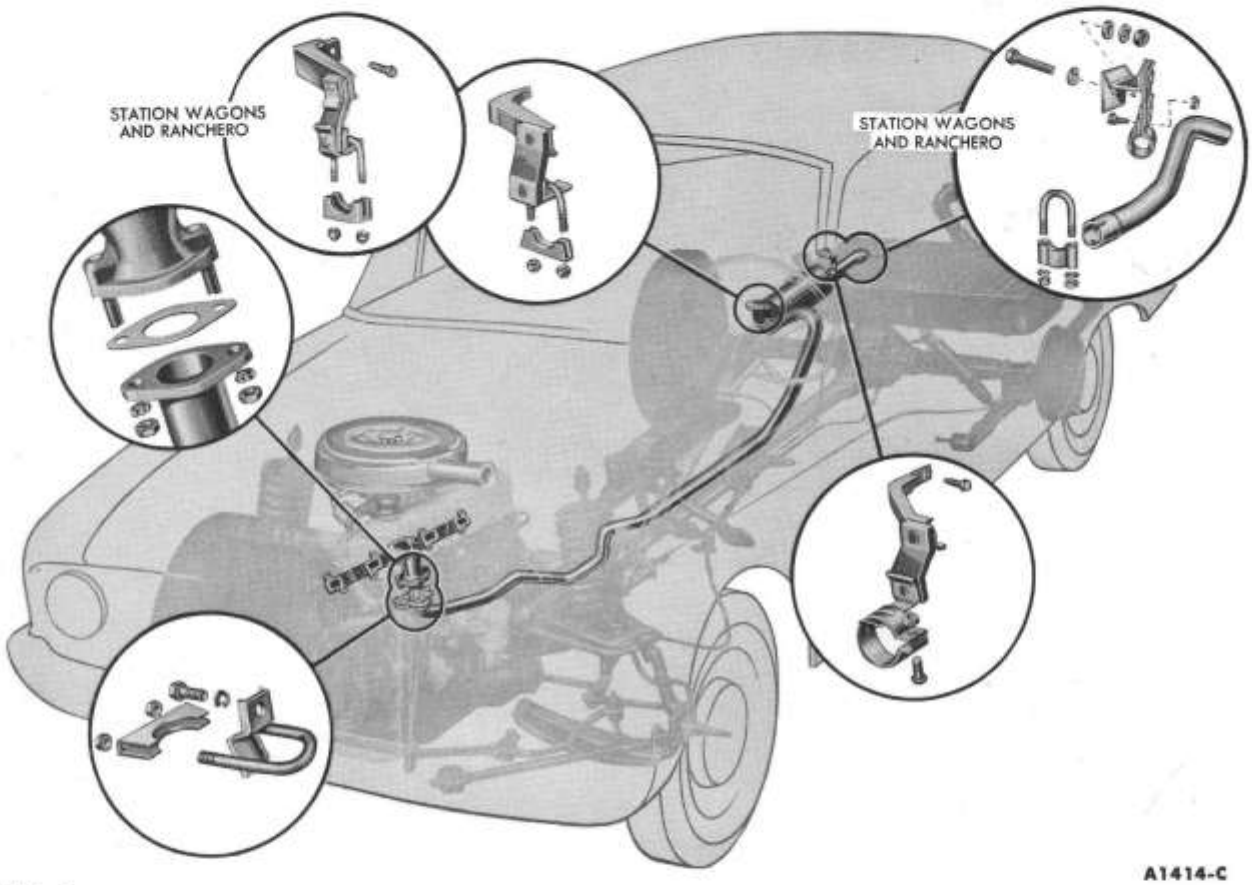

FIG. 1—Exhaust System

INLET PIPE REPLACEMENT

1. Disconnect the inlet pipe at the exhaust manifold.

2. Loosen the inlet pipe clamp and slide it off the support bracket on the engine.

On a Station Wagon or Ranchero, loosen the inlet pipe clamp on the transmission extension housing.

3. Loosen the inlet pipe to muffler clamp and slide it forward.

4. Loosen the muffler outlet pipe clamp. Separate the inlet pipe from the muffler by sliding the muffler and outlet pipe to the rear.

5. Remove the old gasket material from the exhaust manifold.

6. Install a new gasket over the studs of the exhaust manifold.

7. Position the inlet pipe on the studs of the exhaust manifold and install the tab washer and nuts. Torque the nuts to 13-18 ft-lbs. Lock the nuts by bending one tab of the washer over a flat on the nut.

8. Slide the muffler and inlet pipe forward until the slots in the muffler extension are blocked by the inlet pipe. The overlap should not be greater than 1¾ inches.

9. Align the muffler, inlet pipe, and outlet pipe, and tighten all clamps.

10. Check the exhaust system for leaks.

MUFFLER REPLACEMENT

1. Loosen the muffler to outlet pipe and inlet pipe clamps.

2. Separate the muffler and outlet pipe by sliding the outlet pipe to the rear.

3. Separate the muffler from the inlet pipe and remove the muffler.

4. Position the new muffler on the inlet pipe. Slide the muffler forward into the inlet pipe until the slots in the muffler extension are blocked. The overlap must not be greater than 1¾ inches. Check for possible interference between the kick-up and the underbody. Align the muffler and tighten the inlet pipe clamp.

5. Slide the outlet pipe forward on

the muffler extension until the slots are blocked. Tighten the outlet pipe clamp.

6. Check the exhaust system for leaks.

OUTLET PIPE REPLACEMENT

1. Loosen the outlet pipe clamp and slide the outlet pipe off the muffler and remove the outlet pipe.

On a Station Wagon or Ranchero, loosen the outlet pipe clamps and slide the outlet pipe off the muffler and out of the bracket clamp.

2. Slide the new outlet pipe on the muffler extension. Tighten the outlet pipe clamp.

On a Station Wagon or Ranchero, slide the new outlet pipe through the bracket clamp and on the muffler extension. Tighten the outlet pipe clamps.

3. Check the connection for leaks.

1961 FORD FALCON SHOP MANUAL

GROUP 2

IGNITION SYSTEM

PAGE

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PART 2-1 IGNITION SYSTEM MAINTENANCE

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1 TROUBLE DIAGNOSIS AND TESTING

GENERAL INFORMATION

The ignition system consists of a primary (low voltage) and a secondary (high voltage) circuit (Fig. 1).

The primary circuit consists of the:

1. Battery
2. Ignition switch.
3. Primary circuit resistance wire.
4. Primary windings of the ignition coil.
5. Breaker points.
6. Condenser

The secondary circuit consists of the:

1. Secondary windings of the ignition coil.
2. Distributor rotor.
3. Distributor cap.
4. High tension wires.
5. Spark plugs.

When the breaker points are closed, the primary or low voltage current flows from the battery through the ignition switch to the primary windings in the coil, then to ground through the closed breaker points. When the breaker points open, the magnetic field built up in the primary windings of the coil moves through the secondary windings of the coil producing high voltage current. **High voltage current is produced each time the breaker points open.** The high voltage flows through the coil high tension lead to the distributor cap where the rotor distributes it to one of the spark plug terminals in the

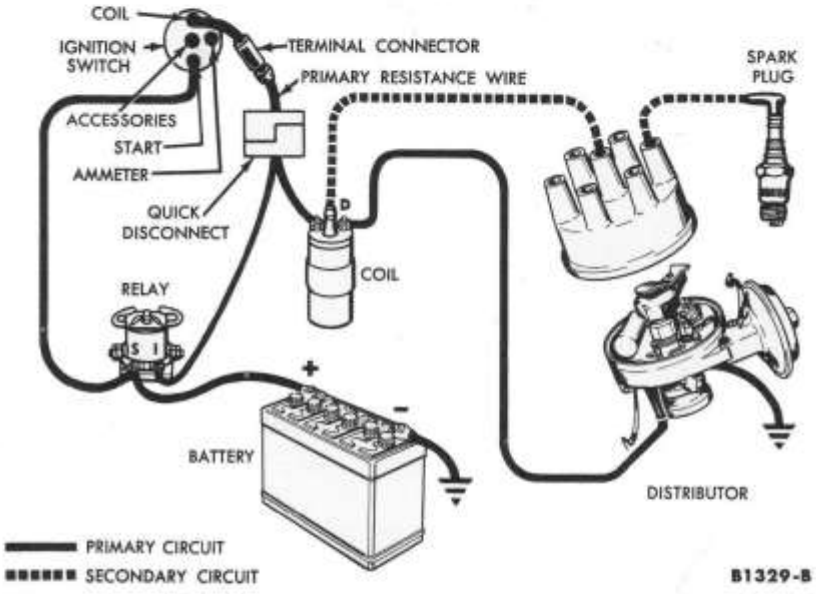


FIG. 1—Ignition Circuit

PROCEDURE

1. Connect the voltmeter leads as shown.
2. Install a jumper wire.
3. Turn the ignition switch on.
4. Turn the accessories and the lights off.

VOLTMETER READING

If the voltmeter reading is 6.9 volts or less, the primary circuit from battery to coil is satisfactory.

If the voltmeter reading is greater than 6.9 volts, check:

1. All components in the battery to coil circuit as outlined under "Preliminary Checks."
2. Resistance wire for defects.
3. Relay to ignition switch for defects.

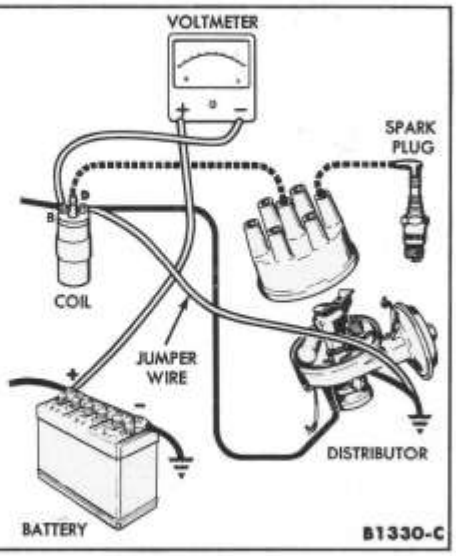


FIG. 2—Battery To Coil Test

PROCEDURE

1. Connect the voltmeter leads as shown.
2. Install a jumper wire.
3. Turn the ignition switch on.
4. Turn the accessories and the lights off.

VOLTMETER READING

If the voltmeter reading is 0.3 volt or less, the ignition switch and the relay to switch wire are satisfactory.

If the voltmeter reading is greater than 0.3 volt, either the ignition switch and or the wire are defective.

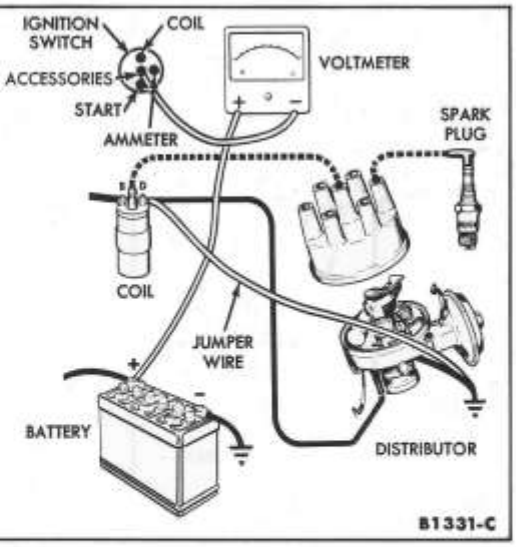


FIG. 3—Ignition Switch Test

distributor cap. This process is repeated for every power stroke of the engine.

Ignition system troubles are caused by a failure in the primary and/or the secondary circuit, or incorrect ignition timing. If an engine trouble has been traced to the ignition system (from the "Engine Trouble Diagnosis Guide" in Part 1-1) the trouble can be further isolated to the primary or secondary circuit as follows:

1. Remove the coil high tension lead from the distributor cap.
2. Hold the high tension lead approximately 3/16 inch from the cylinder head.
3. With the ignition switch on, crank the engine and check for a spark.

If the spark is good, the trouble lies in the secondary circuit.

If there is no spark or a weak spark, the trouble is in the primary circuit, coil to distributor high tension lead, or the coil.

A break down or energy loss in the primary circuit can be caused by:

1. Defective primary wiring.
2. Burned or improperly adjusted breaker points.
3. A defective coil.
4. A defective primary resistance wire.

PROCEDURE

1. Connect the voltmeter leads as shown.
2. Install a jumper wire.
3. Turn the ignition switch on.
4. Turn the accessories and the lights off.

VOLTMETER READING

If the voltmeter reading is 6.6 volts or less, the resistance wire is satisfactory.

If the voltmeter reading is greater than 6.6 volts, replace the resistance wire.

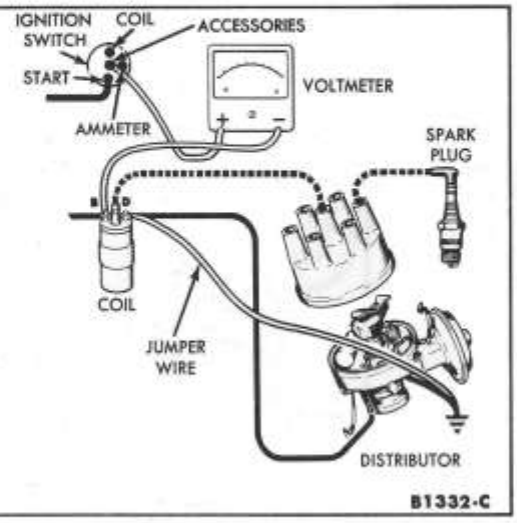


FIG. 4—Resistance Wire Test

5. A defective condenser.

A break down or energy loss in the secondary circuit can be caused by:

1. Fouled or improperly adjusted spark plugs.
2. Defective high tension wiring.
3. High tension leakage across the coil, distributor cap, or rotor.

PRIMARY CIRCUIT TESTS

A complete test of the primary circuit consists of checking the circuit from the battery to the coil, from the coil to ground, and the starting ignition circuit. The test procedures are shown in Figs. 2 thru 6.

Excessive voltage drop in the primary circuit will reduce the secondary output of the ignition coil, resulting in hard starting and poor performance.

PRELIMINARY CHECKS

1. Inspect the battery for corrosion due to acid. If necessary, clean the battery and cables with a baking soda solution. Be sure the cable connectors and the contacting surfaces on the battery, engine, and relay are clean. Tighten the cables securely upon installation. Test the battery (Part 11-1).
2. Inspect all the primary wiring for worn insulation, broken strands, and loose or corroded terminals. Replace any defective wiring. Make sure all connections are tight.

BREAKER POINTS

The breaker point assembly consists of the stationary point bracket assembly, breaker arm, and the primary wire terminal.

Breaker points should be inspected, cleaned, and adjusted at specified intervals. Breaker points can be cleaned with chloroform and a stiff bristle brush. Replace the breaker point assembly if the contacts are badly burned or excessive metal transfer between the points is evident (Fig. 7). Metal transfer is considered excessive when it equals or exceeds the gap setting.

PROCEDURE

1. Connect the voltmeter leads as shown.
2. Disconnect the high tension lead from the distributor cap and ground the lead.
3. Using a remote starter switch, crank the engine while observing the voltage drop.

VOLTMETER READING

If the voltage drop is 0.1 volt or less, the starting ignition circuit is satisfactory.

If the voltage drop is greater than 0.1 volt, clean and tighten terminals in the circuit or replace wiring as necessary.

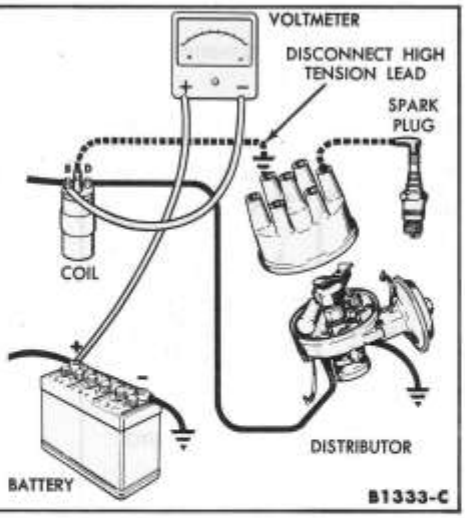


FIG. 5—Starting Ignition Circuit Test

COIL

Coil tests can be made with the coil installed on the engine or on a test set. The coil tests include coil heat, secondary continuity, and coil capacity.

A coil may break down after it has reached operating temperature; therefore, a coil heat test is made to test the coil at operating temperature. The coil secondary continuity test is performed to test the coil secondary windings for high resistance. The coil capacity test is made to determine the condition of the windings of the coil.

Perform all tests following the instructions of the test set manufacturer.

CONDENSER

A capacity test, a leakage test, and a series resistance test should be performed on the condenser. The tests can be made with the condenser installed in the distributor or with the condenser installed on a test unit. Use reliable test equipment and follow the instructions of the manufacturer. The capacity is 0.21-0.25 microfarads. Leakage should be 5 megohms or greater at room temperature, and series resistance should be 1 ohm or less. The condenser should be replaced if it does not meet the above specifications.

PROCEDURE

1. Connect the voltmeter leads as shown.
2. Install a jumper wire.
3. Turn the ignition switch on.
4. Turn the accessories and the lights off.

VOLTMETER READING

If the voltmeter reading is 0.1 volt or less, the primary circuit from coil to ground is satisfactory.

If the voltmeter reading is greater than 0.1 volt, test the voltage drop of each of the following:

1. Coil to distributor primary wire.
2. The moveable breaker point and the breaker plate.
3. The breaker plate and the distributor housing.
4. The distributor housing and engine ground.

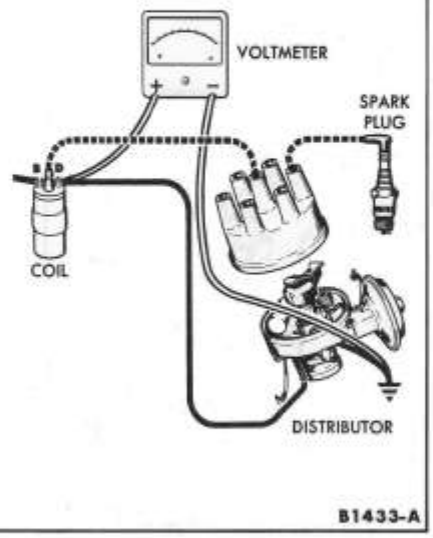


FIG. 6—Coil to Ground Test

SECONDARY CIRCUIT TESTS

PRELIMINARY CHECKS

1. Remove the coil to distributor high tension lead and the spark plug wires from the distributor cap and from the spark plugs. Inspect the terminals for looseness and corrosion. Inspect the wires for breaks and cracked insulation. Replace all defective wiring.

2. Clean the inside of the distributor cap, and inspect it for cracks, burned contacts, or permanent carbon tracks. Remove dirt or corrosion from the sockets. Replace the cap if it is defective.

3. Inspect the rotor for cracks or a burned tip. Replace the rotor if it is defective.

SECONDARY (HIGH TENSION) WIRES

The secondary wires include the wires connecting the distributor cap to the spark plugs and the wire connecting the center terminal of the distributor cap to the center terminal of the ignition coil.

These wires are the radio resistance-type which filter out the high frequency electrical impulses that are the source of ignition noise interference. The resistance of each wire should not exceed 24,500 ohms. **When checking the resistance of the wires or when setting ignition timing, do not puncture the wires with a probe. The probe may cause a separation in the conductor.** A spark plug wire set is available for service.

At regular intervals, clean and inspect the wires for cracked insulation and loose terminals. Repair or replace the wires as required.

When removing the wires from the spark plugs, grasp the moulded cap only. Do not pull on the wire because

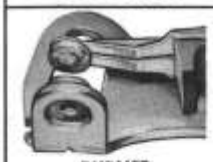
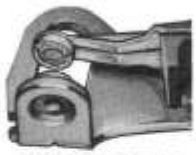
CONDITION	CAUSED BY
 BURNED	Accumulation of oil and dirt on the breaker points from the distributor base bushing, excessive or improper cam lubricant, and/or neglect to clean points periodically.
 EXCESSIVE METAL TRANSFER OR PITTING	Incorrect alignment. Incorrect voltage regulator setting. Radio condenser installed to the distributor side of the coil. Ignition condenser of improper capacity. Extended operation of the engine at speeds other than normal. B1443-A

FIG. 7—Breaker Point Inspection

the wire connection inside the cap may become separated or the weather seal may be damaged.

Spark Intensity

1. Disconnect all the spark plug wires. **Check the spark intensity of one wire at a time.**

2. Install a terminal adapter in the terminal of the wire to be checked. Hold the adapter approximately 5/16 inch from the exhaust manifold and crank the engine using a remote starter switch. The spark should jump the gap regularly.

3. If the spark intensity of all leads is satisfactory, the coil, condenser, rotor, distributor cap, and the secondary wires are probably satisfactory.

If the spark is good at only some wires, perform a high resistance test of the faulty leads.

If the spark is equal at all wires, but weak or intermittent, make a high resistance check of the coil, distributor cap, and the coil to distributor high tension lead. Follow the instructions of the test set manufacturer when making the tests.

SPARK PLUGS

Inspection. Examine the firing ends of the spark plugs, noting the type of deposits and the degree of electrode erosion. Refer to Fig. 8 for the various types of spark plug fouling and their causes.

Testing. After the proper gap is obtained, test the plugs on a testing machine. Compare the sparking efficiency of the cleaned and regapped plug with a new plug. Replace the plug if it fails to meet requirements.

Test the plugs for compression leakage at the insulator seal. 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.

IGNITION TIMING

Incorrect ignition timing can be caused by:

1. Timing incorrectly adjusted.

2. Distributor bushing and/or shaft worn, or a bent distributor shaft.

3. Defective vacuum advance system.

4. Pre-ignition (caused by spark plugs of the wrong heat range), fouled plugs, improperly adjusted plugs, etc.

DISTRIBUTOR

CAM LOBE ACCURACY

Worn cam lobes will cause the corresponding cylinders to fire out of time and result in a loss of power.

Install the distributor on a test set and check the accuracy of the cam lobes following the instructions of the test equipment manufacturer. If the test indicates that any lobe is worn, replace the cam.

DIAPHRAGM LEAKAGE AND FREENESS OF OPERATION

These tests can be made with the distributor installed on the engine. The tests are sufficient for an engine tune-up. However, if there are indications that the spark advance is not functioning properly, remove the distributor from the engine and check it on a distributor test set following the instructions under "Spark Advance Adjustments."

Check the vacuum advance mechanism for freeness of operation by manually rotating the breaker plate in the direction of rotation. **Do not rotate the plate by pushing on the condenser or the breaker points. Use a hook or other suitable instrument to rotate the plate.** The breaker plate should turn without binding and return to its original position when released. If the breaker plate binds, remove the plate. Clean, inspect, and lubricate it as described for the particular distributor.

To check the diaphragm for leakage:

1. Adjust the vacuum gauge to 25 inches Hg following the instructions of the test set manufacturer.

2. Install the vacuum hose on the diaphragm vacuum line fitting. The vacuum gauge reading should not fall off when the vacuum is applied to the diaphragm assembly if no leak exists. If a leak is indicated by the test, replace the diaphragm assembly.

BREAKER PLATE WEAR TEST

A worn breaker plate will cause the breaker point gap and contact dwell to change as engine speed and load conditions are varied. Perform the test following the instructions of the dwell meter manufacturer.

CONDITON	IDENTIFICATION	CAUSED BY
 OIL FOULING	Wet, sludgy deposits.	Excessive oil entering combustion chamber through worn rings and pistons, excessive clearance between valve guides and stems, or worn or loose bearings.
 GAS FOULING	Dry, black, fluffy deposits.	Incomplete combustion caused by too rich a fuel-air mixture or by a defective coil, breaker points or ignition cable.
 BURNED OR OVERHEATING	White, burned, or blistered insulator nose and eroded electrodes.	Inefficient engine cooling, or engine overheating caused by improper ignition timing, wrong type of fuel, or loose spark plugs.
 NORMAL CONDITIONS	Rusty brown to grayish-tan powder deposit and minor electrode erosion.	Regular or unleaded gasoline.
 NORMAL CONDITIONS	White, powdery deposits.	Highly leaded gasolines.
 CARBON FOULING	Hard baked on black carbon.	Too cold a plug. B1005-B

FIG. 8—Spark Plug Inspection

There should not be over a 3° variation in dwell between engine idle speed and 2500 rpm. If the contact dwell changes more than 3°, the bushing should be replaced.

Gear Backlash

1. Mount a dial indicator on the distributor so that the indicator point rests on the rotor, ⅝ inch from the center.

2. Turn the rotor as far as it will go and set the indicator on zero.

3. Turn the rotor in the opposite direction and note the reading on the dial indicator. This is the backlash.

4. The backlash should be 0.003-0.005 inch. If the backlash is not to specifications, it indicates incorrect number of teeth on the distributor or camshaft gear, or excessively worn gears.

Distributor Shaft End Play. If the shaft end play is not to specifications, check the location of the gear on the shaft.

The shaft end play can be checked with the distributor installed on the engine.

1. Mount the dial indicator on the distributor so that the indicator tip rests on the top of the distributor shaft.

2. Push the shaft down as far as it will go and set the dial indicator on zero.

3. Pull the distributor shaft upward as far as it will go and read the end play. The end play should be 0.005-0.008 inch.

2 ADJUSTMENTS AND REPAIRS

DISTRIBUTOR SPARK ADVANCE

The spark advance is checked to determine if the ignition timing advances in proper relation to engine speed and load.

1. Mount the distributor on a test set, and calibrate the test set following the instructions of the manufacturer.

2. Check the breaker point contact dwell. If the contact dwell is not between 35-38°, or the breaker point gap is not within 0.024-0.026 inch, adjust the breaker points.

3. Check the breaker arm spring tension (17-20 ounces). Adjust it if necessary.

4. Adjust the test set to 0° advance, 0-inch vacuum, and the initial rpm setting listed in the specifications (Group 17).

5. Check the operation of the vacuum advance at the lowest and high-

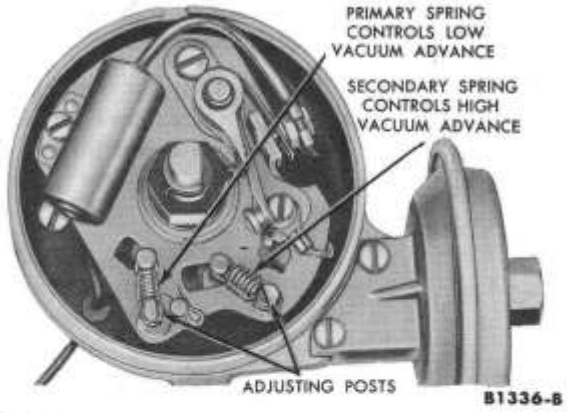


FIG. 9—Spark Advance Adjustment

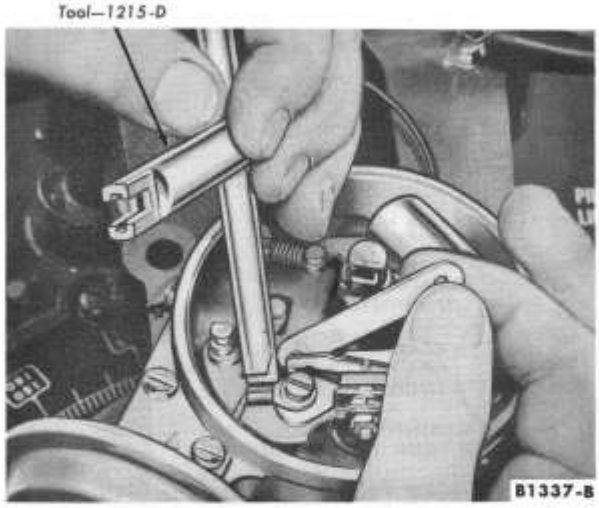


FIG. 10—Adjusting New Breaker Point Gap

est vacuum and rpm settings given in the specifications (Group 17).

6. If the spark advance is not within the limits under low vacuum, the primary spring adjustment is at fault. If the spark advance is not within the limits under high vacuum, the secondary spring adjustment is at fault.

To adjust the spark advance, release the tension on the retard springs by turning the adjusting posts as required (Fig. 9). Adjust the primary spring (spring farthest from the vacuum chamber) first, for the low vacuum settings. Adjust the secondary spring last, for the high vacuum settings. As a final check, check the advance throughout the entire range.

If it is impossible to adjust both springs to give the correct spark advance throughout the range, one or both springs should be replaced and the spark advance readjusted. If the advance characteristics still cannot be brought within specifications, replace the diaphragm assembly.

BREAKER POINTS

The breaker point assembly can be replaced without removing the distributor from the engine.

REMOVAL

1. Remove the distributor cap and rotor.

2. Disconnect the primary and condenser wires.

3. Remove the screws that secure the breaker point assembly to the breaker plate. Remove the breaker point assembly.

INSTALLATION

1. Place the primary and condenser leads on the breaker point assembly primary terminal. Install the lockwasher and nut. Tighten the nut securely.

2. Position the breaker point assembly on the breaker plate. Install the hold down screws. Make sure the ground wire terminal is on the screw nearest the adjustment slot.

3. Adjust the breaker point gap or dwell.

BREAKER POINT GAP OR DWELL

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

To adjust the breaker points with a feeler gauge:

1. Check and adjust breaker point alignment. Rotate the distributor cam until the rubbing block rests on the peak of a cam lobe.

2. Insert the correct blade of a **clean** feeler gauge between the breaker points (Fig. 10). The gap should be set to the larger opening (0.026 inch) because the rubbing block will wear down slightly while seating to the cam. If the fit is loose or if there is binding, loosen the stationary point lock screw and adjust the gap (Fig. 10).

3. Apply a light film of high-temperature, non-fiber grease to the cam when new points are installed. **Do not use engine oil to lubricate the distributor cam.**

4. Set the ignition timing.

If a dwell meter is used to adjust new points, be sure the points are in proper alignment. Also set the contact dwell to the low setting (35°). New points must be set to the low dwell as the rubbing block will wear down slightly while seating to the cam.

Used Breaker Points. If the gap of used breaker points is being checked, use a dwell meter to test the contact dwell. It is not advisable to use a feeler gauge to adjust or to check the gap of used breaker points because the roughness of the points makes an accurate gap reading or setting impossible. Clean the breaker points and check and adjust the alignment. Check the contact dwell following the instructions of the dwell meter manufacturer. The contact dwell should be 35°-38°.

BREAKER POINT ALIGNMENT

The vented-type breaker points used in Ford distributors must be accurately aligned and strike squarely

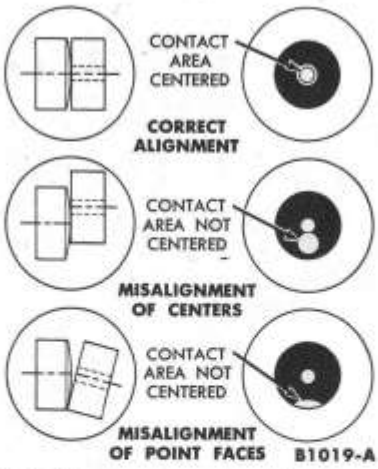


FIG. 11—Breaker Point Alignment

in order to realize the full advantages provided by this design, and assure normal breaker point life. Any misalignment of the breaker point surfaces will cause premature wear, overheating, and pitting.

1. Turn the distributor cam so that the breaker points are closed and check the alignment of the points (Fig. 11).

2. Align the breaker points to make full face contact by bending the stationary breaker point bracket (Fig. 12). **Do not bend the breaker arm.**

3. After the breaker points have been properly aligned, adjust the breaker point gap or dwell.

BREAKER POINT SPRING TENSION

Correct breaker point spring tension is essential to proper engine op-

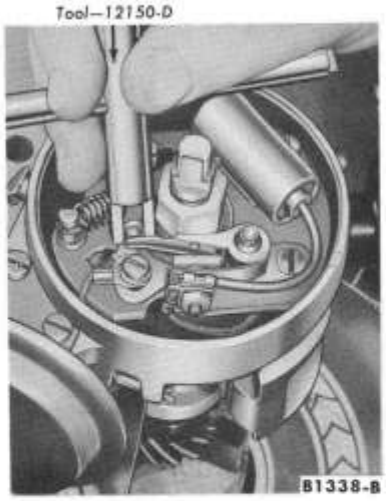


FIG. 12—Aligning Breaker Points

eration and normal breaker point life. If the spring tension is too great, rapid wear of the breaker arm rubbing block will result, causing the breaker point gap to close up and retard the spark timing. If the spring tension is too weak, the breaker arm will flutter at high engine rpm resulting in an engine miss.

To check the spring tension, place the hooked end of the spring tension gauge over the movable breaker point, then pull the gauge at a right angle (90°) to the movable arm until the breaker points just start to open (Fig. 13). If the tension is not within specifications (17-20 ounces), adjust the spring tension.

To adjust the spring tension (Fig. 14):

1. Disconnect the primary and condenser leads at the breaker point assembly primary terminal.

2. Loosen the nut holding the spring in position. **Move the spring toward the breaker arm pivot to decrease tension and in the opposite direction to increase tension.**

3. Tighten the locknut, then check spring tension. Repeat the adjustment until the specified spring tension is obtained.

4. Install the primary and condenser leads with the lockwasher and tighten the nut securely.

IGNITION TIMING

The timing pointer (Fig. 15), has four timing marks ranging from top dead center (TDC) to 10° before top center (BTC). The crankshaft pulley has a timing notch. To adjust ignition timing, align the notch on the pulley with the proper timing mark on the timing pointer.

CHECKING IGNITION TIMING

1. Disconnect the distributor vacuum line.

2. 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 puncture the spark plug wire or moulded cap.**

3. Clean the dirt from the timing marks and from the timing notch on the crankshaft pulley. If necessary,

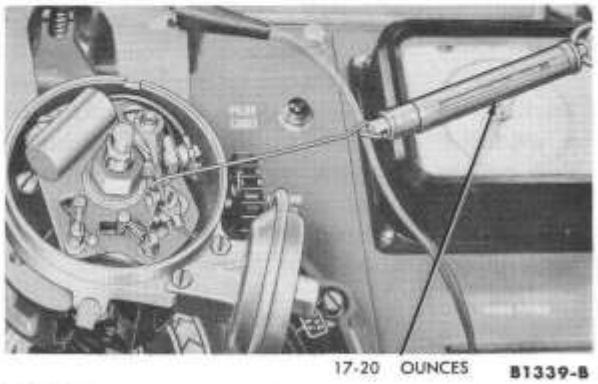


FIG. 13—Checking Breaker Point Spring Tension

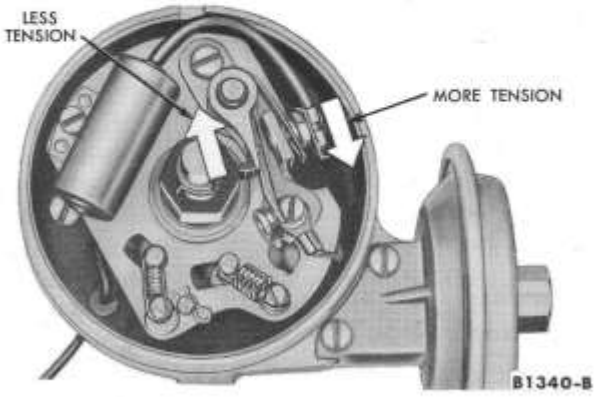


FIG. 14—Adjusting Spring Tension

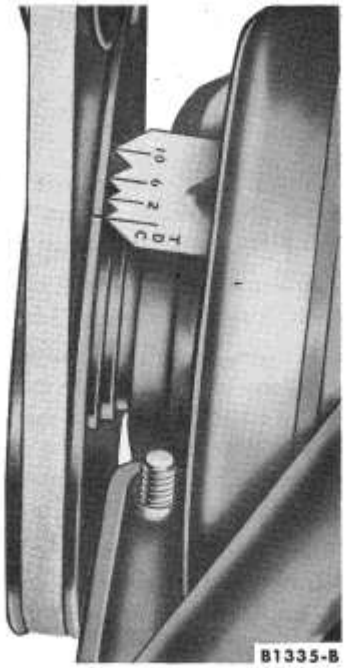


FIG. 15—Timing Marks

chalk the proper mark and the timing notch to improve legibility.

4. Operate the engine at idle speed. The timing light should flash just as the proper mark lines up with the notch indicating correct timing. The operator's eye should be in line with the center of the pulley and the timing pointer.

5. If the proper timing mark and the notch do not line up, rotate the distributor until the correct mark and the pointer or notch are in line.

Timing is advanced by counterclockwise rotation of the distributor body, and retarded by clockwise rotation.

6. After the ignition timing has been properly set, connect the distributor vacuum line.

7. Check the distributor to determine if the advance mechanism is operating. To do this, hold the timing light so that the timing marks and the notch can be seen, and accelerate the engine. If no advance is evident, one of the following is the probable cause; no vacuum available at the distributor or the vacuum advance diaphragm is leaking or it is disconnected from the breaker plate, or the breaker plate is binding in the housing or on the bushing.

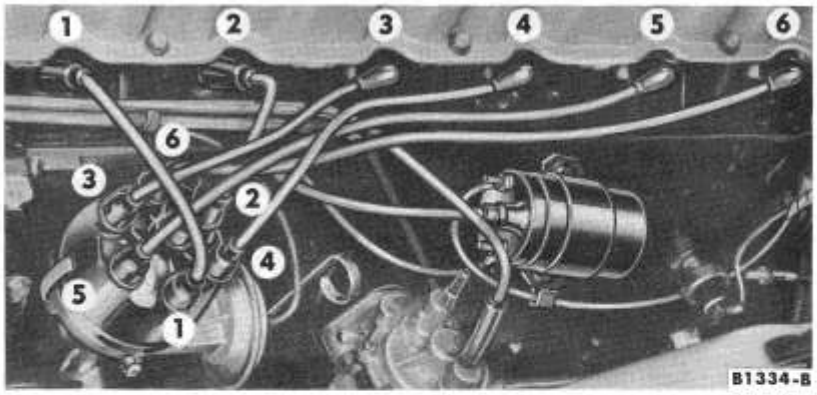


FIG. 16—Ignition Wiring

SPARK PLUG WIRE REPLACEMENT

The ignition wire installation is shown in Fig. 16.

REMOVAL

1. Disconnect the wires at the spark plugs and at the distributor cap.

2. Remove the coil high tension lead.

INSTALLATION

1. Connect the wires to the proper spark plugs.

2. Insert the ends of the wires in the correct sockets in the distributor cap. Be sure the wires are forced all the way down into their sockets and that they are held firmly in position. The No. 1 socket is identified on the cap. Install the wires in a clockwise direction in the firing order (1-5-3-6-2-4) starting at the No. 1 socket.

3. Install the coil high tension lead. Push all weather seals into position.

SPARK PLUGS

REMOVAL

1. Remove the wire from each spark plug by grasping the moulded cap only. **Do not pull on the wire because the wire connection inside the cap may become separated or the weather seal may be damaged.**

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

INSTALLATION

1. Install the plugs. Tighten each plug to 15-20 ft-lbs torque.

When a new spark plug is installed in a new replacement cylinder head, torque the plug to 20-30 ft-lbs.

2. Connect the spark plug wires. Push all weather seals into position.

CLEANING

Clean the plugs on a sand blast cleaner, following the manufacturer's instructions. **Do not prolong the use of the abrasive blast as it will erode the insulator.** Remove the carbon and other deposits from the threads with a stiff wire brush. Any deposits will retard the heat flow from the plug to

FIG. 17—Cleaning Plug Electrode

the cylinder head causing spark plug overheating and pre-ignition.

Clean the electrode surfaces with a small file (Fig. 17). Dress the electrodes to secure flat parallel surfaces on both the center and side electrode.

After cleaning, examine the plug carefully for cracked or broken insulators, badly pitted electrodes, or other signs of failure. Replace as required.

ADJUSTMENT

Set the spark plug gap (0.032-0.036 inch) by bending the ground electrode (Fig. 18).

FIG. 18—Gapping Spark Plug

RESISTANCE WIRE REPLACEMENT

The primary resistance wire is checked for excessive resistance as shown in Fig. 4 "Resistance Wire Test."

To replace the resistance wire:

1. Cut the brown wire and cut the red wire (with a green band) from the upper quick disconnect at the dash panel. Cut the wires as close to the quick disconnect as possible.

2. Solder a male bullet-type terminal to the brown wire and to the red wire (with a green band). Make a single terminal of the two wires. Using a female bullet terminal connector, connect the wires to one end of the service replacement resistance wire. **Do not splice the resistance wire.**

3. Drill a ¾ - inch hole through one of the accessory dimples in the dash panel.

4. Install a grommet into the hole drilled in the dash panel.

5. Thread one end of the service replacement resistance wire through the grommet in the dash panel and connect it to the jumper wire at the ignition switch. Make sure the wire is routed through the retaining clips.

6. Cut off and discard (at the point where it enters the taped area) the length of defective resistance wire which is not enclosed in the taped portion of the wiring assembly.

PART 2-2 DISTRIBUTOR

Section		Page
1	Distributor Operation	2-11
2	Distributor Removal and Installation	2-11
3	Distributor Disassembly, Cleaning and Inspection, and Assembly	2-12

1 DISTRIBUTOR OPERATION

The direction of distributor rotation is clockwise as viewed from the top of the distributor.

Engine speed and load requirements are satisfied by the action of the breaker plate which is controlled by a vacuum-actuated diaphragm working against the tension of two calibrated breaker plate springs. The breaker plate is free to rotate on the shaft bushing. The diaphragm moves the breaker plate in a counterclockwise direction to advance the spark, and the springs move the plate in a clockwise direction to retard the spark. The degree of spark advance is determined by the strength of the vacuum acting on the diaphragm.

Vacuum is transmitted to the distributor diaphragm from two interconnected passages in the carburetor (Fig. 1). The opening of one passage is in the throat of the venturi and the opening of the other passage is in the throttle bore just above the closed throttle plate.

All manifold vacuum to the distributor passes through a spark control valve located in the carburetor throttle body. Under steady part throttle operation, the spark valve is held open against the pressure of a calibrated spring. A combination of atmospheric pressure outside of the spark valve diaphragm and manifold vacuum from within holds the spark valve open. When accelerating, manifold vacuum momentarily drops below a predetermined point and the calibrated spring closes the spark valve shutting off the manifold vacuum port. Vacuum from the venturi prevents full spark retard.

As engine speed approaches the throttle setting, manifold vacuum increases sufficiently to open the spark valve and allow a higher vacuum to operate the distributor.

At high engine speed, manifold vacuum falls and the valve closes. This prevents loss of venturi vacuum due to bleed back caused by the lower manifold vacuum. This assures full spark advance at high engine speed.

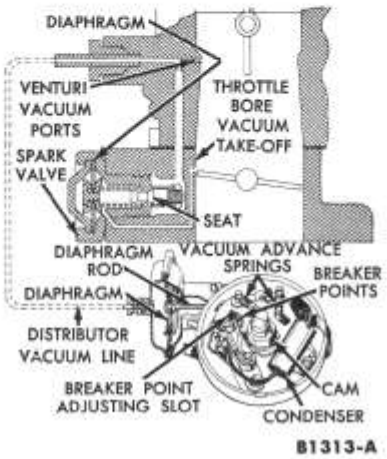


FIG. 1—Spark Advance Controls

The spark valve functions in a similar manner to provide an intermediate spark retard whenever the load on the engine is increased to a degree where normal road load spark advance would be too great and the wide-open throttle spark retard would reduce the efficiency of the engine.

2 DISTRIBUTOR REMOVAL AND INSTALLATION

REMOVAL

1. Disconnect the primary wire at the coil. Disconnect the distributor vacuum line at the distributor. Remove the distributor cap.

2. Scribe a mark on the distributor body, indicating the position of the rotor, and scribe another mark on the body and engine block, indicating the position of the body in the block. These marks can be used as guides when installing the distributor in a correctly timed engine.

3. Remove the screw, lockwasher and clamp and pull the distributor out of the block. **Do not rotate the crankshaft while the distributor is removed or it will be necessary to time the engine.**

INSTALLATION

The distributor installed is shown in Fig. 2.

1. If ignition timing is required, rotate the crankshaft until No. 1 piston is on TDC after the compression stroke. Position the distribu-

tor in the block with the rotor at the No. 1 firing position. **Make sure the oil pump intermediate drive shaft is properly seated in the oil pump. It may be necessary to crank the engine with the starter after the distributor drive gear is partially engaged, in order to engage the intermediate shaft fully in the oil pump.** Install, but do not tighten, the distributor retaining screws. Rotate the distributor body clockwise until the breaker points are just starting to open. Tighten the retaining screws.

2. If the crankshaft has not been rotated while the distributor was removed, position the distributor in the block with the rotor aligned with the mark previously scribed on the distributor body, and the marks on the body and engine block in alignment. Install the distributor retaining screws.

3. Connect the distributor primary wire. Install the distributor cap.

4. Start the engine and check the ignition timing with a timing light (Part 2-1). Connect the distributor vacuum line, and check the advance with the timing light when the engine is accelerated (Part 2-1).

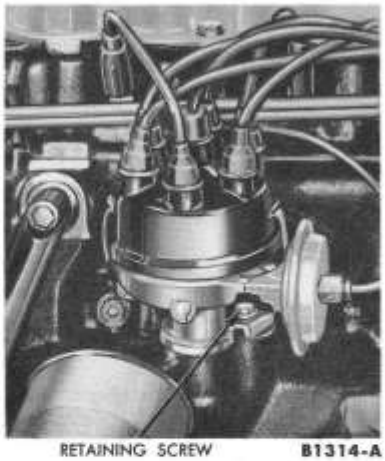


FIG. 2—Distributor Installation

3 DISTRIBUTOR DISASSEMBLY, CLEANING AND INSPECTION, AND ASSEMBLY

DISASSEMBLY

1. Install the distributor in a vise.

2. Remove the rotor and retainer.

3. Remove the vacuum advance rod retainer. Push the rod out of the plate. Remove the vacuum unit from the distributor.

4. Disconnect the primary and condenser wires from the breaker point terminal.

5. Remove the condenser.

6. Remove the breaker point assembly.

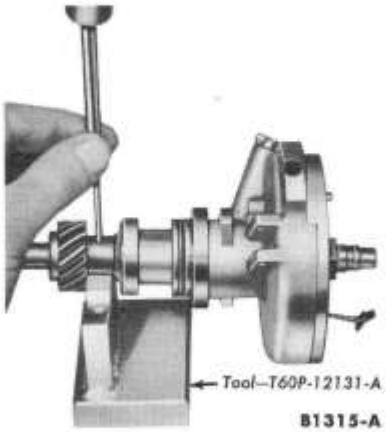


FIG. 3—Gear Pin Removal

7. Release the tension on the return springs and disconnect the springs. **Do not stretch the springs as distortion may result, making it impossible to obtain an adjustment. If the springs are distorted, discard them.**

8. Remove the distributor from the vise. Remove the distributor cap clamps. If a solid-type drive gear pin is used, file the peened end from the pin. Drive out the pin with a punch (Fig. 3).

9. If the gear and shaft are to be used again, mark the gear and shaft so that the pin holes can be easily aligned for assembly.

10. Press the gear off the shaft (Fig. 4). Slide the distributor shaft out of the body.

11. Position the distributor in a vise.

12. Remove the lock ring attaching the breaker plate to the bushing (Fig. 5). Lift the breaker plate from the body. Pull the primary wire through the opening in the distributor, working from the inside of the distributor.

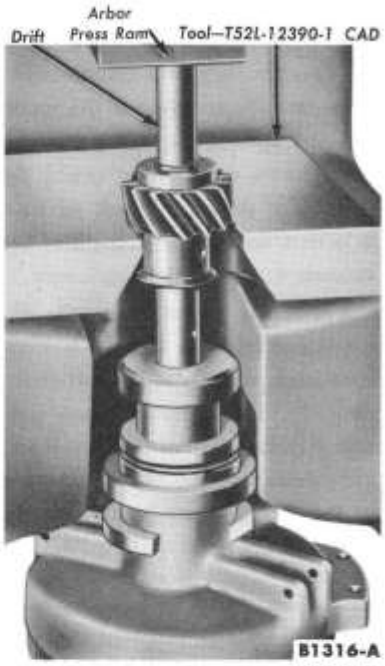


FIG. 4—Gear Removal

13. Remove the ground wire.

14. Compress and insert the slotted end of the bushing removal tool into the distributor body. Allow it to expand and butt against the bushing. Drive out the bushing (Fig. 6).

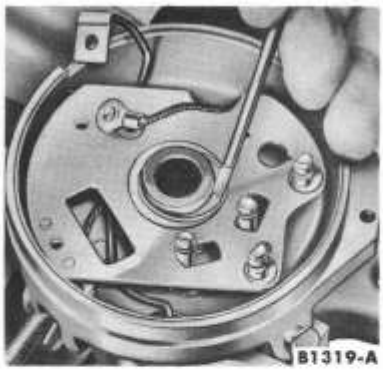


FIG. 5–Lock Ring Removal

CLEANING AND INSPECTION

Soak all parts of the distributor assembly (except the condenser, breaker point assembly, diaphragm assembly, and electrical wiring) in a mild cleaning solvent or mineral spirits. **Do not use a harsh cleaning solution.** Wipe all parts that cannot be immersed in a solvent with a clean dry cloth.

After foreign deposits have been loosened by soaking, scrub the parts with a soft bristle brush. **Do not use a wire brush, file, or other abrasive object.** Dry the parts with compressed air.

Examine the bushing surfaces of the distributor shaft and examine the bushings for wear. The minimum allowable shaft diameter at the bushing is 0.4675 inch. The maximum allowable inside diameter of the bushing is 0.4690 inch. Replace worn parts.

Inspect the cam lobes for scoring and signs of wear. If any lobe is scored or worn, replace the shaft.

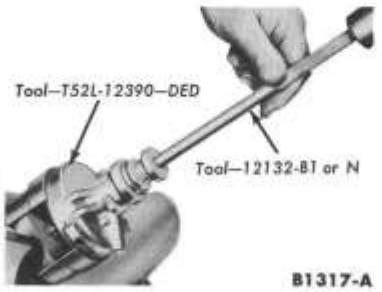


FIG. 6–Bushing Removal

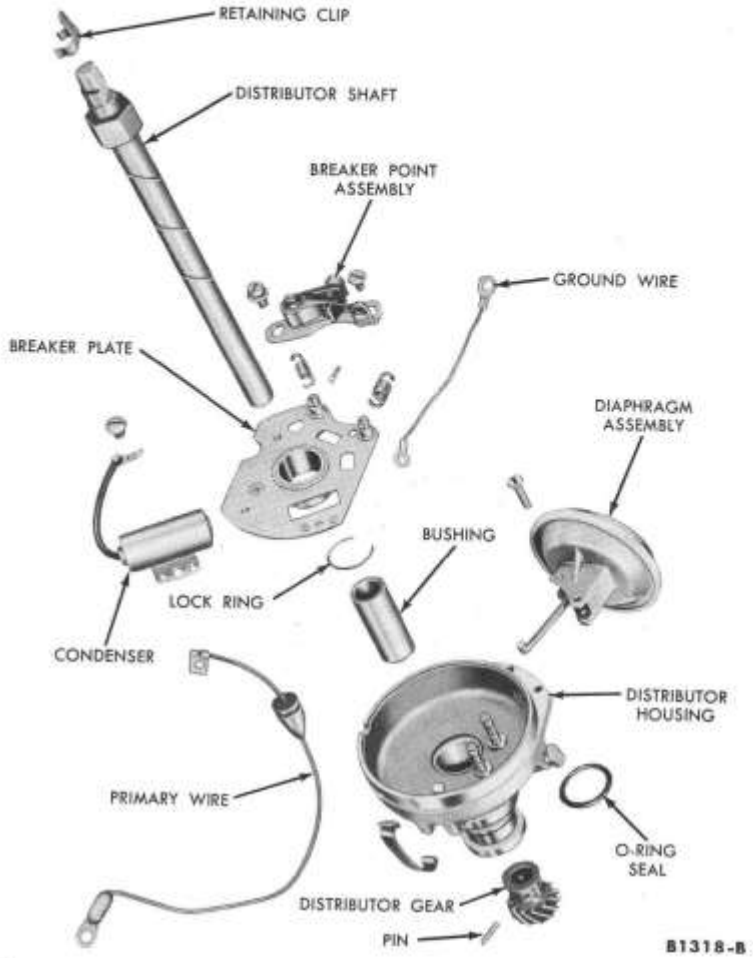


FIG. 7–Distributor Assembly

Inspect the breaker plate assembly for signs of distortion or other defects. Replace it if it is defective.

The breaker point assembly and condenser should be replaced whenever the distributor is overhauled.

Inspect all electrical wiring for fraying, breaks, etc., and replace any that are not in good condition.

Check the distributor base for cracks or other damage. Check the diaphragm housing, bracket, and rod for damage. Check the vacuum line fitting threads for stripping or other damage. Test the diaphragm assembly for leakage. Replace all defective parts. Test the condenser on a test set. Replace it if it does not meet specifications.

ASSEMBLY

The distributor assembly is shown in Fig. 7.

1. Oil the bushing and position it

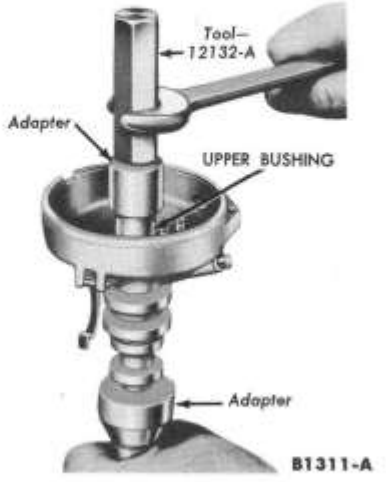


FIG. 8–Bushing Installation

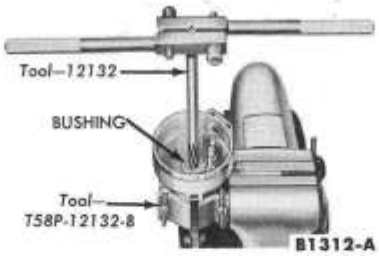


FIG. 9—Burnishing Bushing

in the body with the lock ring end up. Install the bushing (Fig. 8). Turn the tool until the adapter bottoms firmly against the distributor body.

2. Burnish the bushing to the proper size (Fig. 9).

3. Pass the primary wire assembly through the opening in the distributor, working from the inside to the outside of the distributor housing. Pull the wire through the opening until the locating stop is flush with the inside of the distributor (Fig. 10). Install the ground wire (Fig. 10).

4. Position the breaker plate in the body. Install the lock ring to secure the plate (Fig. 11).

5. The breaker plate is shown installed in Fig. 12. Position a new breaker point assembly on the breaker plate. Be sure the pivot pin enters the hole in the breaker plate.

6. Connect the ground wire to the breaker plate at the end closest to the adjustment slot. Install the other screw and lockwasher at the opposite end of the assembly.

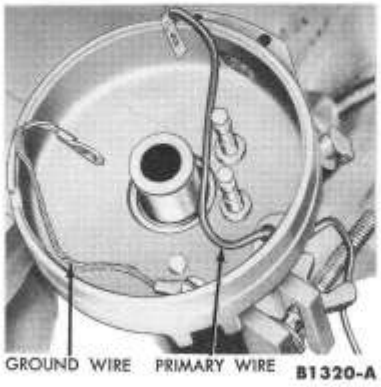


FIG. 10—Primary and Ground Wire Installation

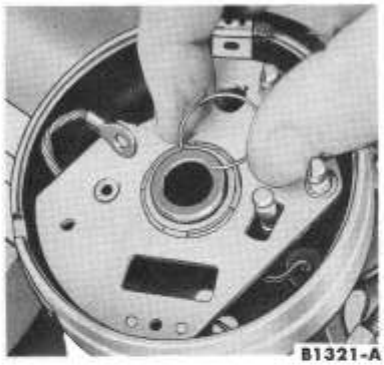


FIG. 11—Lock Ring Installation

7. Install a new condenser. Place the condenser lead, primary lead, lockwasher, and nut on the primary terminal.

8. Install the two return springs on the adjustment and breaker plate post. **Make certain that the secondary spring is installed adjacent to the vacuum chamber.**

9. Install the vacuum unit on the distributor body.

10. Insert the tip of the vacuum rod through the breaker plate. Attach the rod with the retainer.

11. Slide the shaft into the body, using care not to damage the rubbing block on the breaker points. **The shaft and gear are replaced as an assembly. One part should not be replaced without replacing the other.**

12. Using the marks made on the gear and shaft as guides to align the pin holes, press the gear on the shaft.

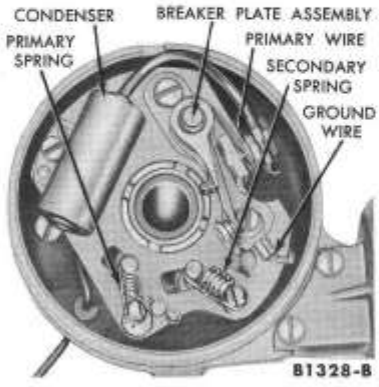


FIG. 12—Breaker Plate Installation

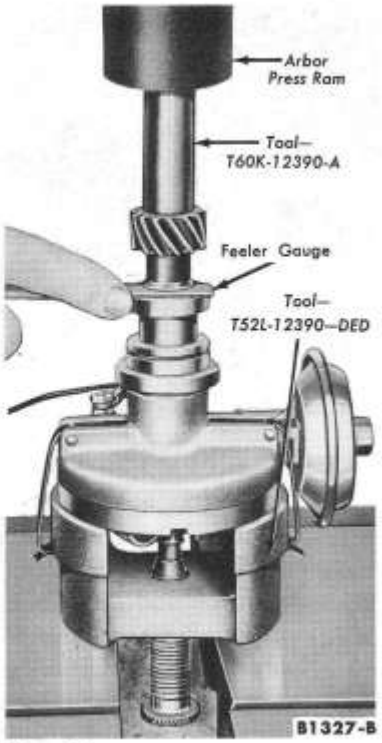


FIG. 13—Gear Installation

If a new shaft is being installed, attach the distributor shaft supporting tool to the distributor and tighten the backing screw on the tool enough to remove all shaft end play. With a 0.028-inch feeler gauge in position against the distributor mounting flange, press the gear on the shaft until it bottoms on the feeler gauge (Fig. 13). Remove the feeler gauge and drill the shaft with a ⅛-inch drill, using the pin hole in the gear shoulder as a guide.

13. Install the pin through the gear and shaft (Fig. 3). Peen the pin if the solid-type pin is used. Install the distributor cap clamps. Lubricate the cam with high temperature, non-fiber grease.

14. Refer to Part 2-1 and make the following checks and adjustments:

Breaker point spring tension.

Align the breaker points and adjust the gap.

Vacuum advance.

Check the breaker point dwell and resistance.

1961 FORD FALCON SHOP MANUAL

GROUP 3

FUEL SYSTEM

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PART 3-1 FUEL SYSTEM MAINTENANCE

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	Fuel Pump and Vacuum Booster	3-3
	Carburetor	3-4
2	Fuel Filter and Air Cleaner Maintenance	3-4
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1 TROUBLE DIAGNOSIS AND TESTING

The fuel system components are shown in Fig. 1.

FUEL TANK AND LINES

Water and dirt that accumulate in the fuel tank can cause carburetor or fuel pump malfunction. Condensation, which is the greatest cause of water entering the fuel tank, is formed by moisture in the air when it strikes the cold interior walls of the tank.

If the accumulation of sediment in the fuel pump sediment bowl is excessive, the fuel tank should be removed and flushed and the line from the fuel pump to the tank should be blown out.

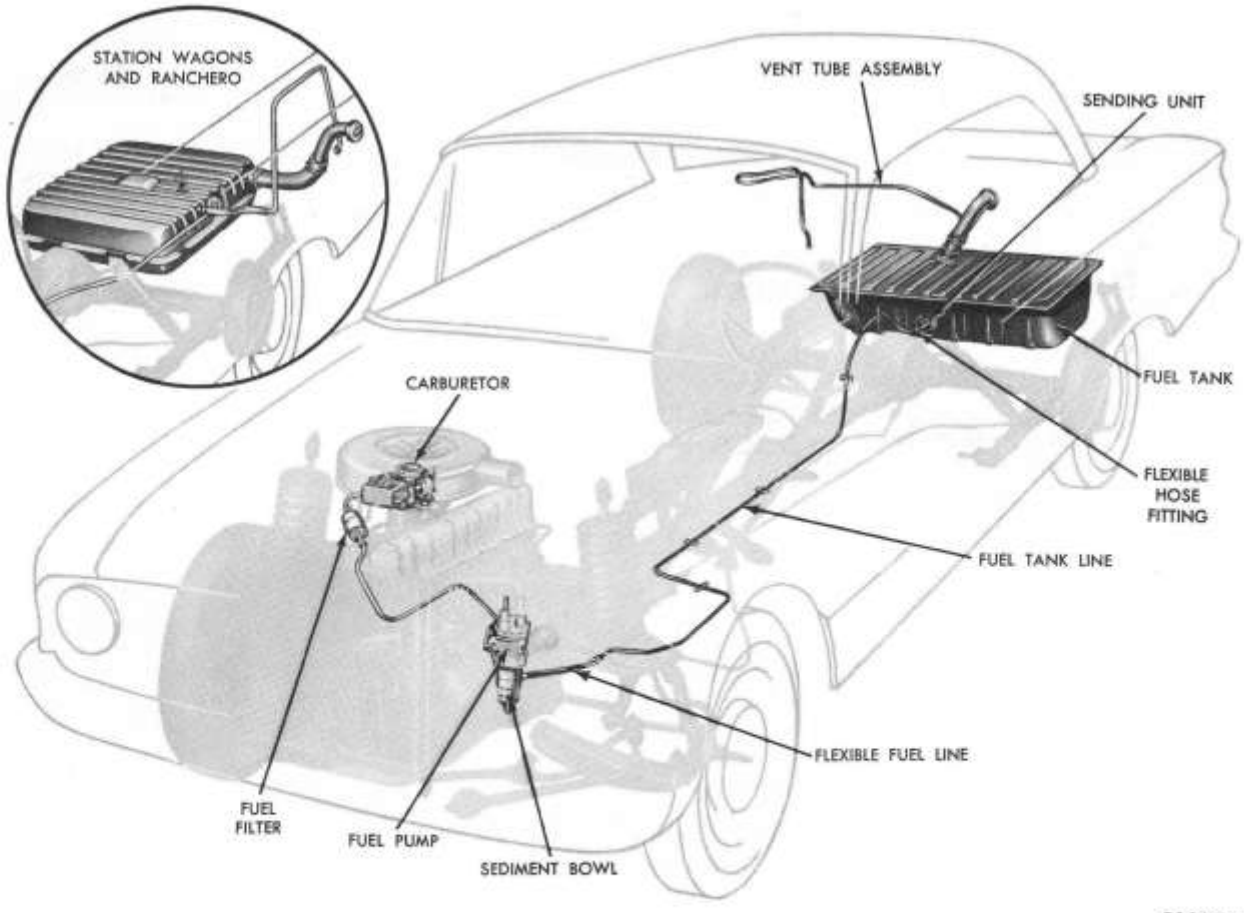

FIG. 1—Fuel System Installation

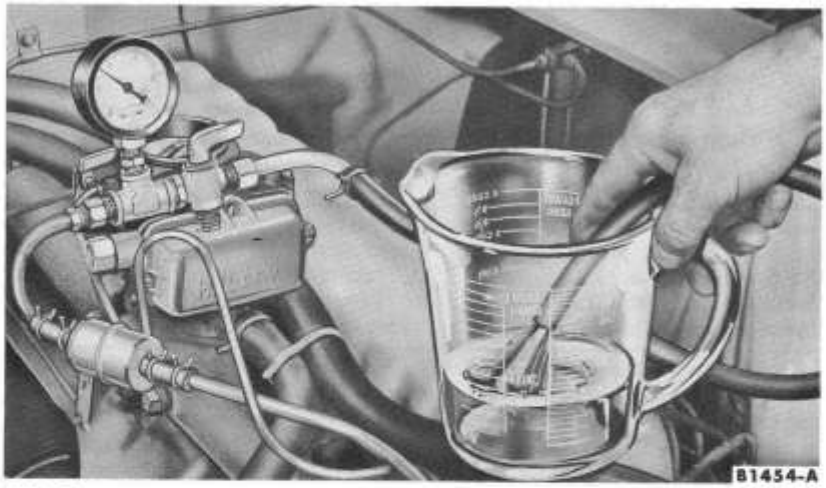

FIG. 2—Fuel Pump Pressure and Capacity Test

FUEL PUMP AND VACUUM BOOSTER

Incorrect fuel pump pressure and low capacity are the two most likely fuel pump troubles that will affect engine performance. Low pressure will cause a lean mixture at high speeds and excessive pressure will cause high fuel consumption and carburetor flooding. Low capacity will cause fuel starvation at high speeds.

TESTS

The tests are performed with the fuel pump installed on the engine.

Clean the fuel pump sediment bowl before performing a pressure or capacity test.

Pressure Test

1. Disconnect the fuel line at the carburetor.

2. Install a pressure gauge (0-15 psi) and a petcock to the fuel line (Fig. 2).

3. Install a flexible hose in the petcock so that the fuel can be expelled into a suitable container for the capacity test.

4. Vent the system, by opening the petcock momentarily, before taking a pressure reading.

5. Operate the engine at 500 rpm and observe the pressure gauge. After the pressure has stabilized, it should be within 3.5-5.5 psi.

6. If the pressure is not to specifications, remove the fuel filter from the system and take another pressure test.

If the pressure is within specifications with the fuel filter removed, the fuel filter was restricted and a new one should be installed.

If the pressure is not within specifications with the fuel filter removed, the fuel pump is defective.

Capacity Test. Perform this test only when the pressure test is within specifications.

1. Operate the engine at 500 rpm.

2. Open the petcock and expel the fuel into a suitable container (Fig. 2). Observe the time required to expel one pint. It should be 1 pint within 30 seconds.

Vacuum Booster Test

1. Connect a vacuum gauge to the windshield wiper connection of the pump.

2. Disconnect the pump to manifold line at the manifold. Plug the line.

3. Operate the engine at specified rpm and observe the vacuum gauge. The vacuum should be 10 inches Hg at 600 rpm.

FUEL PUMP TROUBLE DIAGNOSIS GUIDE

LOW FUEL PUMP PRESSURE	Diaphragm stretched or leaking. Spring weak. Rocker arm worn. Excessive clearance between rocker arm, vacuum link, and fuel pump link.	Fittings loose or cracked. Fuel line cracked or broken. Valve improperly seating. Dirt in the fuel tank and/or lines. Fuel tank vent restricted. Diaphragm ruptured.
HIGH FUEL PUMP PRESSURE	Spring too strong or improper spring.	
FUEL PUMP LEAKS FUEL	Main body retaining screws loose. Diaphragm defective. Fittings loose.	Threads on fittings stripped. Body cracked.
FUEL PUMP LEAKS OIL	Pull rod oil seal defective. Fuel pump mounting bolts loose.	Mounting gasket defective.
FUEL PUMP NOISE	Mounting bolts loose. Rocker arm worn.	Rocker arm spring weak or broken.
LOSS OF BOOSTER PUMP VACUUM	Vacuum pump cover retaining screws loose. Valves not seating properly.	Spring weak. Diaphragm defective.

CARBURETOR

Dirt accumulation in the fuel and air passages, improper idle adjustments, and improper fuel level are the major sources of troubles.

TESTS

Accelerating Pump Discharge

1. Remove the air cleaner.
2. Open the throttle plate.
3. Observe the fuel flow from the accelerating pump discharge nozzle.

If the system is operating satisfactorily, a quick steady stream will flow from the discharge nozzle.

CARBURETOR TROUBLE DIAGNOSIS GUIDE

HARD STARTING (HOT OR COLD)	Binding or broken choke linkage. Improper starting procedure causing a flooded engine. Improper carburetor fuel level. Improper idle adjustments.	Sticking or incorrectly seating fuel inlet needle. Incorrect fuel pump pressure. Improper carburetor gasket and spacer combination.
ROUGH IDLE	In addition to the items listed under "Poor Performance Caused By a Lean Mixture" or "Poor Performance Caused By A Rich Mixture," the following conditions will cause poor idle: Incorrect idle mixture adjustment.	Idle adjustment needles grooved, worn, or otherwise damaged. Idle air bleeds restricted. Idle air or fuel passages restricted. Idle discharge holes restricted. Idle discharge holes not in proper relation to the throttle plate.
POOR ACCELERATION	Poor acceleration complaints fall under one of three headings; the engine is sluggish on acceleration, the engine stalls when accelerated, or the engine hesitates or develops a flat spot when accelerated. Poor acceleration is caused by either an excessively lean or rich mixture on acceleration. A lean mixture on acceleration can be caused by: Accelerating pump diaphragm defective. Incorrect pump stroke adjustment. Fuel inlet ball check not seating on acceleration. Low fuel level or float setting.	Restriction in the accelerating pump discharge passage. Discharge ball check not coming fully off its seat, or failing to seat properly on the reverse stroke of the pump diaphragm. Air leak between the carburetor and the spacer caused by loose mounting bolts or defective gasket. Air leak at the throttle shaft caused by worn throttle shaft. Fuel filter clogged. A rich mixture on acceleration can be caused by: High fuel level or float setting. Excessively dirty air cleaner. Incorrect pump stroke adjustment.
FLOODING OR LEAKING CARBURETOR	Cracked main body or fuel bowl. Defective main body gaskets or fuel bowl gaskets. High fuel level or float setting. Fuel inlet needle not seating properly or worn needle and/or seat.	Ruptured accelerating pump diaphragm. Excessive fuel pump pressure.
POOR PERFORMANCE CAUSED BY A RICH MIXTURE	Excessive dirt in the air cleaner. High fuel level or float setting. Fuel inlet needle not seating properly or worn needle and/or seat. Power valve leaking.	Restricted air bleeds. Worn or damaged main jet. Accelerating pump discharge ball check and/or weight not seating. Fuel pump pressure excessive.
POOR PERFORMANCE CAUSED BY A LEAN MIXTURE	Low fuel level or float setting. Restriction in main fuel passage.	Sticking fuel inlet needle. Low fuel pump pressure.

2 FUEL FILTER AND AIR CLEANER MAINTENANCE

Refer to the "Maintenance Guide" in Group 16 for the proper maintenance interval.

SEDIMENT BOWL

REMOVAL

Loosen the bowl bail assembly and remove the sediment bowl and gasket, and filter screen (Fig. 3). Discard the gasket.

CLEANING AND INSPECTION

Clean the sediment bowl and filter screen in cleaning solvent and dry them with compressed air.

INSTALLATION

1. Place a new gasket and filter screen on the sediment bowl (Fig. 4).
2. Position the sediment bowl on the fuel pump and tighten the bail nut.
3. Start the engine. Check for leaks.

FUEL FILTER REPLACEMENT

The fuel filter is located in the carburetor fuel inlet line (Fig. 5). There is no provision for cleaning the filter. Replace it if it becomes clogged and

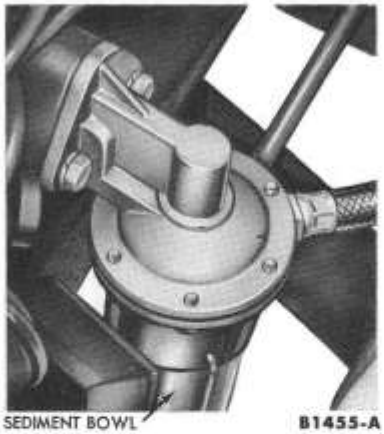

FIG. 3—Fuel Pump Installation

at the recommended mileage interval (Group 16).

1. Loosen the clamps on the rubber sleeves and slide the clamps away from the filter. Remove the filter.

2. Position the new filter in the fuel line so that the fuel flow arrow on the filter points toward the carburetor. Install the filter in the rubber sleeves and slide the clamps into position.

3. Start the engine and check the fuel line for leaks.

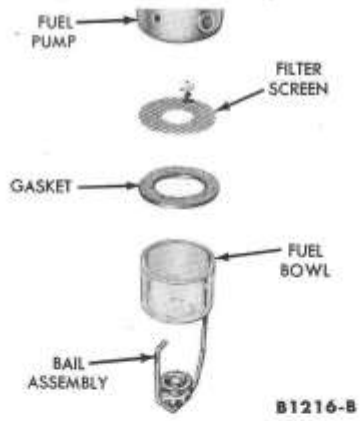

FIG. 4—Sediment Bowl Assembly

AIR CLEANER

The engine is equipped with a dry-type air cleaner that has a replaceable cellulose fiber filtering element (Fig. 6). The air from the engine compartment enters the air cleaner through an open tube on the left side of the air cleaner. The air then passes through the filter element. After leaving the filter element, the air is deflected down into the carburetor. The dust particles are trapped in the filter element as the air rushes through it.

REMOVAL

1. Remove the wing nut retaining the cover on the air cleaner, then lift the cover off.

2. Lift the element out of the air cleaner body.

3. To remove the air cleaner body, loosen the clamp and lift the air cleaner body off the carburetor.

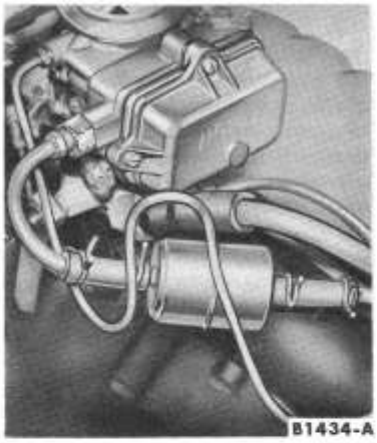

FIG. 5—Fuel Filter Installation

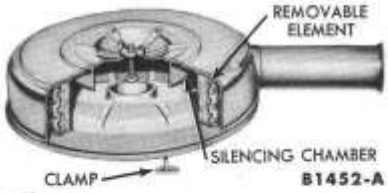

FIG. 6—Air Cleaner

INSTALLATION

1. Position the air cleaner body on the carburetor with the word "FRONT" toward the front of the engine. Tighten the clamp (Fig. 7).

2. Place the filter element in the air cleaner body.

3. Position the cover and install the wing nut.

MAINTENANCE

Refer to Group 16 for the recommended maintenance mileage interval.

Direct clean compressed air against the element in the opposite direction of normal air flow, that is, from the inside of the element out. When the element is cleaned or replaced, clean the air cleaner body and cover in cleaning solvent, then wipe them dry.

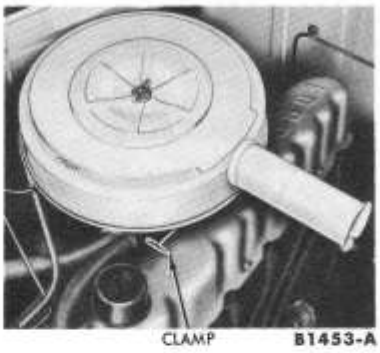

FIG. 7—Air Cleaner Installation

3 CARBURETOR IN-CHASSIS ADJUSTMENTS

IDLE ADJUSTMENTS

For purposes of an engine tune-up, the idle adjustments should be made in the sequence listed.

ENGINE IDLE SPEED

A stop screw (Fig. 8) controls the engine idle speed. Turn the screw in to increase the engine idle speed and out to decrease the engine idle speed.

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

2. Operate the engine at fast idle until the temperature has stabilized (approximately 1200 rpm for 30 minutes). Be sure the choke plate is fully open. **On a car with an air conditioner, operate the air conditioner 20 minutes before setting the engine idle speed.**

3. Attach a tachometer to the engine.

On a car with a manual-shift transmission, with the transmission selector lever in neutral position, turn the idle speed stop screw in a direction to obtain 500-525 rpm. Open the throttle by hand and allow it to close normally. Check the engine idle speed.

On a car with Fordomatic, **be sure the parking brake is on.** Place the selector lever in drive range position.

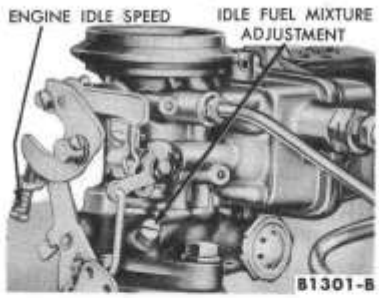

FIG. 8—Idle Adjustments

Adjust the engine idle speed to 475-500 rpm.

After the correct engine idle speed has been obtained, open the throttle by hand and allow it to close normally. Check the engine idle speed.

FIG. 9—Anti-Stall Dashpot Adjustment

Final engine idle speed may be varied to suit the conditions under which the car is to be operated.

Remove the tachometer if the idle fuel mixture is not going to be adjusted. If the idle fuel mixture is to be adjusted, leave the tachometer installed so that the idle speed can be rechecked after the fuel mixture has been adjusted.

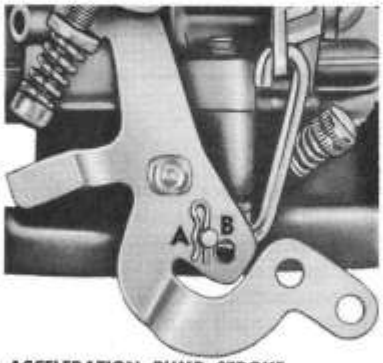

FIG. 10—Accelerating Pump Stroke

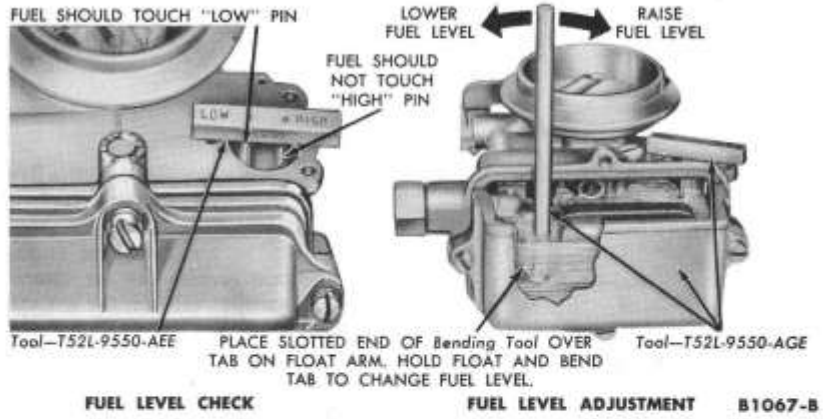

FIG. 11—Fuel Level and Fuel Level Adjustment

IDLE MIXTURE

The idle fuel mixture is controlled by the idle mixture adjusting needle (Fig. 8).

1. Adjust the engine idle speed.

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

3. Check the engine idle speed and adjust it if necessary. Remove the tachometer.

ANTI-STALL DASHPOT—FORDOMATIC

1. With the engine idle speed and mixture properly adjusted, and the engine at operating temperature, turn the anti-stall dashpot adjusting screw in or away from the dashpot plunger (Fig. 9).

2. Hold the throttle in the closed position. Depress the plunger with a screwdriver blade (Fig. 9). Turn the adjustment screw out (toward the plunger) until a clearance of 0.060-0.090 is obtained between the screw head and the tip of the plunger.

ACCELERATING PUMP

Acceleration requirements in summer and winter are satisfied by controlling the quantity of fuel discharged by the accelerating pump (Fig. 10). The pump stroke is controlled by changing the position of

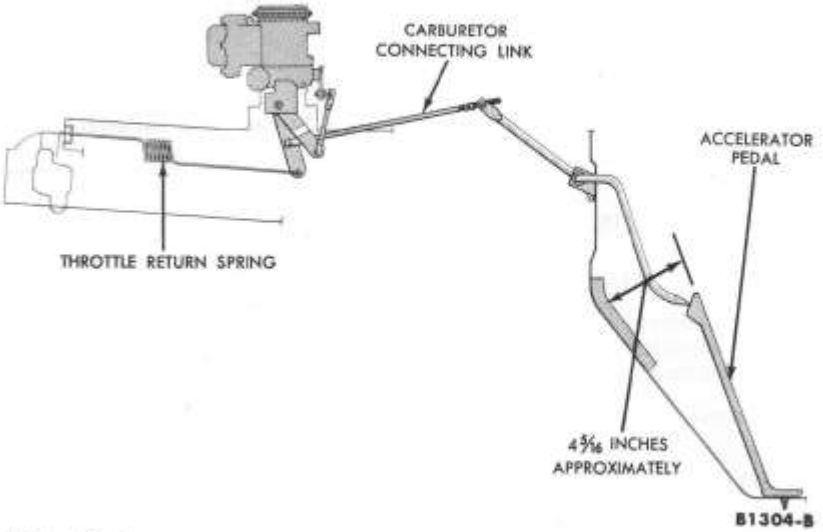

FIG. 12—Manual-Shift Throttle Linkage

the pump link in the throttle lever. The inner hole (hole closest to the throttle shaft) is for average or hot weather operation. The outer hole is for cold weather operation.

FUEL LEVEL

1. Remove the power valve diaphragm cover and valve assembly.

2. Place the fuel gauge in the opening and crank the engine. The fuel should touch the tip of the low gauge pin for the maximum fuel level setting. **The fuel should never be higher than the tip of the low gauge pin (Fig. 11).**

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

3. Install the dummy bowl, using the fuel bowl gasket and three of the retaining screws (Fig. 11). **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 recheck the fuel level.

THROTTLE LINKAGE

MANUAL-SHIFT TRANSMISSION

Adjust the engine idle speed to specifications. Set the accelerator pedal height to 4 5/16 inches and adjust the carburetor connecting link, as necessary, to allow a smooth bind-free operation (Fig. 12).

FORDOMATIC

The throttle linkage adjustments for this transmission are covered in Group 6.

PART 3-2 CARBURETOR

Section		Page
1	Carburetor Operation	3-8
2	Carburetor Removal and Installation	3-9
3	Carburetor Disassembly, Cleaning and Inspection, and Assembly	3-10

1 CARBURETOR OPERATION

The carburetor (Fig. 1) has two main assemblies. They are the main body and the throttle body.

FUEL INLET SYSTEM

The amount of fuel entering the fuel bowl (Fig. 2) is controlled by the distance the fuel inlet needle is moved off its seat and by fuel pump pressure. Movement of the fuel inlet needle in relation to the seat is controlled by the float and lever assembly which rises and falls with the fuel level. When the fuel in the fuel bowl reaches a pre-set level, the float moves the fuel inlet needle to a position where it restricts the flow of fuel, admitting only enough fuel to replace that being used.

A spring and pin, inside the hollow fuel inlet needle, cushions the fuel inlet needle against road shocks and vibrations. A clip, to assure reaction of the fuel inlet needle to any float movement, is attached to the needle and float.

A spring attached to the float tab and secured to the fuel inlet needle seat and bracket assembly helps to stabilize the float.

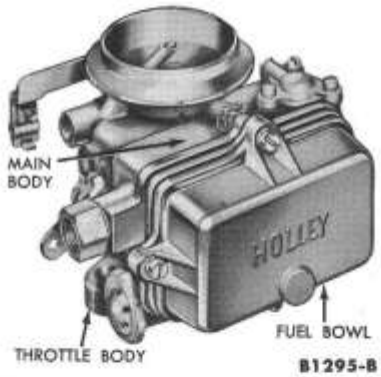

FIG. 1—Carburetor

IDLE FUEL SYSTEM

High manifold vacuum at idle creates a low pressure area at the idle discharge port. The pressure in the fuel bowl is near atmospheric pressure. The difference in pressure between the fuel bowl and the idle discharge port forces fuel through the idle fuel system.

Fuel is forced through the main jet into the bottom of the main well (Fig. 3). From the main well, the fuel flows into the idle fuel passage.

The fuel is metered through a calibated restriction located at the top of the idle fuel passage. Air enters the idle fuel system, to vaporize the fuel, through an air bleed at the top of the idle passage. The air bleed also acts as a vent to prevent siphoning at high speeds or when the engine is stopped. The fuel-air mixture travels down the idle channel past two idle transfer holes in the throttle body and is discharged through the idle discharge hole. As the throttle plate is moved past the two transfer holes, during off idle, each hole begins to discharge fuel as it is exposed to manifold vacuum. The transfer holes act as additional air bleeds at idle.

Fuel discharge at idle is controlled by an idle adjusting needle which seats in the discharge hole.

ACCELERATING SYSTEM

Upon acceleration, there is a brief interval before the fuel, which is heavier than air, can gain speed and maintain the desired balance of fuel and air. The accelerating system (Fig. 4) operates during this interval to supply fuel until the other systems can provide the proper mixture.

When the throttle is suddenly opened, a diaphragm which is connected by linkage to the throttle,

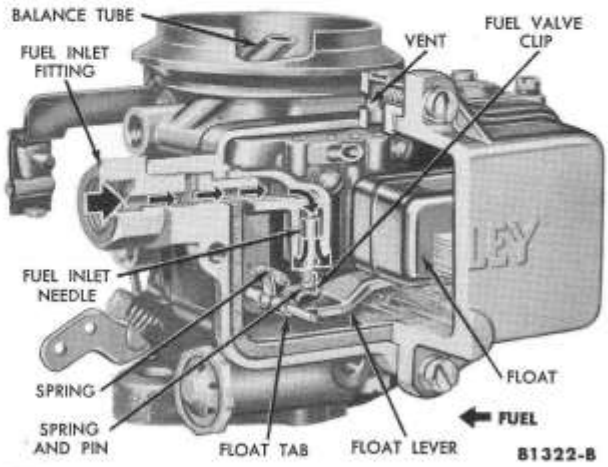

FIG. 2—Fuel Inlet System

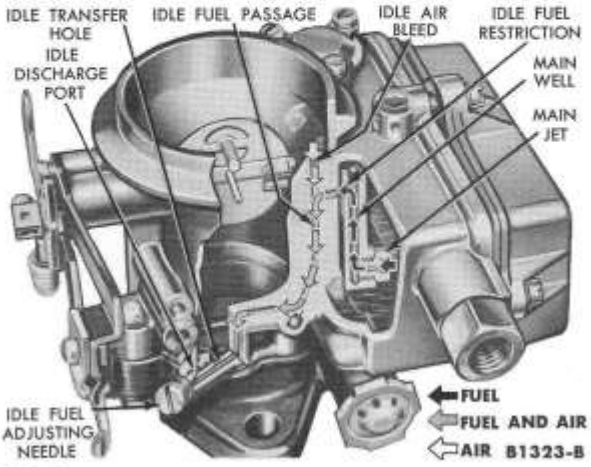

FIG. 3—Idle Fuel System

INSTALLATION

1. Clean the gasket surface of the carburetor and spacer. Position a new gasket on the spacer.
2. Install the carburetor.
3. Connect the choke and throttle linkage to the carburetor. Adjust the linkage if necessary.
4. Connect the fuel inlet line and the distributor vacuum line. Install the air cleaner.
5. Adjust the idle fuel mixture, engine idle speed, and the anti-stall dashpot (Fordomatic). Check the fuel level, and adjust it if necessary.

IN-CHASSIS ADJUSTMENTS

Carburetor in-chassis adjustments are covered on page 3-5.

3 CARBURETOR DISASSEMBLY, CLEANING AND INSPECTION, AND ASSEMBLY

CARBURETOR DISASSEMBLY

Use a separate container for the component parts of the various assemblies to facilitate cleaning, inspection, and assembly.

MAIN BODY

1. Remove the cotter pin from the accelerating pump connecting link and remove the link.
2. Remove the two throttle body screws and lockwashers. Separate the throttle body and main body, and remove the gasket.
3. Remove the accelerating pump discharge nozzle and gasket.
4. Remove the fuel bowl and gasket.
5. Remove the fuel inlet fitting with a box wrench, and remove the gasket. Remove the fuel inlet seat screw and gasket located in the fuel inlet opening.
6. Remove the fuel inlet needle seat and bracket assembly, and the gasket from inside the main body.
7. Remove the float shaft, releasing the float. Slide the fuel inlet needle assembly off the float lever tab.
8. Remove the power valve cover and gasket. Lift the power valve diaphragm and stem assembly out of the main body.
9. Remove the anti-stall dashpot if so equipped.
10. Using a jet wrench, remove the main jet (Fig. 7). Remove the main well.
11. Remove the accelerating pump diaphragm return spring from the metal disc on the accelerating pump piston, then remove the spacer gasket.
12. Pull the accelerating pump diaphragm out of the main body. Remove the accelerating pump operating lever retainer, then slide the lever off the stud.
13. If it is necessary to remove the choke plate or shaft, drive the fuel distribution pin out of the shaft (Fig. 8).
14. Remove the two choke plate screws, and slide the choke plate out of the slot in the choke shaft. Remove the shaft and bracket. **If the tips of the screws are flared excessively, file off the flared portion to avoid damaging the threads in the choke shaft. Be careful not to damage the choke shaft or venturi while filing the screws.**
15. Remove the accelerating pump inlet ball retainer and the discharge ball retainer from the main well. Invert the main well, allowing the inlet ball and discharge weight and ball to fall out into the hand.
16. Press the accelerating pump rod sleeve toward the diaphragm until the sleeve retainer ball drops out. Remove the sleeve and spring.

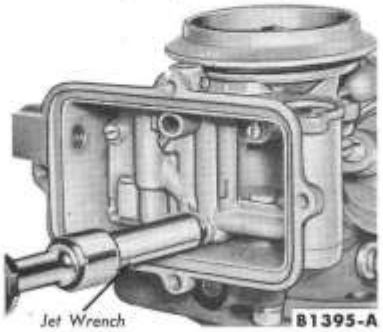

FIG. 7—Jet Removal or Installation

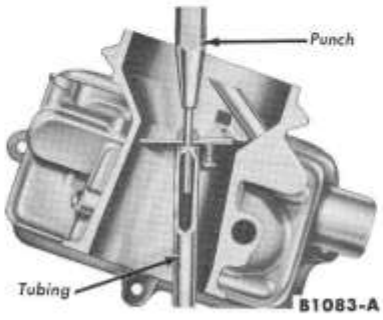

FIG. 8—Distribution Pin Removal

THROTTLE BODY

1. Remove the anti-stall dashpot operating lever if so equipped. Remove the idle adjusting needle and spring.
2. Remove the spark control valve and gasket using a socket wrench.
3. At times, it may be necessary to remove the throttle plate and shaft to accomplish a thorough cleaning job. If this is done, lightly scribe the plate along the throttle shaft before removal so it can be installed in exactly the same position. **The throttle plate and shaft cannot be interchanged between carburetors, nor are they serviced as separate parts.**

CARBURETOR CLEANING AND INSPECTION

The cleaning and inspection of only those parts not included in the carburetor overhaul repair kit are covered. All gaskets and parts included in the repair kit should be installed when the carburetor is assembled and the old gaskets and parts should be discarded.

Wash all the carburetor parts (except the accelerating pump diaphragm, power valve diaphragm, and the anti-stall dashpot assembly) in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, lacquer thinner or denatured alcohol may be used. Rinse the parts in kerosene to remove all traces of the cleaning solvent. Be sure all dirt, gum, carbon, and other foreign matter are removed from all parts. Dry them with compressed air. Wipe all parts that can not be immersed in solvent with a clean, soft, dry cloth.

Force compressed air through all passages of the throttle body, main body, and the main well. Do not use a wire brush to clean any parts or a drill or wire to clean out any openings or passages in the carburetor. A drill or wire may enlarge the hole or passage changing the calibration of the carburetor.

Check the choke shaft for grooves, wear, and excessive looseness or binding. Inspect the choke plate for nicked edges and the poppet valve for ease of operation and free them if necessary.

Check the throttle shaft in its bore for excessive looseness or binding and check the throttle plate for burrs which prevent proper closure. If the throttle shaft and plate assembly is not serviceable, it will be necessary to replace the throttle body.

Inspect the throttle body, main body, metering block, and fuel bowl for cracks.

Check the float for leaks by holding it under water that has been heated to just below the boiling point. Bubbles will appear if there is a leak. If the float leaks, replace it. Replace the float if the arm needle contact surface is grooved. If the floats are serviceable, polish the needle contact surface of the arm. Replace the float shaft if it is worn.

Replace all screws and nuts that have stripped threads.

Replace all distorted or broken springs.

Inspect all gasket mating surfaces for nicks and burrs. Repair or replace any parts that have a damaged gasket surface.

Inspect the rubber boot of the anti-stall dashpot for proper installation in the groove of the stem bushing. Check the stem movement for smooth operation. Do not lubricate the stem. Replace the assembly if it is defective.

CARBURETOR ASSEMBLY

A disassembled view of the carburetor is shown in Fig. 9.

THROTTLE BODY

1. If the throttle plate was removed, slide the throttle shaft into the throttle body. Referring to the line scribed on the throttle plate, install the plate in its original position with the screws snug, but not tight. Hold the throttle body up to the light. Little or no light should show between the throttle plate and the throttle bore. Tap the plate lightly with a screw driver handle to seat it. Tighten and stake the screws.

2. Install the accelerating pump link in the throttle lever. Secure it with a cotter pin. Install the link in the hole closest to the throttle shaft for warm weather and the hole farthest from the throttle shaft for cold weather.

3. Install the idle adjustment needle and spring. Turn the needle in gently with the fingers until it seats, then back it off 1-1½ turns for a preliminary idle adjustment. **Do not force the needle against the seat. If the needle is damaged, it must be replaced before a proper idle mixture adjustment can be made.**

4. Install the spark control valve and gasket, using a socket wrench.

5. Install the anti-stall dashpot operating lever on carburetors so equipped.

MAIN BODY

If the choke plate was not removed, omit steps 1 thru 9.

1. Position the choke bracket assembly on the protruding boss on the main body, but do not install the screw and washer.

2. Slide the choke shaft and lever assembly into the main body.

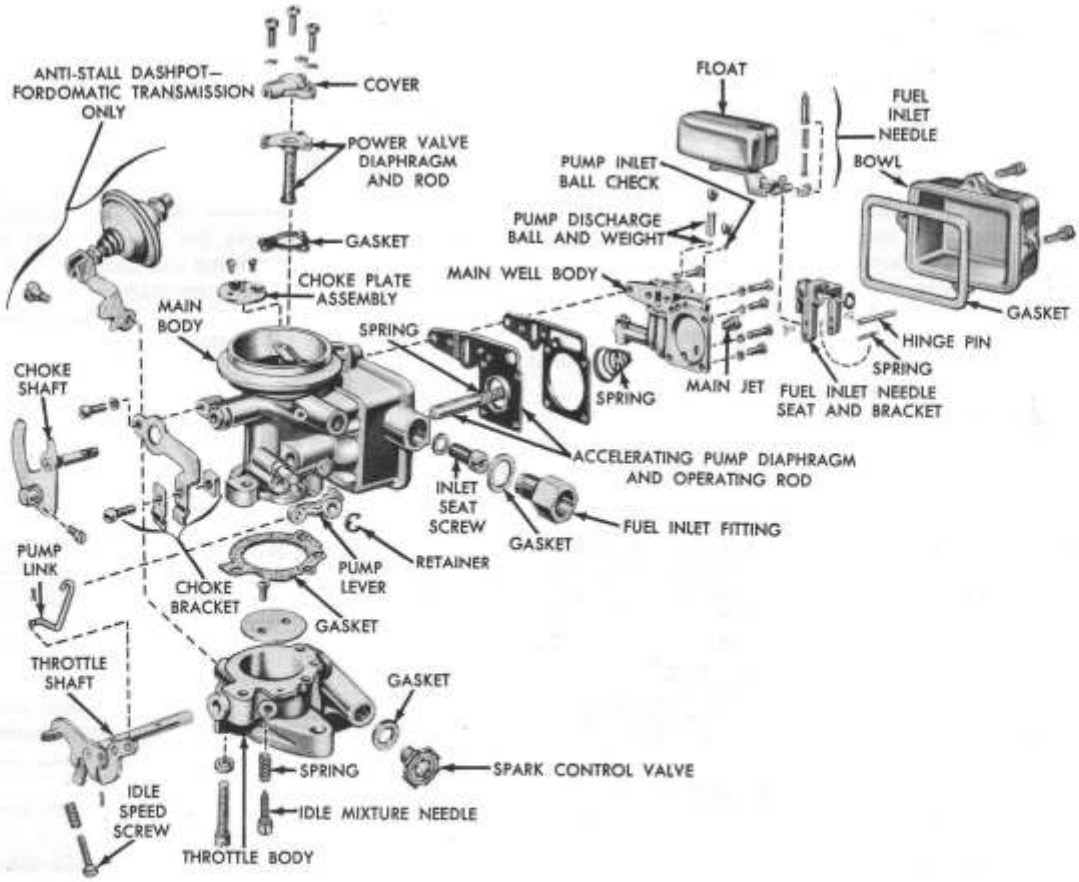

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FIG. 9—Carburetor Assembly

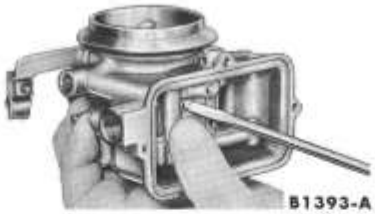

FIG.10 –Main Well Body Installation

3. Turn the choke lever so that the swivel is directly beneath the choke shaft.

4. Insert the choke plate in the shaft with the poppet valve spring up. **Be careful not to damage the main discharge nozzle with the edge of the plate.**

5. Turn the choke lever counterclockwise, centering the plate in the venturi opening, and install the two choke plate screws.

6. Tighten the screws just enough to hold the plate. Make sure that the distribution pin hole in the choke shaft is aligned with the corresponding hole in the choke plate.

7. Drive the distribution pin into position in the choke shaft. Brace the shaft on a length of brass tubing for this operation to prevent bending. Install the distribution pin so that the clearance, between the throat of the venturi and the ends of the pin, is equal on both sides when the plate is in the full open position.

8. Check the choke plate for binding by moving it from the closed position to the open position. If it moves freely, tighten the two choke plate screws while holding the choke plate in the full closed position.

9. Stake the screws. Install the choke bracket screw and lockwasher.

10. Place the spring on the accelerating pump diaphragm rod, and press the rod sleeve onto the rod to compress the spring.

11. Drop the rod sleeve retainer ball into the hole in the sleeve.

12. Position the accelerating pump assembly in the main body.

13. Place the main well spacer gasket over the accelerating pump assembly.

14. Insert the accelerating pump inlet and discharge balls into the main well. **The inlet ball is slightly larger than the discharge ball. Be sure they are installed in their proper chamber.**

15. Seat the balls with one gentle tap of a light hammer and a soft brass drift. Be sure the balls move freely in their chambers.

16. Install the inlet retainer and

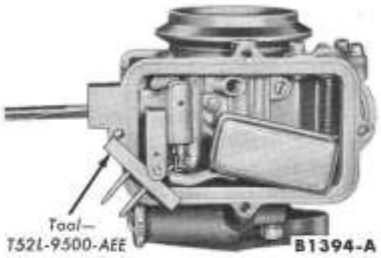

FIG.11 –Fuel Inlet Needle and Seat Installation

the discharge weight and retainer.

17. Position the large end of the accelerating pump return spring in the metal disc on the diaphragm.

18. Position the screws and lockwashers in the main well. The two long screws are placed in the center top and center bottom holes. The short screws are used in the three remaining holes.

19. Insert the power valve end of the main well body into position against the spacer gasket as follows:

Apply pressure with the index finger against the protruding end of the accelerating pump rod sleeve to fully compress the accelerating pump return spring as the thumb presses the main well body into position (Fig. 10). This will prevent the return spring pressure from disturbing the alignment of the holes in the diaphragm, spacer gasket, and main body. Before releasing the accelerating pump rod sleeve, tighten the screws. Install the main jet.

20. Position the power valve gasket and power valve diaphragm stem assembly into the main body.

21. Install the power valve cover.

22. Clip the fuel inlet needle on the float lever tab.

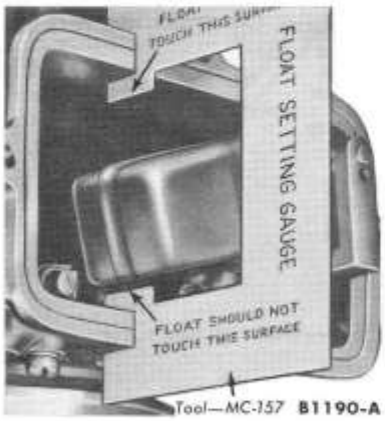

FIG. 12–Float Setting–Bench Check Only

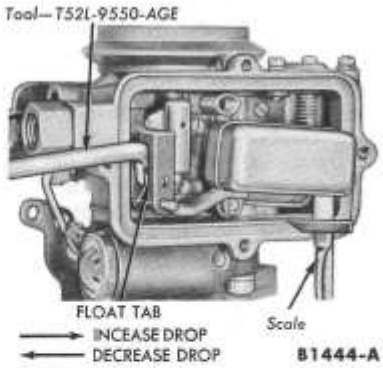

FIG.13–Float Drop

23. Guide the fuel inlet needle into the seat, and position the float lever between the two float hinge bracket arms. Install the float lever shaft. **Do not attempt to interchange the fuel inlet needle or seat. They are matched assemblies.**

24. Place the fuel inlet needle seat screw gasket on the screw and insert the screw through the fuel inlet fitting boss.

25. Place the seat gasket on the threaded end of the inlet seat screw which protrudes into the fuel bowl.

26. Place the fuel inlet needle seat and bracket, float, and fuel inlet needle assembly into position. Place the fuel level gauge under the float hinge bracket to prevent the assembly from tilting when the seat screw is tightened (Fig. 11).

27. Tighten the screw securely, then remove the gauge. Install the fuel inlet fitting and gasket.

28. Invert the main body assembly, and check the setting of the float (Fig. 12). With the main body in the upright position, check the float drop (Fig. 13). There should be a $\frac{3}{16}$ inch clearance between the bottom of the float at the lowest point and the floor of the float chamber. Bend the upright tang to achieve the correct clearance.

29. If necessary, bend the tab on the float arm to bring the float setting within limits. This should provide the proper fuel level.

30. Install a new fuel bowl gasket in the recess in the main body.

31. Place the fuel bowl into position. Install the retaining screws, and lockwashers. Tighten the two center screws, then the two end screws, alternately, to evenly compress the gasket.

32. Install the accelerating pump discharge nozzle and gasket. Align the accelerating pump discharge

nozzle so that the stream of fuel will be directed through the opening in the choke plate when the plate is closed.

33. Install the anti-stall dashpot on carburetors so equipped.

34. Place a new throttle body to main body gasket on the throttle body, and check the alignment of all holes in the gasket with the corresponding holes in the throttle body.

35. Insert the two throttle body screws and lockwashers through the throttle body and gasket to maintain gasket alignment, then position the main body on the throttle body.

36. Invert the carburetor, and evenly tighten the two throttle body screws.

37. Insert the accelerating pump link through the hole in the pump operating lever.

38. Install the other end of the accelerating pump link in the throttle lever. Secure it with a cotter pin. Install the link in the hole closest to the throttle shaft for warm weather and the hole farthest from the throttle shaft for cold weather operation.

39. Slide the accelerating pump operating lever on the lever stud and install the retainer.

PART 3-3 FUEL PUMP AND VACUUM BOOSTER, FUEL TANK, AND FUEL LINES

Section		Page
1	Combination Fuel Pump and Vacuum Booster	3-14
2	Fuel Tank Replacement	3-15
3	Fuel Line Replacement	3-16

1 COMBINATION FUEL PUMP AND VACUUM BOOSTER

TESTS AND TROUBLE DIAGNOSIS

Tests and trouble diagnosis are covered in Part 3-1.

REMOVAL

1. Disconnect the fuel line at the pump and fuel filter.

2. Disconnect the vacuum lines at the vacuum booster.

3. Remove the pump and gasket from the block.

INSTALLATION

1. Apply sealer to both sides of a new gasket. **Be sure all the old gasket material is removed from the gasket surfaces.**

2. Position the gasket on the pump flange, and hold the pump in position against the mounting pad. Make sure the rocker arm is riding on the camshaft eccentric.

3. Press the pump tight against the pad, install the retaining bolts, and alternately tighten them to specifications.

4. Connect the vacuum lines and the fuel lines.

DISASSEMBLY

1. Remove the sediment bowl, filter screen, and gasket.

2. Scribe a line to identify the pulsator chamber position. Remove the pulsator chamber retaining screw with a clutch-type screw driver. Then remove the pulsator chamber and pulsator.

3. Scribe a line on the fuel pump cover and body to identify their original position.

4. Remove the fuel pump cover.

5. Remove the vacuum booster cover.

6. Remove the vacuum diaphragm spring and spring seat.

7. Remove the upset on the end of the rocker arm pin. Remove the retaining washer. Drive the pin out (Fig. 1). Work the fuel pump and vacuum booster links out of the diaphragm stems.

8. Remove the vacuum booster diaphragm.

9. Remove the fuel pump diaphragm, spring seat, and spring. Remove the rocker arm and link assembly.

10. Remove the staking marks around the valves and flip the valves out with a screwdriver. **Note the position of the inlet and outlet valves so that the new valves can be installed in the same manner.**

11. Remove the vacuum booster valve located in the pump body near the mounting pad.

12. Scrape away the staking marks and remove the other valve.

13. Scrape away the staking marks, and remove the valves in the cover.

14. Scrape away the staking marks, and remove the diaphragm rod oil seals and retainers.

CLEANING AND INSPECTION

Clean the sediment bowl, pump body, and the covers in solvent. Blow out all cover passages. Inspect the body, bowl, and covers for cracks or damage and replace them if necessary. Inspect the staked areas around the valve and seal counterbores for high spots which may cause distortion of the new parts upon installation. Remove all high spots. Inspect the mounting flange for distortion. Replace the pump body or lap the distorted flange if necessary.

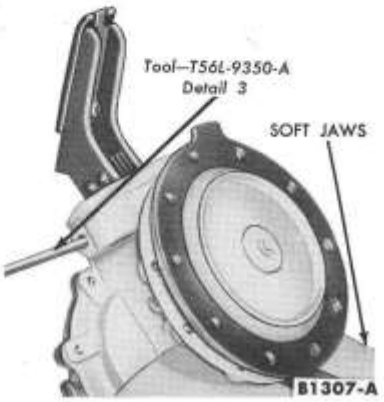

FIG. 1—Rocker Arm Pin Removal or Installation

ASSEMBLY

Install all the parts included in the overhaul kit. The combination fuel pump and vacuum booster assembly is shown in Fig. 2.

1. Install the diaphragm rod oil seals and seal retainers (Fig. 3). Stake the seal retainers in place.

2. Press the booster pump valves and gaskets in the pump body and vacuum pump cover (Fig. 4). Stake the valves in place.

3. Install the gaskets and fuel valves in the fuel pump cover using the tool shown in Fig. 3, then stake them in place.

4. Place the fuel pump link (short link), with the hook up, inside the return spring retainer spacer. Place this assembly inside the vacuum pump link (long link). Place all these parts inside the rocker arm, and install the bushing. **Make sure the cam contact surface of the rocker arm faces down.**

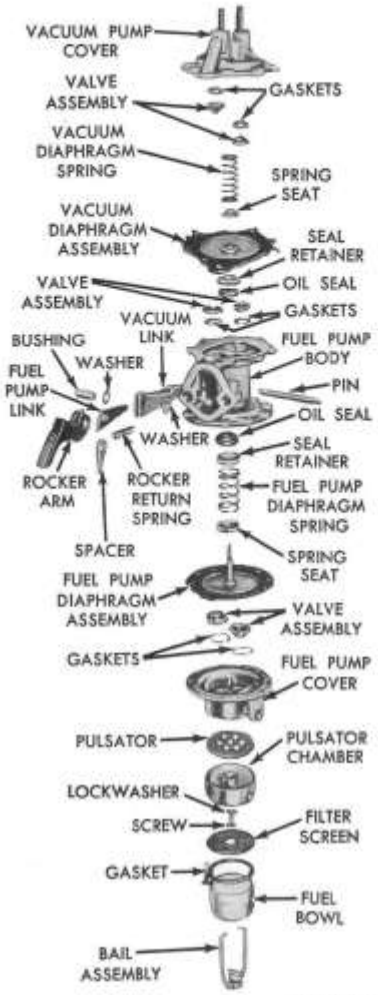

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FIG. 2—Combination Fuel Pump and Vacuum Booster

5. Install a thin washer, then a thick washer on each end of the bushing.

6. Place the rocker arm return spring over the boss in the pump body. Place the rocker arm and link assembly in the pump body and hold them in place (Fig. 1).

7. Install the rocker arm pin. Place the retaining washer on the end of the pin, then peen the pin.

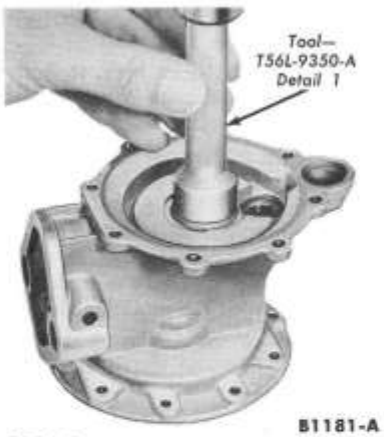

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FIG. 3—Diaphragm Rod Oil Seal and Retainer Installation

8. Lubricate the fuel pump diaphragm rod with grease.

9. Assemble the spring seat (cup side toward the spring) and spring on the fuel pump diaphragm rod. Insert the rod through the fuel pump oil seal, and hook the rod slot over the short link (Fig. 5).

10. Lubricate the booster diaphragm rod with grease. Insert the booster diaphragm rod through the oil seal, and hook the slot in the rod in the long link.

11. Install the spring seat with the cup side toward the diaphragm.

12. Position the spring and cover in place. Hold the cover tight against the diaphragm and pump body, and install the cover retaining screws. Make sure the diaphragm extends evenly around the edge of the cover. Tighten the screws evenly.

13. Place the fuel pump cover on the diaphragm, aligning the scribed line on the cover with the line on the pump body. Be sure the diaphragm extends evenly all around the edge of the cover. Compress the spring with the rocker arm, and install the cover retaining screws. Tighten the screws evenly, then release the rocker arm.

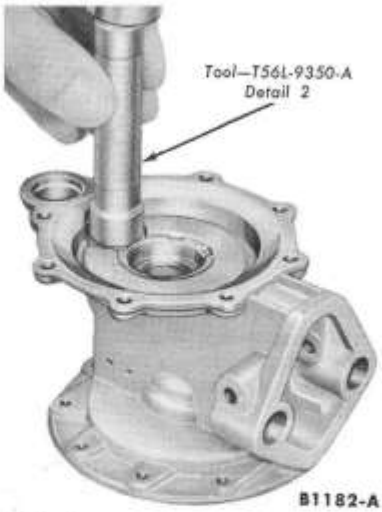

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FIG. 4—Booster Pump Valves and Gaskets Installation

14. Install the pulsator diaphragm and the pulsator chamber. Be sure the scribe marks on the pulsator chamber and fuel pump cover are aligned.

15. Install the filter screen, bowl gasket, and the sediment bowl. Rotate the bowl against the gasket before tightening the bail nut to make sure the bowl seats evenly against the gasket.

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FIG. 5—Diaphragm Installation

2 FUEL TANK REPLACEMENT

CONVENTIONAL CAR

Removal

1. Raise the rear of the car.
2. Remove the fuel tank drain plug and drain the fuel into a suitable container.
3. Disconnect the fuel gauge sending unit wire at the sending unit.
4. Loosen the hose clamp, slide the clamp forward and disconnect the fuel line at the fuel gauge sending unit.

5. Disconnect the fuel tank vent hose at the tank.

If the fuel gauge sending unit is to be removed, turn the unit retaining ring counterclockwise and remove the sending unit retaining ring and gasket.

6. Remove the spare tire from the luggage compartment. Pull the compartment floor mat out of the way for access to the fuel tank.

7. Remove the fuel tank filler neck retaining screws.

8. Loosen the filler neck to tank hose clamps. Remove the filler neck, mounting gasket, and filler neck to tank hose.

9. Remove the fuel tank to luggage compartment floor pan retaining screws and remove the fuel tank.

INSTALLATION

1. Make sure all the old sealer has been removed from the fuel tank mounting flange and mounting surface at the luggage compartment floor pan. Apply caulking cord to the fuel tank mounting surface at the luggage compartment floor pan.

2. Position the fuel tank to the luggage compartment floor pan and install the retaining screws.

3. Position the hose and filler neck assembly and gasket to the body back panel. Position the hose to the fuel tank neck.

4. Install the filler neck to body back panel retaining screws and tighten the hose clamps.

5. If the fuel gauge sending unit was removed, make sure all the old gasket material has been removed from the unit mounting surface on the fuel tank. Using a new gasket, position the fuel gauge to the fuel tank and secure with the retaining ring.

6. Position the luggage compartment floor mat and install the spare tire.

7. Connect the fuel gauge sending unit wire to the sending unit.

8. Connect the fuel line at the fuel gauge sending unit and tighten the hose clamps securely. Install the drain plug.

9. Connect the fuel tank vent hose.

10. Fill the tank and check all connections for leaks.

11. Lower the car.

STATION WAGON AND RANCHERO

Removal

1. Remove the fuel tank drain plug and drain the fuel into a suitable container.

2. Loosen the filler hose clamp at the tank and disconnect the hose.

3. Disconnect the fuel gauge sending unit wire at the sending unit.

4. Loosen the clamps and disconnect the flexible fuel line at the sending unit and the vent hose at the tank.

5. Remove the two nuts retaining the tank support straps to the underbody at the rear of the tank. Remove the straps and lower the tank.

6. Remove the fuel gauge sending unit.

Installation

1. Using a new gasket, install the fuel gauge sending unit.

2. Hold the tank in position against the underbody. Hook the support straps to the retainers in the underbody at the front of the tank. Position the straps over the studs, then install the nuts retaining the straps to the underbody at the rear of the tank.

3. Connect the fuel line, vent hose, and filler hose.

4. Connect the fuel gauge sending unit wire. Install the drain plug.

5. Fill the tank and check all connections for leaks.

3 FUEL LINE REPLACEMENT

The fuel tank metal line that runs from the fuel pump flexible hose to the tank flexible connection is not serviced as an assembly. It must be made up from the 5/16-inch (OD) line serviced in 25 foot rolls.

1. Drain the fuel from the tank. Disconnect the fuel line at the flexible hoses at the fuel pump and fuel tank.

2. Remove the line from the holding clips along the underbody.

3. Cut the new line to approximately the same length as the original. Square the ends of the line with a file. Ream the inside edges of the line with the reamer blade on the tube cutter. Be sure that the metal chips are removed from the inside of the tube.

4. Bend the line to conform with the contour of the original line.

5. Position the line in the underbody clips. Connect the line to the flexible hoses. Install the drain plug. Fill the tank and check the line and connections for leaks.

1961 FORD FALCON SHOP MANUAL

GROUP 4

COOLING SYSTEM

PAGE

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PART 4-1 COOLING SYSTEM MAINTENANCE

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2	General Maintenance	4-2
3	Radiator, Hoses, and Thermostat	4-3
4	Fan and Drive Belt	4-4

1 TROUBLE DIAGNOSIS

Engine overheating and slow engine warm-up are the two engine troubles most commonly attributed to the cooling system.

Loss of coolant and the accumulation of rust and scale or other foreign matter in the system are the main causes of overheating. Coolant loss can be caused by external leakage at the radiator, pressure cap, water pump, hose connections, heater, and core plugs. Coolant loss can be caused by internal leakage due to a defective cylinder head gasket, improper tightening of the cylinder head bolts, or warped cylinder head or block gasket surfaces.

Internal leakage can be detected by operating the engine at fast idle and looking for the formation of bubbles in the radiator. Oil in the radiator may indicate leakage in the engine block. Also, water formation on the oil level dip stick could be an indication of internal leakage.

Rust and scale that form in the engine water passages are carried into the small passages in the radiator by the circulation of the coolant. This clogs the radiator passages and causes overheating. Rust can be detected by the rusty or muddy appearance of the coolant.

A defective thermostat valve that remains open will cause slow engine warm-up.

TROUBLE DIAGNOSIS GUIDE

ENGINE OVERHEATS	Insufficient coolant. Belt tension incorrect. Radiator fins obstructed. Thermostat stuck closed. Alcohol used with high temperature thermostat.	Cooling system passages blocked by rust or scale, or other foreign matter. Faulty radiator pressure cap. Water pump inoperative.
ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	Thermostat stuck open or incorrect heat range. Temperature sending unit defective (causing gauge to indicate low	engine temperature). Temperature gauge defective (not indicating true engine temperature).
LOSS OF COOLANT	Leaking radiator. Loose or damaged hose connections. Water pump leaking. Cylinder head gasket defective. Improper tightening of cylinder head bolts.	Cylinder block core plugs leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface. Radiator cap defective or wrong type.

2 GENERAL MAINTENANCE

Correct coolant level is essential for maximum circulation and adequate cooling. In addition, for the cooling system to perform its function, it must receive proper care. This includes periodic flushing of the entire system, keeping radiator fins clean, and periodic inspection of the cooling system for leakage.

Use care when removing the radiator cap, to avoid injury from escaping steam or hot water.

CLEANING COOLING SYSTEM

To remove rust, sludge, and other foreign material from the cooling system, use either FoMoCo Regular Cooling System Cleanser or in severe cases use Heavy Duty Cleanser. Removal of such material restores cooling efficiency and avoids overheating.

In severe cases where cleaning solvents will not properly clean the cooling system for efficient operation, it will be necessary to use the pressure flushing method.

Various types of flushing equipment are available. If pressure flushing is used, make sure the cylinder head bolts are properly tightened to prevent possible water leakage into the cylinders. **Always remove the thermostat prior to pressure flushing.**

A pulsating or reversed direction of flushing water flow will loosen sediment more quickly than a steady flow in the normal direction of coolant flow.

RUST INHIBITOR

Use FoMoCo Rust Inhibitor after the cooling system has been cleaned, to prevent additional corrosion or rust. Rust inhibitor does not remove rust nor dissolve rust. It is a preventive only and not a cleaner.

All anti-freeze sold by reputable manufacturers contains an anti-rust additive. Therefore, the addition of rust inhibitor, when anti-freeze is used, will not be necessary.

DRAINING AND FILLING THE COOLING SYSTEM

To drain the radiator, open the drain cock located at the right bottom of the radiator. The cylinder block has one drain cock located at the right rear of the cylinder block, ahead of the starter.

To fill the cooling system, close the drain cocks. Disconnect the heater outlet hose at the water pump to bleed or release trapped air in the system. When the coolant begins to escape, connect the heater outlet hose.

Operate the engine and add more coolant, if necessary, to fill the radiator to the proper level.

3 RADIATOR, HOSES, AND THERMOSTAT

RADIATOR REPLACEMENT

REMOVAL

1. Drain the cooling system. Disconnect the radiator upper and lower hoses at the radiator.

2. Remove the radiator to support bolts and remove the radiator.

INSTALLATION

1. If a new radiator is to be installed, remove the drain cock from the old radiator and install it in the new radiator.

2. Position the radiator assembly and install the retaining bolts.

3. Connect the radiator upper and lower hoses.

4. Close the drain cock. Fill and bleed the cooling system.

5. Operate the engine and check for coolant leaks.

RADIATOR HOSES

Radiator hoses should be replaced whenever they become cracked.

REMOVAL

Drain the radiator. Loosen the quick disconnect clamps at each end of the hose to be removed and slide them toward the center of the hose. Slide the hose off the connections.

INSTALLATION

Position the clamps on the hose and slide them towards the center of the hose. Slide the hoses onto the radiator and engine connections. Slide the clamp into position. Fill the radiator. Operate the engine for several minutes and check the hoses and connections for leaks.

THERMOSTAT

The engine is equipped with a poppet-type thermostat, mounted in the cylinder head at the coolant outlet elbow mounting surface.

The standard production thermostat operating temperatures are from 173°-183°F, for use with water or permanent-type anti-freeze. A thermostat with operating temperatures of 157°-162°F is available for use with non-permanent-type anti-freeze and water.

Do not attempt to repair the thermostat. It should be replaced if it is not operating properly.

REMOVAL

1. Drain the cooling system to below the level of the coolant outlet elbow.

2. Remove the coolant outlet elbow retaining bolts and slide the elbow with the hose attached to one side.

3. Remove the thermostat and gasket.

INSTALLATION

1. Clean the coolant outlet elbow and cylinder head surface. Coat a new coolant outlet elbow gasket with sealer. Position the gasket on the cylinder head. **The gasket must be positioned on the cylinder head before the thermostat is installed.**

2. Coat the edge of the thermostat with grease for thermostat adhesion. Position the thermostat in the recess of the coolant outlet elbow so that the copper pellet or heat element will be in the head.

3. Position the coolant outlet elbow and install the retaining screws. Be careful not to disturb the thermostat.

4. Fill the radiator. Operate the engine and check for coolant leaks.

TEST

1. Insert a piece of 0.003-inch feeler stock ⅛-inch wide under the sleeve opening. Suspend the thermostat, by the feeler stock, in a large container of water so that it is completely submerged, and 1 to 2 inches from the bottom.

Suspension of the thermostat in this manner will give an accurate indication when the sleeve starts to open. The thermostat will drop off the feeler stock when the sleeve starts to open. If the thermostat will not stay on the feeler stock when it is first inserted, discard the thermostat.

2. Suspend a thermometer in the water so that the bulb is at the same level as the thermostat element. Heat the water slowly, and stir it frequently to normalize the temperature. If the sleeve opens at a temperature of more than 5° below the start-to-open specification, or if the sleeve does not open at a temperature of more than 5° above the start-to-open specification, replace the thermostat. The sleeve should open to a minimum of 0.26 inch from its seat in boiling water. If the sleeve will not open this far, replace the thermostat.

4 FAN AND DRIVE BELT

FAN

The fan and water pump pulley is bolted to the water pump hub.

REMOVAL

Remove the fan blade retaining bolts and remove the fan and pulley.

INSTALLATION

Position the fan and pulley on the water pump hub and install the retaining bolts.

DRIVE BELT

A single belt drives the water pump and generator.

The fan belt should be properly adjusted at all times. A loose belt

causes improper generator, fan, and water pump operation. A belt that is too tight places a severe strain on the water pump and the generator bearings.

REPLACEMENT

1. Loosen the generator mounting bolts and the generator adjusting arm bolt. Move the generator toward the engine. Remove the belt from the generator, crankshaft pulley, and water pump pulley. Lift it over the fan.

2. Place the belt over the fan. Insert the belt in the water pump pulley, crankshaft pulley, and generator pulley grooves. Adjust the tension.

ADJUSTMENT

1. Install the belt deflection tool (33-73F) on the drive belt and check the deflection following the instructions of the tool manufacturer.

2. If adjustment is necessary, loosen the generator mounting bolts and the generator adjusting arm bolt. Move the generator toward or away from the engine until the correct deflection is obtained. Tighten the generator adjusting arm bolt and the mounting bolt before checking the deflection.

PART 4-2 WATER PUMP

Section		Page
1	Water Pump Removal and Installation	4-5
2	Water Pump Disassemby and Assembly	4-5

A single water pump assembly is used. The pump is equipped with a sealed bearing integral with the water pump shaft. The bearing requires no lubrication. The hole in the water pump housing is a bleed hole to allow water that may leak past the seal to be thrown out by the slinger. **This is not a lubrication hole.**

1 WATER PUMP REMOVAL AND INSTALLATION

REMOVAL

1. Drain the cooling system.
2. Disconnect the radiator lower hose at the water pump. Remove the drive belt, fan, and water pump pulley.
3. Disconnect the heater hose at the water pump.
4. Remove the water pump.

INSTALLATION

1. Clean the gasket surfaces on the water pump and cylinder block.
2. Coat a new gasket on both sides with sealer and position it on the cylinder block.
3. Position the water pump in place and install the lockwashers and retaining bolts (the generator adjusting arm is retained by one water pump bolt).
4. Connect the radiator lower hose and the heater hose to the water pump.
5. Install the water pump pulley and fan.
6. Install and adjust the drive belt.
7. Fill and bleed the cooling system. Start the engine and check for leaks.

2 WATER PUMP DISASSEMBLY AND ASSEMBLY

DISASSEMBLY

The water pump assembly is shown in Fig. 1.

1. Remove the hub from the impeller shaft (Fig. 2).
2. Position the pump on an arbor press and press the shaft and bearing out of the housing (Fig. 3).
3. Remove the impeller from the shaft (Fig. 4).

ASSEMBLY

1. Clean all gasket material from the pump.
2. If a new shaft is used, install the slinger on the shaft in the same

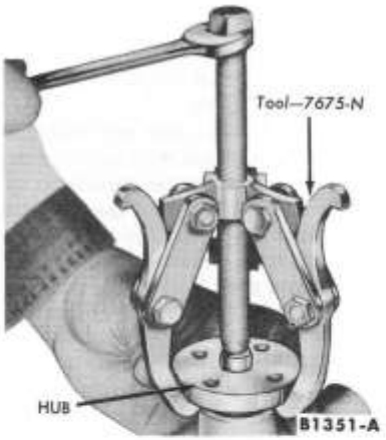

FIG. 2—Hub Removal

FIG. 3—Shaft and Bearing Removal

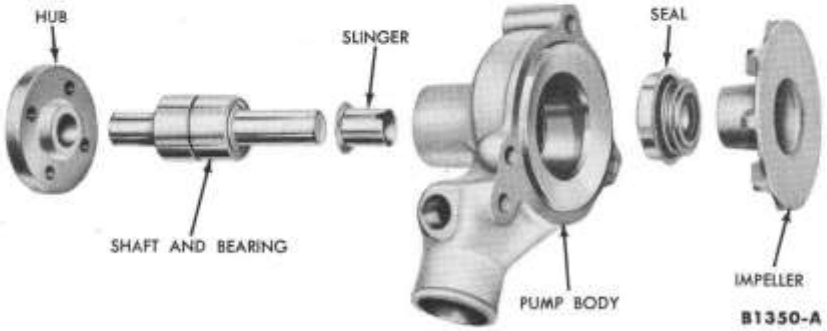

FIG. 1—Water Pump Assembly

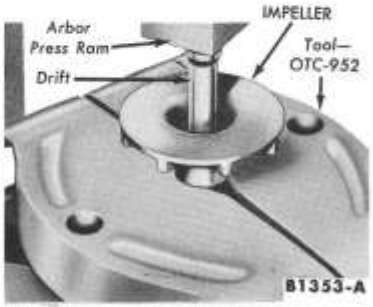

FIG. 4—Impeller Removal

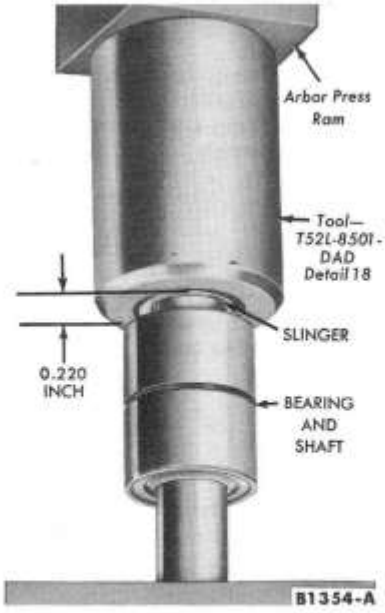

FIG 5—Slinger Installation

relative position as the slinger on the old shaft (Fig. 5).

3. Coat the bearing outer diameter with grease, and position the shaft assembly and press it into the housing (Fig. 6).

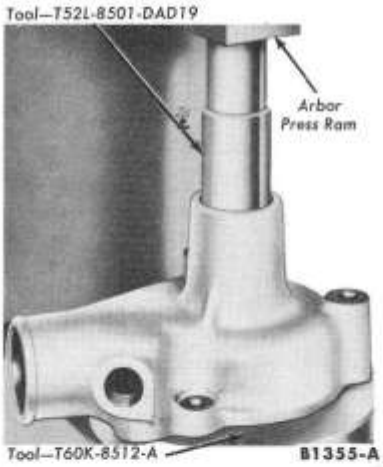

FIG. 6—Shaft Installation

FIG. 7—Seal Installation

4. Apply a light film of water resistant sealer on a new seal and press the seal into the housing (Fig. 7).

5. Replace the impeller if it is worn or damaged.

6. Lightly coat the seal rubbing face of the impeller with grease, then press the shaft into the impeller (Fig. 8). **Press the shaft into the impeller just far enough so that the pump housing lightly touches the face of the adapter ring. If excessive pressure is exerted on the shaft after the rear face of the housing contacts the adapter ring, the pump bearing will be damaged. The impeller to pump body clearance should be 0.005-0.025 inch after the impeller is installed.**

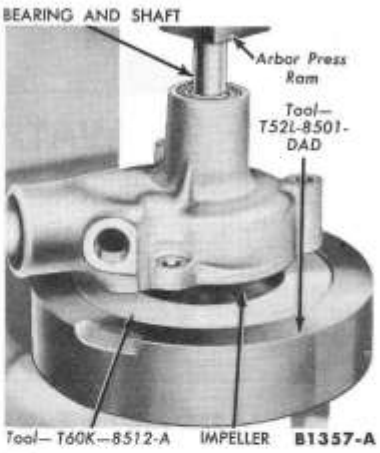

FIG. 8—Impeller Installation

7. Adjust the set screw in the bottom of the fixture plate until the screw touches the end of the shaft. Do not lift the pump body. Position the water pump hub over the shaft and press it into place, holding the specified distance from the housing mounting face to the hub front face (Fig. 9).

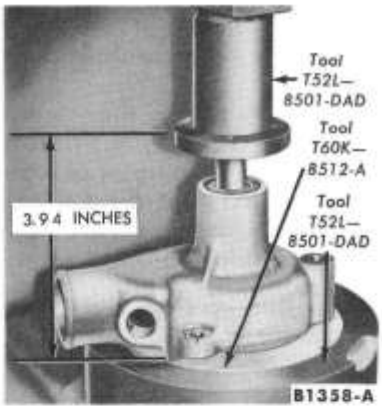

FIG. 9—Hub Installation

1961 FORD FALCON SHOP MANUAL

GROUP 5

CLUTCH AND MANUAL-SHIFT TRANSMISSION

PAGE

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PART 5-1 CLUTCH

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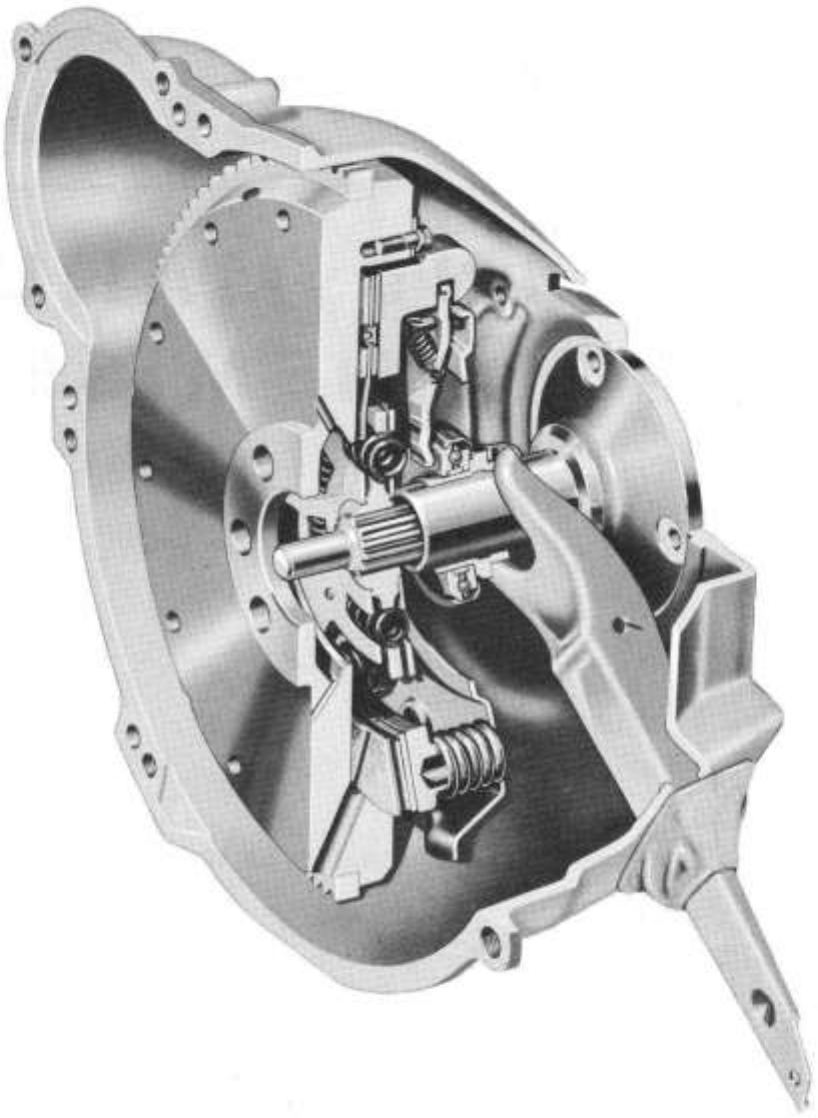
2	Clutch Pedal Adjustment	5-4
3	Clutch Linkage Repair	5-4
4	Clutch Repair	5-5
5	Flywheel Housing Alignment	5-6



C1161-B

FIG. 1—Clutch

1 TROUBLE SHOOTING

TROUBLE SYMPTOMS AND POSSIBLE CAUSES

GEAR CLASH OR POOR RELEASE	Incorrect pedal travel	Excessive disc runout
	Disc binding on transmission input shaft	Flywheel housing or transmission misaligned
	Linkage failure	Excessive engine idle speed

CONTINUED ON NEXT PAGE

TROUBLE SYMPTOMS AND POSSIBLE CAUSES (Continued)

CLUTCH NOISY WITH ENGINE STOPPED	Pressure plate lugs rubbing against cover Assist spring squeaking Retracting spring rubbing	Release bearing hub burred and dragging on transmission bearing retainer Rough release lever fulcrum
CLUTCH PEDAL "SCRAPES"	Release lever cocked Pedal push rod rubbing on firewall felt and insulator	Rough release lever fulcrum Pressure plate finger rubbing internally
CLUTCH NOISY WHEN PEDAL FREE TRAVEL IS TAKEN OUT, ENGINE RUNNING	Release bearing failure due to: Improper travel adjustment Bearing cocked on hub	Flywheel housing misalignment Excessive crankshaft end play
CLUTCH NOISY WHEN PEDAL IS THREE-QUARTERS TO FULLY DEPRESSED, ENGINE RUNNING	Pressure plate lugs rubbing against window openings in cover Flywheel housing misalignment	Release bearing cocked or failed Loose and worn pilot bearing
CLUTCH SLIPS OR CHATTERS	Incorrect pedal travel Grease or oil on clutch facings from: Release bearing Pilot bearing Transmission	Pressure plate fingers binding Pressure plate lugs binding on cover Pressure plate fingers at uneven height (See Section 4) Disc binding on input shaft splines
CLUTCH VIBRATION	Improper or defective clutch disc Release bearing cocked on hub	Pressure plate fingers binding Flywheel housing misalignment

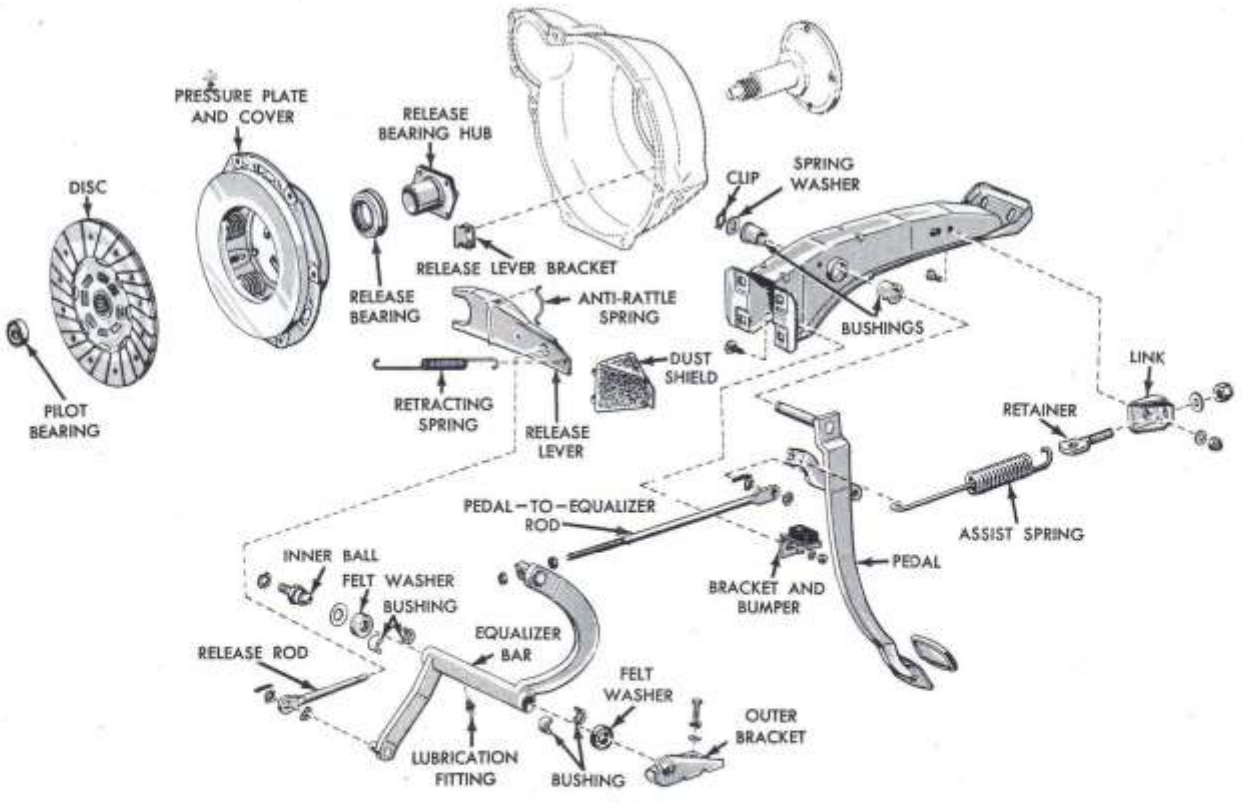


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FIG. 2 – Clutch Mounting and Linkage

2 CLUTCH PEDAL ADJUSTMENT

Adjust the clutch pedal whenever the clutch does not disengage or engage properly, or when new clutch parts are installed. Both the total travel and the free travel of the pedal should be adjusted. **Improper adjustment of the clutch pedal is one of the most frequent causes of clutch failure and can be a contributing factor in some transmission failures.**

1. To check pedal assist spring tension, measure the distance between the end of the assist spring retainer and the rear surface of the link (Fig. 2). See Group 17 for the specified distance.

2. Measure the total travel of the pedal (Fig. 3). If the travel is less than specification, move the clutch pedal bumper and the bracket until the travel is within these limits. **Always check and adjust total travel before checking free travel.**

3. To check and adjust pedal free travel, depress the pedal slowly until the release fingers contact the release bearing, and note the reading on the tape. The difference between this reading and the reading when the pedal is released is the free travel measurement. If free travel is not within specification, loosen the pedal-to-equalizer rod nuts (Fig. 2). Move the equalizer bar as required, and then tighten the nuts. **Both nuts must be tightened against the trunnion after the adjustment is made.**

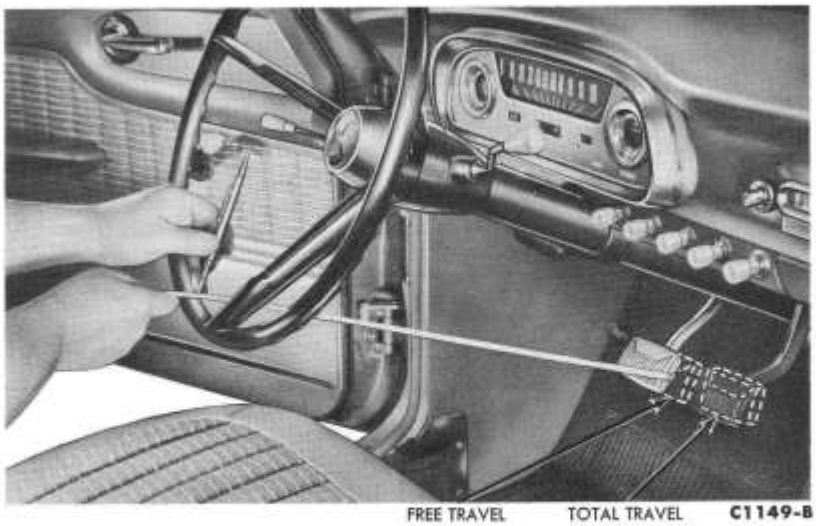

FIG. 3—Pedal Travel Measurement

3 CLUTCH LINKAGE REPAIR

CLUTCH (AND BRAKE) PEDAL AND/OR SHAFT BUSHING REPLACEMENT

REMOVAL

1. Remove the nut on the clutch pedal assist spring retainer, and then remove the assist spring (Fig. 2).

2. Disconnect the pedal-to-equalizer rod from the pedal (Fig. 2).

3. Disconnect the brake master cylinder push rod from the brake pedal.

4. Remove the retaining clip from the clutch pedal pivot shaft, and remove the clutch pedal and shaft assembly, brake pedal, brake pedal return spring, and the pedal shaft bushings.

INSTALLATION

1. After lubricating the bushings, position the bushings, brake pedal return spring, brake pedal, and clutch pedal and shaft assembly in the pedal support bracket. Install the pivot shaft retaining clip.

2. Connect the brake master cylinder push rod to the brake pedal and adjust brake free travel (Part 10-1).

3. Connect the clutch pedal-to-equalizer rod.

4. Install the clutch pedal assist spring (including the plastic anti-squeak in the shaft notch), and then adjust the assist spring tension to specification.

5. Adjust clutch pedal travel.

EQUALIZER BAR AND BRACKET AND/OR BUSHING REPLACEMENT

1. Disconnect the clutch pedal-to-equalizer rod at the pedal shaft, remove the lower adjustment nut, and then disconnect the equalizer bar from the rod (Fig. 2).

2. Remove the equalizer bar outer bracket attaching nuts, and remove the bar, bracket, bushings, and felt washers.

3. Transfer parts as applicable.

4. Position the flat washer, the felt washer, and the split bushings on the inner ball.

5. Position the felt washer and the split bushings on the equalizer bracket ball. Then position the equalizer bar on the bushings.

6. Position the bracket and the equalizer assembly in the car, with the inner end of the bar mating with the split bushing on the inner ball.

7. Attach the outer bracket, being careful to align the inner edge parallel with the edge of the underbody. Allow ⅛ inch side motion of the assembly.

8. Install the pedal-to-equalizer rod, and lubricate the equalizer bar at the grease fitting.

9. Adjust clutch pedal free travel.

4 CLUTCH REPAIR

For necessary hoisting and jacking instructions, see Part 8-4.

PRESSURE PLATE AND/OR DISC REMOVAL

1. Disconnect the cable from the starting motor, and remove the starter and rubber dust ring.
2. Raise the car, and disconnect the drive shaft. Place tool T60K-7657-A in the output shaft to prevent lubricant leakage.
3. Disconnect the speedometer cable. On a station wagon, remove the nuts from the insulator retaining bolts (Fig. 4). On a sedan, remove the bolt at the transmission support (Fig. 5). Disconnect the shift rods at the transmission shift levers.
4. Place a jack under the engine oil pan and, using a wood block between the pan and jack, raise the engine slightly.
5. Remove the transmission to flywheel housing bolts allow the front of the transmission to drop slightly, and remove the tool from the extension housing. Then slide the transmission back and allow it to rest on the cross member.
6. Disconnect the retracting spring and the release rod (Fig. 2).
7. Remove the hub and release bearing assembly.
8. Remove the flywheel housing dust cover and the flywheel housing.
9. Remove the pressure plate and disc assembly from the flywheel.

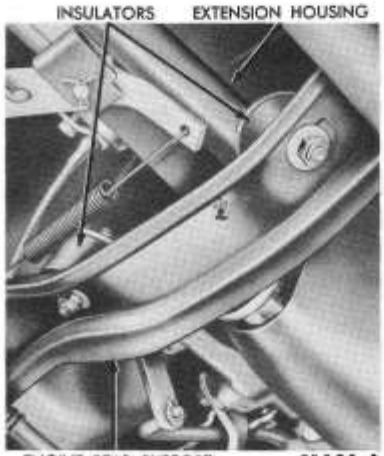

FIG. 4—Extension Housing Mounting—Station Wagon

FIG. 5—Extension Housing Mounting—Sedan

PARTS INSPECTION

RELEASE BEARING

The release bearing is pre-lubricated and should not be cleaned in solvent.

Wipe all oil and dirt from the bearing. Hold the inner race stationary and rotate the outer race. If any bind or noise is noted, replace the bearing (Fig. 6).

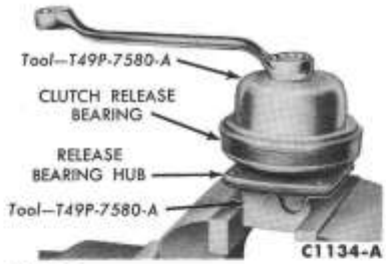

FIG. 6—Release Bearing Installation

Inspect the input shaft bearing retainer and the inside diameter of the release bearing hub for burrs or scores. Inspect the bearing hub for uneven wear. Burrs or scores may be removed with fine emery cloth.

PRESSURE PLATE

Inspect the surface of the pressure plate for excessive score marks, burned areas, or ridges. If any of these conditions is present, replace the pressure plate.

Light scratches, burned areas, or ridging may be removed with fine emery cloth, **providing the surface flatness is maintained.**

If there is evidence of heat damage to the pressure plate, replace the release bearing as well as the pressure plate and/or disc.

Being careful not to scratch the surface, place the pressure plate on the floor. Force each finger down, and then quickly release. If the finger does not have a rapid return, a binding condition is indicated and the pressure plate should be replaced.

Check the release finger height as follows.

1. Place the pressure plate and cover assembly on a flywheel. Insert a 0.250-inch shim (about 6 inches square) between the plate and flywheel. 3 pieces of quarter-inch drill rod placed directly under the release fingers may be used instead. **Do not use a clutch disc as a spacer.**
2. Install and evenly tighten the pressure plate bolts.
3. Use a depth gauge and check the height of each finger (Fig. 7). If a height difference of 0.031 inch or more between any two fingers is noted, replace the pressure plate assembly.

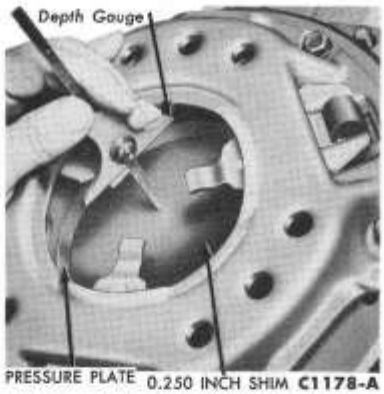

FIG. 7—Release Finger Height Check

CLUTCH DISC

Replace the clutch disc if it is greasy or oily, and check for possible sources of the grease or oil. Excessive transmission lubricant or a plugged transmission vent can force lubricant along the input shaft and on to the clutch disc. Excessive lubricant on the pilot bushing, release bearing, or bearing hub may also reach the disc during operation.

Inspect the clutch disc for worn and/or loose facings, loose rivets at the hub, broken springs, rusty or burred splines, and distortion. If any of these conditions is present, replace the disc. **Loose disc springs will not affect the efficient, quiet operation of the clutch disc.**

PILOT BUSHING

Check to be sure the bushing is tight in the crankshaft. Check for excessive wear and an out-of-round condition. If the ID exceeds 0.634 inch, replace the bushing (Part 1-1, Section 8).

PRESSURE PLATE AND/OR DISC INSTALLATION

1. Wash the flywheel surface with alcohol. **Do not use an oil-base cleaner or gasoline.**

2. Place the clutch disc and the pressure plate and cover assembly in position on the flywheel (Fig. 8). Start the retaining bolts finger-tight.

FIG. 8—Disc Alignment

3. Align the clutch disc with the pilot bushing, and then evenly torque the bolts to specification.

4. After lightly lubricating the release lever fulcrum and ends with COAZ-19584-A grease, position the release lever in the flywheel housing. Crimp the dust seal wires flush against the flywheel housing.

5. Apply a very light film of COAZ-19584-A grease to the ID of the bearing retainer journal. **Do not lubricate the bearing hub.** Position the release bearing and hub on the release lever.

6. Position the flywheel housing and release lever assembly, and install the mounting bolts. Install the dust cover, and torque the housing and cover bolts to specifications.

7. Remove any dirt, paint or burrs from the mounting faces of the flywheel and transmission housing. **Insert a guide pin in each of the two lower mounting bolt holes.** Guide the transmission over the pins and flush against the flywheel housing.

8. Install the two upper mounting bolts. Remove the guide pins and install the two lower mounting bolts. Torque the bolts to specification, and lower the engine.

9. Connect the release rod and the clutch retracting spring.

10. Install the transmission support mounting bolt or nuts, and torque the bolt or nuts to specification.

11. Install the drive shaft assembly, and connect the speedometer cable. Connect the shift rods.

12. Lower the car and install the starting motor and rubber dust ring.

13. Adjust the clutch pedal free travel.

FLYWHEEL HOUSING REPLACEMENT

To get the transmission out of the way and to install it, see Pressure Plate and/or Disc Removal or Installation.

1. After disconnecting the starter cable, remove the starter.

2. Raise the car. Disconnect the release lever retracting spring and disconnect the release rod at the equalizer bar.

3. Remove the release bearing, the housing dust cover, and the housing (including the release lever).

4. Transfer the release lever and dust shield. Crimp the dust seal wires flush against the inside of the flywheel housing.

5. Install the housing, and torque the bolts to specification.

6. Install the dust cover and the release bearing, and connect the linkage.

7. Lower the car, and install the starter.

8. Adjust clutch pedal free travel.

5 FLYWHEEL HOUSING ALIGNMENT

Alignment of the flywheel housing bore and rear face with the engine should be checked as a possible cause when any of the following occur: Excessive transmission gear wear, transmission jumping out of gear, (especially third gear), vibration of the drive line, excessive pilot bushing wear, a noisy release bearing, or gear clash.

INSPECTION

With the transmission and clutch release bearing removed, install the indicator pilot tool shown in Fig. 9. Clean the faces of the flywheel housing bolt bosses, and remove all burrs, nicks, and paint from the mounting face of the housing.

Install the adapter plate on the housing (Fig. 9). Install the dial indicator on the pilot and adjust the holder to locate the indicator button between the scribed lines. Remove the flywheel housing cover and pull the engine flywheel outward or push in inward to remove normal crankshaft end play. Set the dial indicator face to read zero.

Remove the engine spark plugs for easier turning, and pull the engine through one revolution. The crankshaft must be held all the way out or all the way in. Note the indicator readings at each of the 4 bolts attaching the adapter plate. Take 2 readings at each bolt. Total indicator reading must not exceed 0.007 inch.

Remove the adapter plate and position the dial indicator to check the bore alignment (Fig. 9). The bore must be clean and free of burrs, nicks and paint.

Pull the engine through one revolution and note the indicator reading at four equally spaced points. Take 2 readings at each point. Total indicator reading must not exceed 0.003 inch.

CORRECTION

ENGINE IN CAR

Since any change in face alignment will change bore alignment, it may be possible to correct bore alignment by changing face alignment. Face alignment can be changed by shimming between the flywheel housing and engine. Figure 10 shows the type of shim which can be made locally.

Not more than 0.010 inch in shims may be used between the flywheel housing and engine.

The shim required is one half the maximum minus (—) indicator reading, and should be located at the point of maximum minus (—) indicator reading.

If both the bore and face alignment

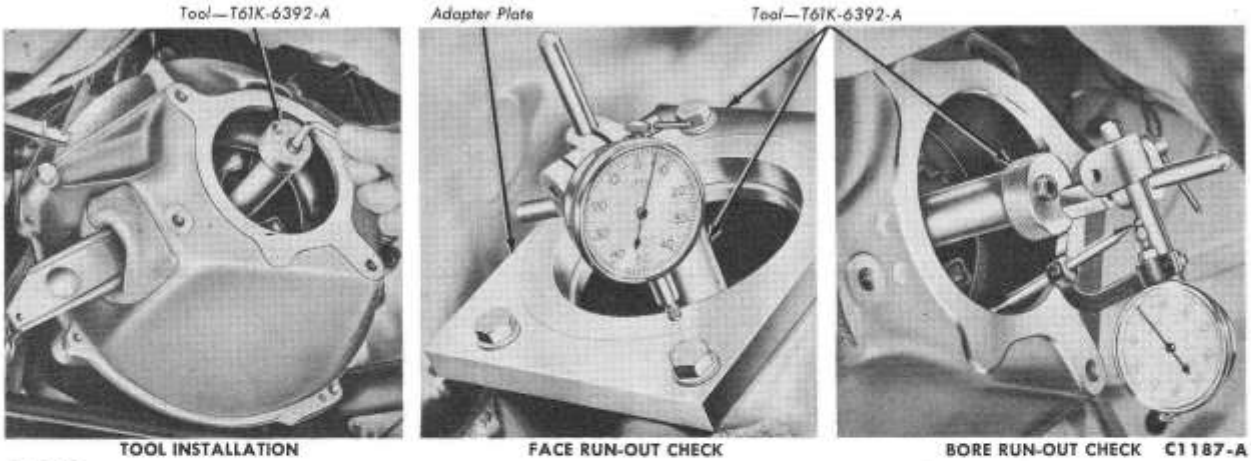

FIG. 9—Bore and Face Alignment Checks

are out of limits, shim between the flywheel housing and engine to bring face alingment within limits. Check the bore alignment.

If bore alignment is out of limits and face alignment is within limits, shim the flywheel housing to the limit of face misalignment and check the bore alignment. If it is not within limits, replace the housing.

If bore alignment is within limits and face alignment is out of limits, shims should be placed between the flywheel housing and the transmission.

ENGINE OUT OF CAR

The same procedure to correct alignment may be used with the engine out of the car or in the car, up to the point or replacing the flywheel housing. If the bore alignment cannot be brought within limits by shimming, follow this procedure.

Remove the flywheel housing from the engine and remove the dowel pins. Install the flywheel housing and tighten the attaching bolts to normal torque.

Install the adapter plate and dial indicator (Fig. 9). Check the face alignment, and shim as required to bring face alignment within limits.

Position the indicator to check bore alignment (Fig. 9). If bore alignment is not within limits, reduce the tension on the flywheel housing attaching bolts so that the housing can be moved by striking it with a lead hammer or a block of wood and a steel hammer.

The lateral alignment should be brought within limits so that an indicator reading is within limits between the 9 o'clock and 3 o'clock positions on the bore circle. When the lateral alignment is within limits, the housing usually can be moved straight up or down without disturbing the lateral alignment. When the bore alignment is within limits, torque the flywheel housing bolts and recheck bore alignment.

If the flywheel housing cannot be moved enough to bring the alignment within limits, mark the holes restricting movement, and then remove the housing and drill the marked bolt holes 1/32 inch larger.

When the flywheel housing bore alignment is within limits and the attaching bolts are at normal torque, ream the dowel pin holes 1/32 inch larger. Use a straight reamer and ream from the flywheel housing side. Oversize dowel pins can be made from drill rod stock.

Remove the flywheel housing and then install the oversize dowel pins in the engine block. Complete the assembly in the usual way.

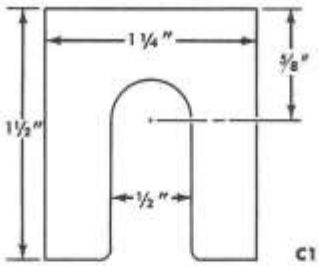

FIG. 10—Flywheel Housing Shim

PART 5-2 3-SPEED CONVENTIONAL DRIVE TRANSMISSION

Section		Page
1	Trouble Shooting	5-8
2	Transmission Removal and Installation	5-8
3	Transmission Overhaul	5-9
4	Gear Shift Linkage	5-12

1 TROUBLE SHOOTING

TROUBLE SYMPTOMS AND POSSIBLE CAUSES

TRANSMISSION NOISY	Misalignment due to loose mounting bolts Flywheel housing misalignment Dirt or metal chips in the lubricant	Insufficient lubricant in the transmission Worn or damaged parts
TRANSMISSION SHIFTS HARD	Linkage out of adjustment Binding caused by bent or worn parts Faulty cross-over adjustment Improper lubricant in the transmission	Worn or damaged gear(s) Worn synchronizer Worn shift column or shift levers
TRANSMISSION WILL NOT ENGAGE	Cross-over mechanism worn or out of adjustment	
TRANSMISSION LOCKS UP	Worn or defective shift mechanism	
TRANSMISSION JUMPS OUT OF GEAR	Partial gear engagement when shifting Worn, bent, or improperly adjusted shift linkage Improper flywheel housing alignment Loose mounting bolts	Excessive end play caused by wear in the shift forks, sliding gear fork grooves, thrust washers, output shaft or countershaft bearings, or clutch pilot bushing Binding or excessive clearance between the sliding gear and the output shaft
TRANSMISSION LEAKS	Overfilled transmission Improper lubricant Worn or damaged seals	Worn or damaged bearing retainers and gaskets Plugged transmission vent No sealer on bolt threads

2 TRANSMISSION REMOVAL AND INSTALLATION

For hoisting and jacking information, see Part 8-4.

TRANSMISSION REMOVAL

1. Raise the car on a hoist.

2. Disconnect the drive shaft from the rear U-joint flange and remove the drive shaft. Insert the tool shown in Fig. 13 into the opening of the extension housing to prevent the lubricant from leaking out.

3. Disconnect the speedometer cable from the extension housing, and disconnect the gear shift rods from the transmission shift levers.

4. On a car, remove the bolt securing the extension housing to the rear support. On a station wagon, remove the nuts from the insulator retaining bolts and remove the brake cable from the support.

5. Place a transmission jack under the flywheel housing and raise the rear of the engine slightly.

6. On a station wagon, loosen the two engine rear support bolts on the right side, and remove the bolts from the left side.

7. Remove the four transmission mounting bolts, and **thread guide pins into the two lower bolt holes.**

8. Remove the tool from the extension housing and move the transmission back just far enough to clear the input shaft and guide pins. Remove the transmission.

TRANSMISSION INSTALLATION

1. Start the extension housing up and over the rear support. After moving the transmission back just far enough to clear the flywheel housing, move it upward and into position.

2. Start the transmission over the guide pins and then move the transmission forward against the flywheel housing.

3. Remove the guide pins and install the transmission retaining bolts. Torque the bolts to specification. On a station wagon, install the rear support before lowering the engine and removing the transmission jack.

4. Secure the extension housing to the rear support and install the brake cable.

5. Connect the gear shift rods and the speedometer cable.

6. Install the drive shaft, and torque the rear U-bolt nuts to specification.

7. Fill the transmission to the level of the filler opening with the lubricant specified in Part 16-2.

3 TRANSMISSION OVERHAUL

TRANSMISSION DISASSEMBLY

1. Mount the transmission in a holding fixture and drain the lubricant.

2. Remove the transmission cover and gasket.

3. Remove the extension housing retaining bolts and remove the extension housing and gasket. To prevent the output shaft from following the housing (with the resultant loss of needle bearings), tap the end of the output shaft with a soft hammer while withdrawing the extension housing.

4. Remove the speedometer drive gear snap ring, the gear, and drive ball from the output shaft.

5. Remove the idler and countershaft retainer (Fig. 1). If necessary, tap the front ends of both shafts to free the retainer.

6. Using the tool shown in Fig. 2, drive the countershaft rearward out of the cluster gear and transmission case. Then carefully lower the cluster gear assembly to the bottom of the case.

7. After removing the input shaft bearing retainer and gasket, remove the input shaft assembly and front synchronizer blocking ring from the transmission case (Fig. 3).

8. Remove the synchronizer retaining snap ring from the output shaft. Then, while holding the synchronizer assembly together, pull the output shaft out of the transmission case. Lift the synchronizer assembly, intermediate, low and reverse sliding gears out of the case and remove the two shift forks. **For reference in assembly, notice which synchronizer hub end faces forward.**

9. Using a soft drift, drive the reverse idler shaft out of the transmission case. Lift the reverse idler gear, shaft, and cluster gear out of the case.

10. Remove the shift levers.

11. From the underside of the case, use a punch to drive out the tapered pins that hold the cam and shaft assemblies in the case (Fig. 4). **Use hard, firm blows.** Using a plastic hammer, drive the intermediate and high cam and shaft

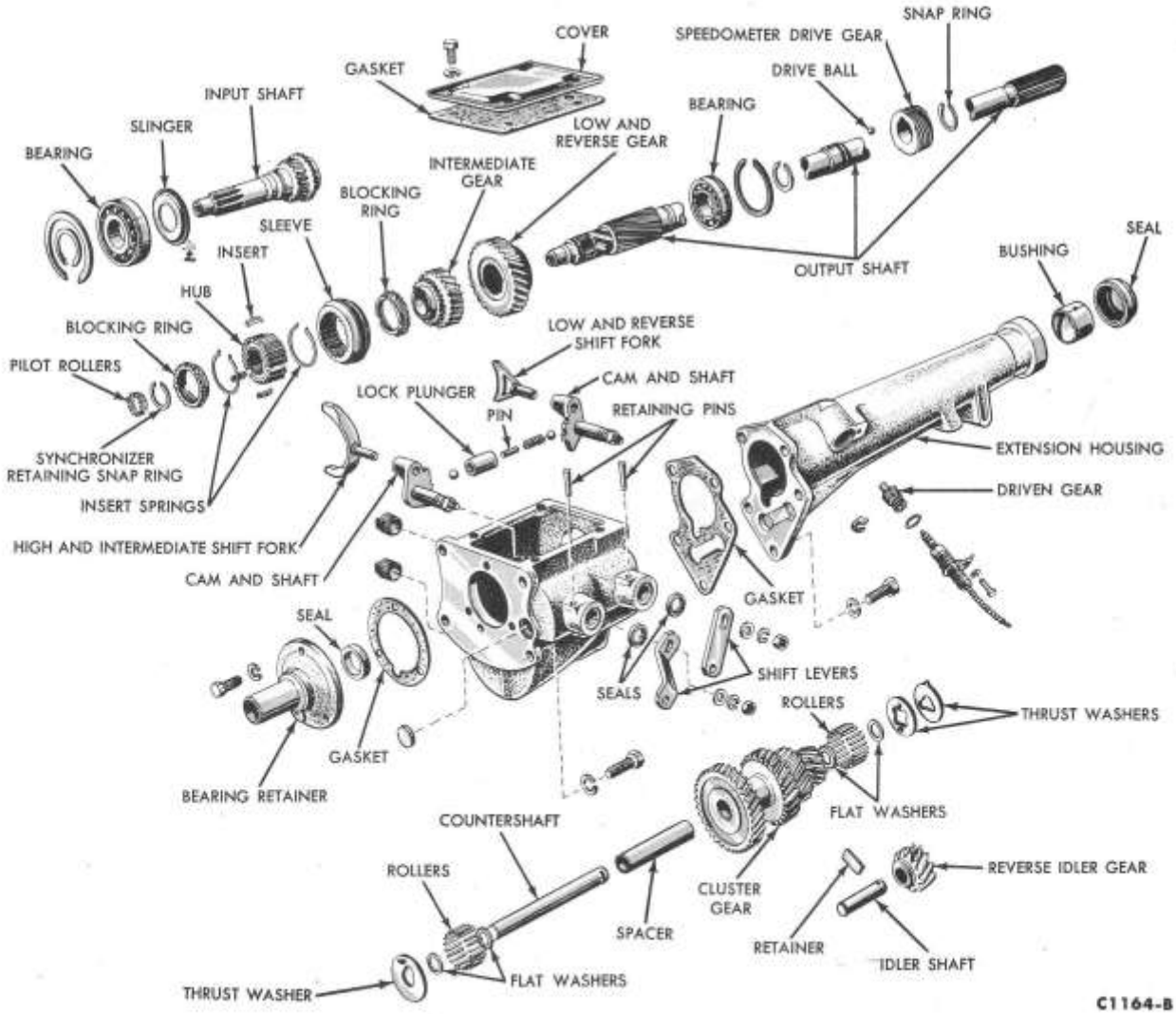

FIG. 1—Conventional Drive Transmission Details

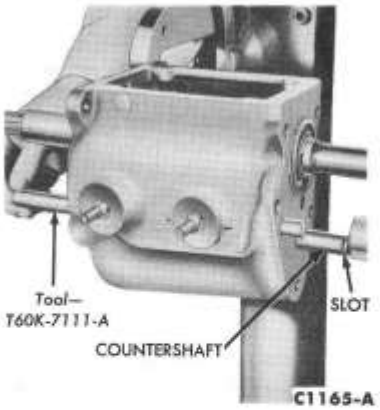

FIG. 2—Countershaft Replacement

toward the outside of the case and separate the balls and spring from the plunger. Push out the cam and shaft assemblies, and remove the plunger.

12. If required, the shift lever oil seals may be removed with the tools shown in Fig. 5.

13. Remove the snap ring securing the input shaft bearing, and press the input shaft out of the bearing and oil slinger.

14. Remove the snap ring securing the output shaft bearing. Remove the bearing as shown in Fig. 6.

15. Remove the synchronizer blocking rings, inserts, and retainers from the synchronizer hub.

16. Remove the flat washers, dummy shaft, spacer and needle bearings from the cluster gear.

TRANSMISSION CLEANING AND INSPECTION

CLEANING

1. Wash all parts, except the ball bearings, in a suitable cleaning solvent. Brush or scrape all foreign matter from the parts. Be careful not to damage any parts with the scraper. Dry all parts with compressed air.

2. Rotate the ball bearings in a cleaning solvent until all lubricant is removed. Hold the bearing assembly to prevent it from rotating, and dry it with compressed air.

3. Lubricate the bearings with transmission lubricant and cover with a clean, lint-free cloth until ready for use.

INSPECTION

Replace a case with worn or damaged bearing bores or damaged threads. If a crack does not enter a bearing bore or mating surface, the crack may be repaired; otherwise, replace the case.

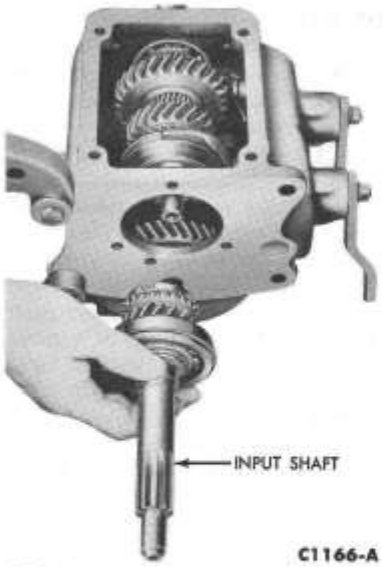

FIG. 3—Input Shaft Removal

Remove any burrs from the front and rear mounting surfaces which could cause transmission misalignment.

Inspect all gears for excessive wear or tooth damage. If either condition is present, replace the defective parts.

If the bushing in the reverse idler gear is worn, a new gear and bushing assembly must be installed.

Inspect all shafts for excessive wear, spline, or tooth damage. If one of these conditions is present, replace the shaft.

Inspect the bearing assemblies for cracked races, and the balls and rollers for looseness, wear, end play or other damage. Replace the bearings if these conditions exist.

If the transmission jumps out of low gear, check the fit of the low and reverse sliding gear on the splines of the output shaft. Replace the gear or output shaft if there is excessive wear.

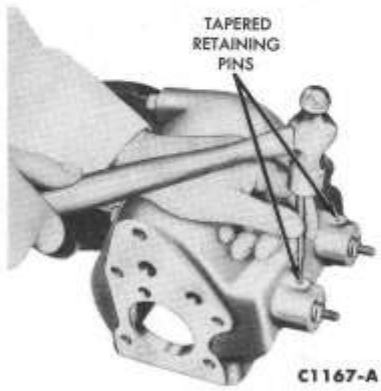

FIG. 4—Cam and Shaft Retaining Pin Removal

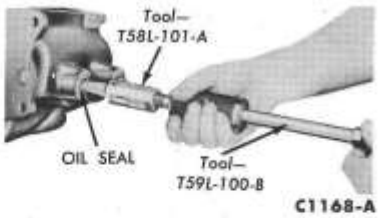

FIG. 5—Cam and Shaft Oil Seal Removal

Check the end play between the cluster gear and the thrust washers of the transmission case. If the end play exceeds specification, replace the thrust washers.

Inspect the bushing and seal in the extension housing. If required, they may be removed and installed as shown in steps 21, 22, 23, and 24 of "Transmission Assembly".

TRANSMISSION ASSEMBLY

1. Press the input shaft bearing and oil slinger onto the input shaft, using the tool shown in Fig. 7, and install the snap ring on the shaft.

2. Press the output shaft bearing onto the output shaft as shown in Fig. 6 and install the snap ring on the shaft.

3. Insert the spacer and dummy shaft (Fig. 2) into the cluster gear assembly. Position one flat washer at each end of the spacer. Apply grease to the needle bearings and assemble the needle bearings around the dummy shaft at each end of the gear. Apply a coating of grease to the other two flat washers and the thrust washers and assemble at each end of the cluster gear. **Note the position of the tangs on the thrust washers (Fig. 1).**

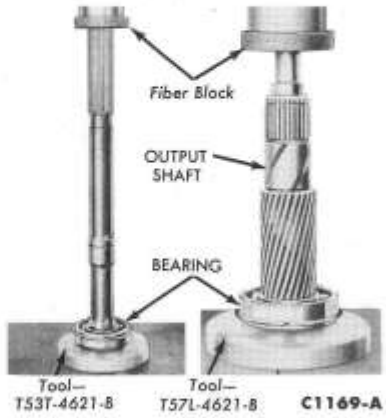

FIG. 6—Output Shaft Bearing Replacement

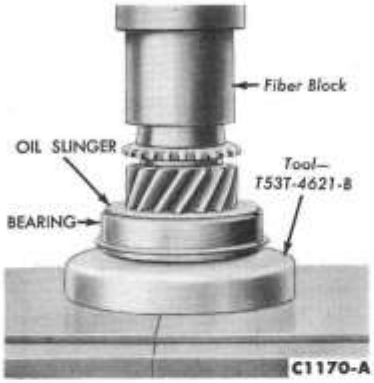

FIG. 7—Input Shaft Bearing Installation

Position the gear assembly in the bottom of the transmission case with the larger gear toward the front of the case.

4. Install the reverse and low shift cam and shaft through the case opening. Assemble the spacer and spring in the plunger. Apply grease to each ball and position in each end of the plunger. Hold the plunger assembly in position and install the intermediate and high cam and shaft in the case opening, allowing the balls to register in the cam detents.

5. Align the cam and shaft grooves with the openings in the shaft bosses, and install the retaining pins. Check the cam action. Bent pins may restrict movement.

6. Position the reverse idler gear, and insert the shaft (from the rear) through the case just far enough to hold the gear.

7. After assembling the three inserts in the synchronizer hub and securing them with two spring retainers, insert the hub assembly into the intermediate and high sleeve. Install one of the blocking rings in the rear side of the hub. Coat the blocking rings with grease.

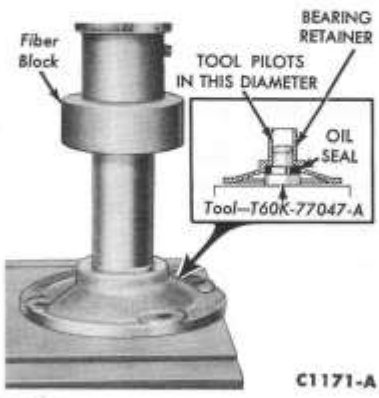

FIG. 8—Input Shaft Oil Seal Installation

8. Using a coating of grease, assemble the needle bearings in the input shaft and install the front synchronizer blocking ring on the input shaft.

9. Install the shift forks in the shift lever shaft assemblies, with the

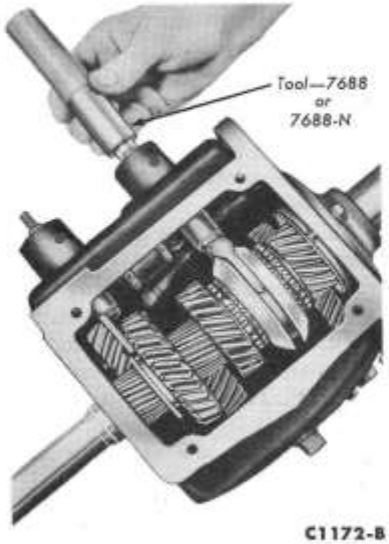

FIG. 9—Cam and Shaft Oil Seal Installation

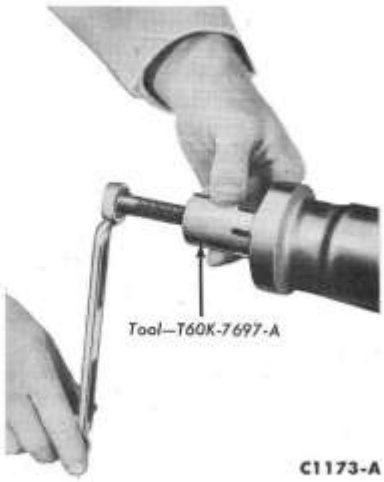

FIG. 10—Bushing Removal

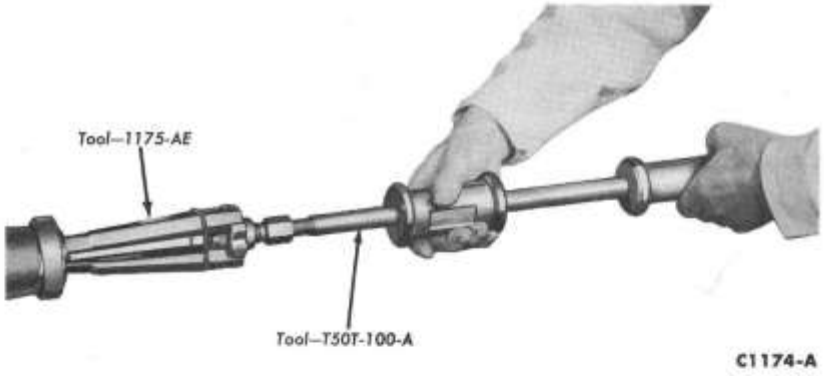

FIG. 11—Seal Removal

FIG. 12—Bushing Installation

FIG. 13—Seal Installation

large fork in the intermediate and high shaft assembly. The web of the low and reverse fork must be to the rear of the shaft center.

10. Start the output shaft through the rear opening of the transmission case. Place the low and reverse gear on the shaft, followed by the intermediate gear. Tilt the output shaft enough to allow the rear shift fork to engage the sliding gear groove.

11. With the longer hub forward, slide the synchronizer assembly onto the output shaft and engage the synchronizer sleeve in the intermediate and high shift fork.

12. Install the synchronizer hub and the snap ring.

13. Position the input shaft and front synchronizer blocking ring.

14. Place a new gasket on the input shaft bearing retainer. If the input shaft oil seal was removed from the retainer, install a new oil seal as shown in Fig. 8. Install the input shaft bearing retainer, using sealer on the bolts. Line up the drain groove in the retainer with the oil hole in the case.

15. Raise the cluster gear assembly and align the dummy shaft with the countershaft opening. Start the countershaft into the case from the rear, and carefully drive the shaft into position.

16. Install the idler gear shaft and install the retainer.

17. Secure the speedometer drive gear and ball with the snap ring.

18. Using a new gasket, install the extension housing, using sealer on the bolts. Torque the bolts to specification.

19. Start a new seal over each cam and shaft. Use the tool shown in Fig. 9 to drive in the seals.

20. Install the shift levers.

21. If the extension housing bushing is to be replaced, use the tool shown in Fig. 10.

22. If the extension housing seal is to be replaced, use the tool shown in Fig. 11 to remove the seal.

23. Install the extension housing bushing (Fig. 12).

24. Install the extension housing seal using the tool shown in Fig. 13.

25. Check transmission operation through all shift positions.

26. Fill the transmission to the proper level and install the transmission case cover and gasket. Use sealer on the bolts. **The gasket vent holes must be toward the rear, and the cover vent hole must be toward the front.**

4 GEAR SHIFT LINKAGE

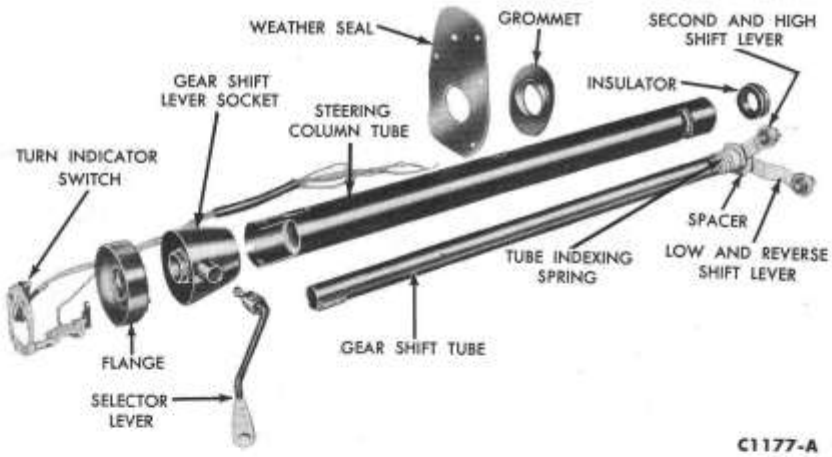

FIG. 14—Steering and Shift Tubes

GEAR SHIFT LINKAGE ADJUSTMENT

If the transmission shifts hard, or if it will not engage, the gear shift levers may need adjustment at the cross-over. Move the selector lever through all shift positions to see that cross-over operation is smooth. If cross-over operation is not smooth, adjust the gear shift lever(s).

1. With the selector lever in neutral, loosen the locknut on each sleeve, and then slide the sleeves up or down on the rods until smooth cross-over operation results when the sleeves are attached to the levers.

2. Tighten both locknuts securely, and check again for smooth operation.

GEAR SHIFT TUBE REPLACEMENT

1. Remove the steering wheel (Part 9-1).

2. Remove the turn indicator lever and the gear shift selector lever, leaving the shift column in neutral.

3. Remove the turn indicator switch plate from the switch.

4. Loosen the flange retaining nuts until pressure on the nuts (toward the column center) will disengage the bolt heads. Remove the flange (Fig. 14).

5. Carefully slide the plastic insulator down the turn indicator wires, leaving the switch and wires connected.

6. Remove the gear shift lever socket from the steering column tube.

7. Remove the shift tube.

8. After applying Lubriplate to the lower area of the shift tube, position the shift tube in the steering column tube. The shift tube is seated when spring pressure can be felt.

9. Install the gear shift lever socket, being careful not to damage the wiring insulation as the socket is positioned.

10. After guiding the turn indicator switch through the flange, install the flange.

11. Install the switch plate, turn indicator lever, and selector lever.

12. Install the steering wheel.

1961 FORD FALCON SHOP MANUAL

GROUP 6

FORDOMATIC TRANSMISSION

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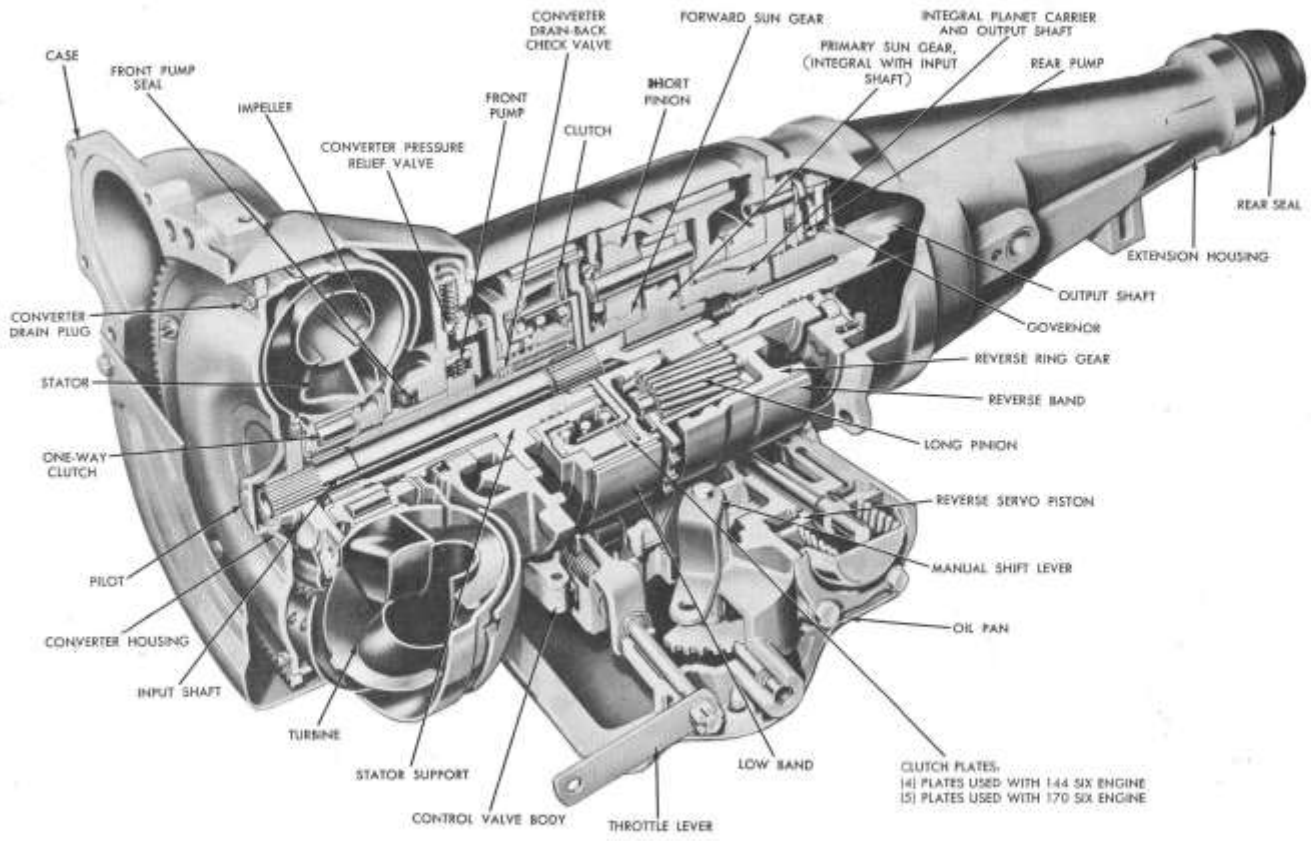

FIG. 1—Fordomatic Transmission

PART 6-1 DESCRIPTION AND OPERATION

Section		Page
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2	Torque Converter	6-3
3	Planetary Gear System	6-4
4	Hydraulic Control System	6-5

The Fordomatic transmission (Fig. 1) combines a hydraulic torque converter and a planetary gear system. Two transmissions are used in the 1961 Falcon. Both transmissions are similar in design and construction, but differ in those components which must be matched with the torque and horsepower specifications of either the 144 Six or the 170 Six engines. The torque converter used for both transmissions is the same and is air cooled.

The transmission used with the 144 Six engine has an external by-pass tube that provides for the recirculation of the transmission fluid, and eliminates the tubing to the cooler.

The transmission used with the 170 Six engine has the following different components: A new case, a new main control assembly, a heavier front servo piston spring, a clutch piston slightly reduced in thickness, and an additional clutch plate. Detailed differences between transmissions are pointed out in each part of this manual where applicable.

Shift points for both transmissions are provided in Table 1. At the P position, the transmission output shaft is locked to the case by a pawl to prevent rotation of the rear wheels.

To prevent overspeeding the engine, the transmission should not be shifted into L at speeds higher than the maximum 1-2 automatic shift point for the particular rear axle ratio (Table 1). Shifts into reverse must be made only after the car has come to a complete stop.

TABLE 1—Fordomatic Shift Points (Approximate)

Engine Model	Transmission Model Prefix	Rear Axle Ratio	Automatic Shift Speeds (mph)			
			Selector Lever at D			
			1-2 Minimum Throttle	1-2 Thru Detent	2-1 Thru Detent	2-1 Closed Throttle
144 Six	PBZ-H	3.10 to 1	12-18	48-55	46-54	8-14
		3.50 to 1	11-16	43-49	41-48	7-12
	PBZ-J	3.89 to 1	10-14	40-44	38-43	7-11
170 Six	PCF-A	3.10 to 1	13-18	47-55	46-54	6-15
		3.50 to 1	12-16	42-49	41-47	6-13
	PCF-B	3.89 to 1	11-15	38-44	37-43	5-12

1 IDENTIFICATION

The tag shown in Figure 2 is attached to a rear servo cover bolt. The service identification number shows changes in service details which affect interchangeability **when the transmission model is not changed.** For interpretation of this number see the Master Parts Catalogue.

2 TORQUE CONVERTER

Under all driving conditions, the torque converter transmits the total drive between the engine and the planetary gear set, or between the planetary gear set and the engine. When the engine is driving the rear wheels, the total engine power flows from the converter impeller to the turbine, and thence through the planetary gear set to the drive shaft. When the rear wheels are driving the engine, the total rear wheel drive power flows from the drive shaft through the planetary gear set to the converter turbine. The converter tur-

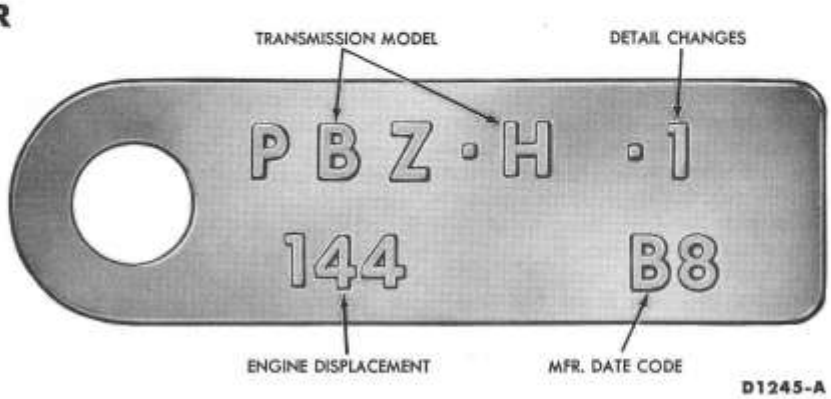


FIG. 2—Fordomatic Identification

bine transmits this drive to the converter impeller, which is locked to the engine by the flywheel (Fig. 3).

The torque converter is a combination hydraulic torque multiplier and fluid coupling. The torque converter parts, impeller turbine and stator, operate in a fluid-filled housing.

The torque converter, used with both transmissions, is air-cooled. Figure 4 shows the air flow around the converter housing. In addition, the fluid in the converter and transmission used with the 170 Six engine, is water-cooled.

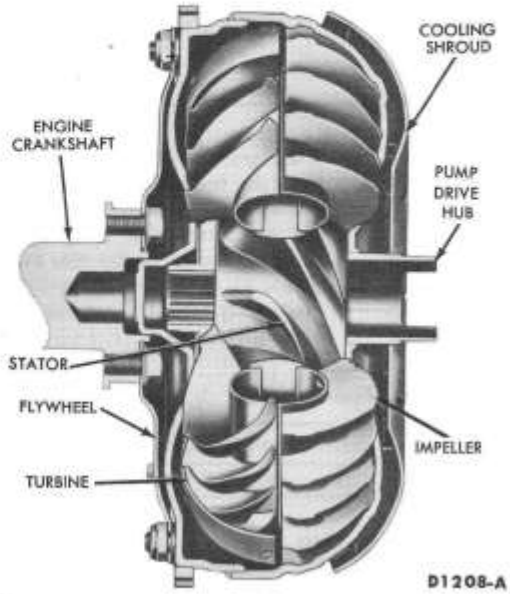


FIG. 3—Cross-Section of Torque Converter

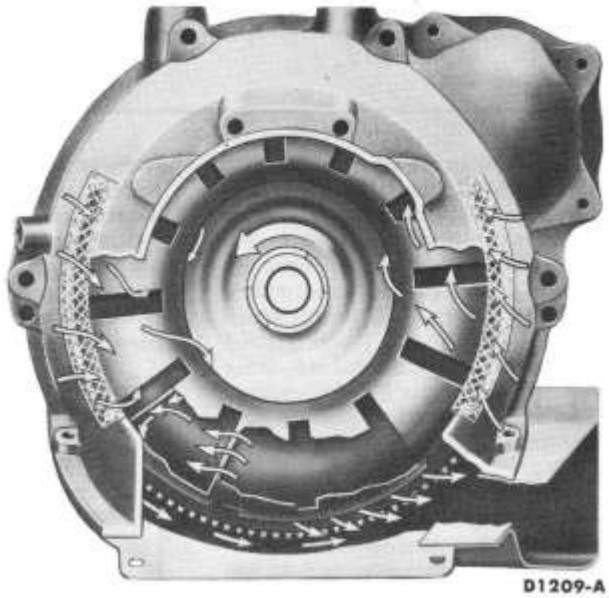


FIG. 4—Converter Cooling Air Flow

3 PLANETARY GEAR SYSTEM

Figure 5 shows a build-up of the planetary gear set. In View 1, note that the engine power always flows from the converter turbine to the primary sun gear. Unlike Cruise-O-Matic, there is no clutch between the turbine and the primary sun gear. Hence, the primary sun gear always drives, whether the car is driven forward or in reverse.

In View 2, Fig. 5, the integral planet carrier and output shaft has been assembled to the primary sun gear. The long pinions are in constant mesh with the primary sun gear. The long pinions are also in constant mesh with the short pinions. The long pinions will always rotate counterclockwise, and the short pinions will always rotate clockwise.

With only this much of the gear set assembled, no drive from input to output shaft is possible.

In View 3, Fig. 5, the integral forward sun gear and flange has been added to the gear set. This gear is in constant mesh with the short pinion, and is free-running as far as the integral primary sun gear and shaft is concerned. Attached to the forward sun gear flange is a brake drum. Surrounding the drum is a (brake) band.

If the band is applied so that the drum and forward sun gear are held stationary, the primary sun gear (input) shaft can now drive the output shaft. Engine power drives the primary sun gear clockwise. The primary sun gear drives the long pinion counterclockwise. The long pinion, in turn, drives the short pinion clockwise. The short pinion must now turn on its own center, and at the same time walk around the stationary forward sun gear. As the short pinion and pinion carrier walk around the forward sun gear, the integral planet carrier and output shaft is driven in an input to output ratio of 1.75:1. The planetary gear set is now operating in first (low) gear.

The low band is applied by transmission control pressure working against the low servo piston (Fig. 6).

In View 4, Fig. 5, a clutch has been added to the planetary gear set. The clutch has 4 or 5 plates, depending upon whether the transmission is used with the 144 Six or 170 Six engines, respectively.

The clutch pack is made up of drive and driven plates stacked alternately. The drive plates have internal spline teeth and are splined to the clutch hub. The clutch hub, in turn, is splined to the primary sun gear shaft. The driven plates (steel) have external teeth and are splined to the clutch drum. The clutch drum is splined to the integral forward sun gear and flange.

A piston in the clutch drum is moved by transmission control pressure to lock the clutch plates together. When the clutch plates are locked together, the primary and forward sun gears are locked together. With the two sun gears locked together, all gear action will stop, and the planetary gear set can now revolve only as a unit. With the clutch applied, the transmission is in second (high) gear.

The clutch releases when control pressure behind the piston is exhausted, and the large coil spring forces the piston away from the clutch plate pack.

In view number 5, Fig. 5, a ring

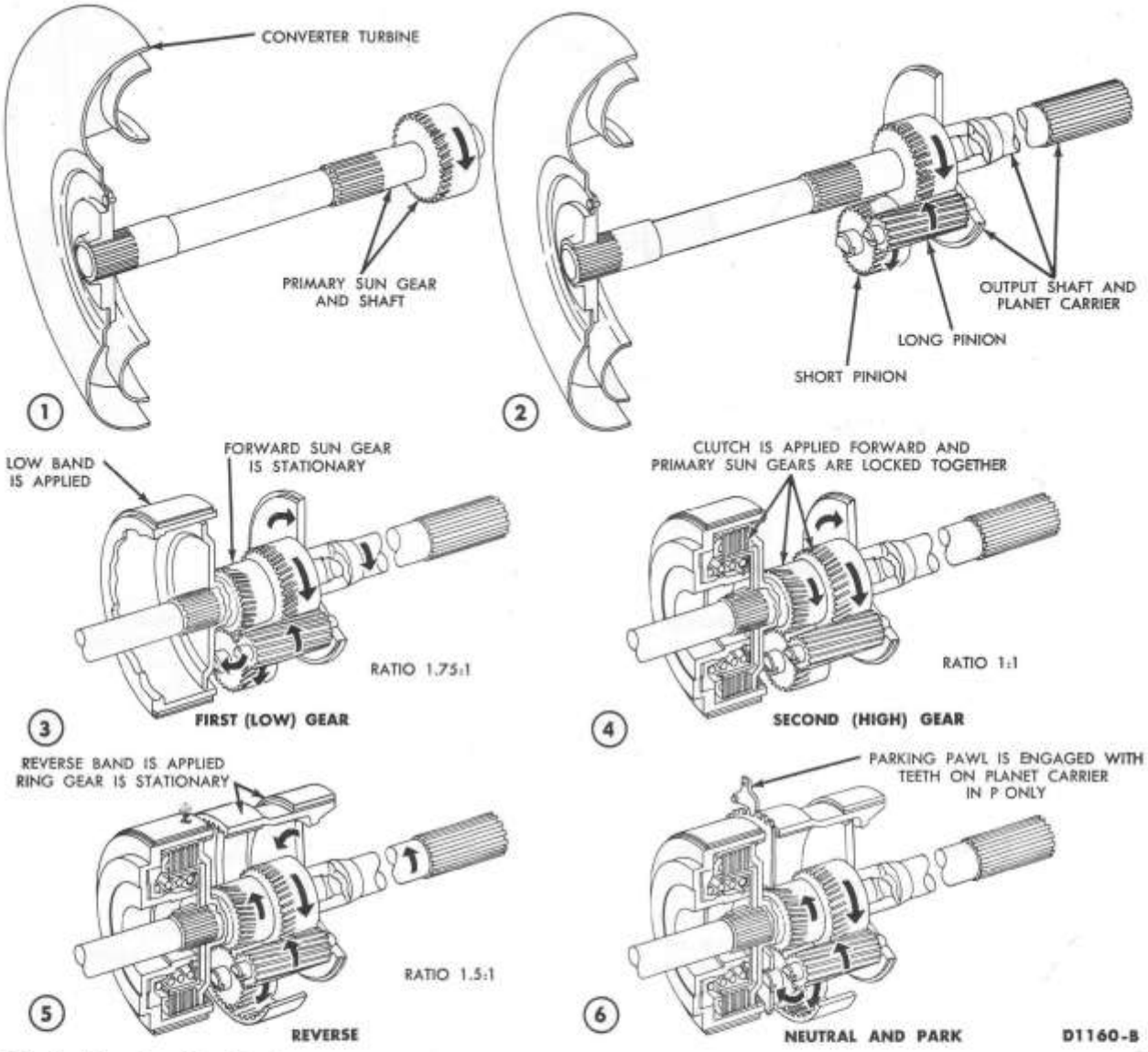


FIG. 5—Planetary Gear System

gear and band have been added. The ring gear is in constant mesh with the short pinions.

With the low band and high clutch released and the reverse band applied, the transmission output shaft will be driven in a reverse (opposite engine) direction.

The reverse band is applied by transmission control pressure working against the reverse servo piston (Fig. 6).

In view number 6, Fig. 5, a parking pawl has been added. The pawl is anchored to the transmission case. When the pawl engages the teeth on the planet carrier, the output shaft is locked to the transmission case. This prevents the rear wheels from turning.

With the engine running and the car standing still, gear action inside the transmission is identical in the N and P positions.

4 HYDRAULIC CONTROL SYSTEM

FLUID PRESSURE SOURCE

Two slipper-type pumps deliver fluid pressure to the transmission control system. The front pump, driven by the converter impeller, operates whenever the engine runs (Fig. 7). The rear pump, driven by the transmission output shaft, delivers fluid to the control system, when the vehicle moves forward.

The front pump has a greater capacity than the rear pump, since it must supply all the fluid to operate the transmission at low speeds and in reverse.

Both pumps deliver fluid pressure to the control valve body. A regulated

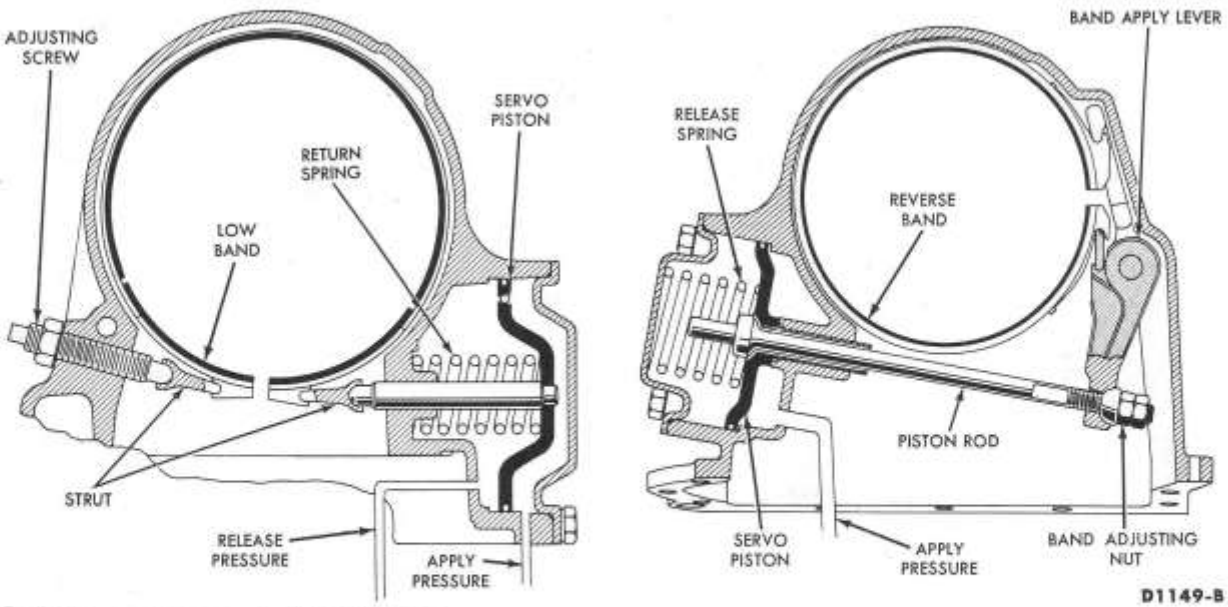


FIG. 6—Low and Reverse Bands and Servos

pressure, called control pressure, is available at the control valve body whenever the engine is running or the vehicle is moving forward above approximately 20 mph.

Check valves are installed on the pressure side of both front and rear pumps.

THROTTLE PRESSURE

To adjust transmission operation to engine torque and driver preference, throttle pressure is used in the control system.

Throttle pressure is produced from control pressure by the throttle valve and is controlled by the compression on the throttle valve spring (Fig. 7). Compression on the throttle valve spring is controlled by accelerator pedal linkage pressure on the downshift valve.

Throttle pressure will vary from zero (at closed throttle) to the same pressure as maximum control pressure (at wide-open throttle).

Throttle pressure is directed to the 1-2 shift valve and 1-2 governor plug to oppose governor pressure, and thereby vary the 1-2 shift according to accelerator pedal depression.

Throttle pressure is also directed to the orifice control valve to position it for two 2-1 downshift conditions, a downshift with closed throttle, a downshift with partial to full throttle.

GOVERNOR PRESSURE

Governor pressure is produced from rear pump pressure by the governor valve. The governor valve operates in the governor body which rotates at output shaft speed. The centrifugal force acting on the governor valve will vary, therefore, with road speed.

Pressure from the rear pump flows through an orifice into the governor body and tries to move the valve inward against centrifugal force. If this rear pump pressure force is greater than the centrifugal force acting on the governor valve, the valve will be forced inward. As the valve moves inward, it opens an exhaust port and reduces rear pump pressure back to the orifice (Fig. 7).

When the pressure force on the governor valve balances the centrifugal force acting on the governor valve, the governor valve moves out and closes the exhaust.

The pressure in the line past the orifice is regulated by the governor valve, and is governor pressure.

Rear pump pressure may, at times, be less than control pressure, but it will never be greater than control pressure.

CONTROL PRESSURE AND COMPENSATOR PRESSURE

The basic regulation of control pressure is accomplished by the control pressure regulator valve. The valve itself is balanced between spring force on one end, and control pressure force at the other end. Should control pressure force be greater than spring force, the valve will move against the spring and exhaust control pressure, until control pressure force balances spring force.

Control pressure is also adjusted to engine torque, road speed and selector lever position.

To accomplish this, compensator pressure under various conditions is adjusted by throttle pressure (engine torque), governor pressure (road speed), or selector lever position. Compensator pressure, in turn, adjusts control pressure.

Control pressure is assisted, in all driving conditions, by compensator pressure in opposition to the control pressure regulator valve spring (Fig. 7).

An emergency relief valve is built inside the control pressure regulator valve. Should the regulator valve stick, the emergency relief valve will open at approximately 275 psi.

CONVERTER PRESSURE

The front pump (and the rear pump at higher speeds) have a supply capacity far greater than any normal demand in the control pressure system. When control pressure exceeds the required balancing pressure at the control pressure regulator valve, the valve is moved against its spring and opens a port, so that the fluid over and

above control pressure requirements can go to the converter. This flow to the converter is under pressure because in almost every case the supply is ample and there is resistance. The converter check valve will not open and permit flow back to sump until converter-out pressure reaches 5 psi. After the fluid gets by the check valve, it returns to sump through a by-pass tube on the outside of the case on transmissions used with the 144 Six engine. On transmissions used with the 170 Six engine the fluid passes through the cooler before it returns to the sump. The purpose of the check valve is to prevent the converter upper half from draining back to sump when the engine is stopped. To keep converter pressure from going too high, a relief valve is installed in the converter-in line (actually in the front pump housing). This valve will open when converter-in pressure reaches 70 psi. Fed from the converter-in line are front and rear lubrication systems. To prevent these systems from taking too much fluid from converter-in flow, the lubrication flows are orificed. The front lubrication system has a spring-loaded valve (converter drain-back check valve) to prevent the lubrication system from draining the converter fluid back to sump, when the engine is stopped. A pressure of 5 psi is required to open this valve.

ORIFICE CONTROL VALVE AND BALL CHECK BY-PASS VALVE

The orifice control valve is positioned in a bore in the lower control valve body by a spring. During a normal 2-1 shift with closed throttle, smooth front band application is provided by exhausting the front servo release fluid through an orifice. When the same shift occurs at open throttle, the orifice control valve, positioned by throttle pressure, permits an unrestricted exhaust of front servo release pressure, providing a rapid front band application (Fig. 7).

On a manual shift to L while in high gear, control pressure is directed to the orifice control valve plug, to position the orifice control valve for unrestricted exhaust of front servo release fluid.

Since a restricted flow is not desirable for front servo release cavity fill, a ball check is provided in the release cavity circuit. This permits flow to the release cavity to by-pass the orifice.

DOWNSHIFT VALVE

The downshift valve (Fig. 7) is positioned in the upper control valve body bore with the throttle valve. The inner throttle lever contacts one end of the downshift valve, and the inner end of the valve contacts the throttle valve spring. Control pressure is directed to a land of the valve. Linkage is connected between the accelerator pedal and throttle lever. The downshift valve is moved to open a passage to direct control pressure to the 1-2 shift valve, and to a face on the governor plug, when the accelerator pedal is depressed through the detent.

DOWNSHIFT DETENT PLUG

A detent downshift plug is installed in the control valve upper body at the end of the throttle valve (Fig. 7).

This plug is spring-loaded at assembly. In high gear, control pressure is directed to the spring side of this plug, to provide an even stronger detent.

The purpose of the detent is to "signal" the driver when the accelerator pedal depression is approaching the forced downshift (or maximum upshift) position.

The signal which the driver gets is the additional pressure required to move the detent plug against its spring and, in high gear, against control pressure. The downshift valve cannot reach its forced downshift (or maximum upshift) position until the detent plug is forced all the way down (Fig. 7). When the driver feels the detent he knows the engine performance is near maximum and that further depression on the accelerator pedal will bring in the downshift (or delay upshift to the maximum shift point).

HYDRAULIC CONTROL SYSTEM OPERATION

N AND P POSITIONS

With the engine running, the front pump is delivering fluid to the control pressure regulator, manual, throttle, compensator and compensator cutback valves (Fig. 7).

The manual valve in N or P positions blocks the fluid flow to the clutch and both bands. With no fluid pressure in the clutch or servos, the clutch and both bands are released by spring pressure, and drive through the transmission is impossible.

The front pump is delivering more fluid than is necessary to maintain control pressure; hence, the control pressure regulator valve (assisted by compensator pressure) has moved against its spring, and is delivering fluid to the converter and front and rear lubrication systems.

The converter has been filled and is at normal pressure.

The converter-out check valve has been forced open, and there is a continuous flow of fluid through the converter and back to sump.

D POSITION—FIRST GEAR

When the manual valve is moved to the D position, control pressure flows to the 1-2 shift valve, downshift valve, and the low servo apply cavity. As soon as the low band applies, the transmission is in first gear (Fig. 7).

When the driver depresses the accelerator pedal, the throttle valve produces throttle pressure which is proportionate to the pedal depression. Throttle pressure flows to the compensator valve to decrease compensator pressure, and thereby increase control pressure. Throttle pressure also flows to the throttle pressure reducing valve. If throttle pressure is more than approximately 20 psi, it will push the valve open, and flow to the spring end of the 1-2 shift valve and to a face on the governor plug. Reduced throttle pressure works with the springs to keep the 1-2 shift valve closed.

Throttle pressure also moves the orifice control valve against its spring, so that the low servo release circuit is not restricted. This does not affect the upshift, however, since flow to the low servo release cavity by-passes the orifice control valve.

As the car begins to move, the rear pump pressure builds up with road speed. As soon as there is rear pump pressure there is governor pressure, which increases proportionate to road speed. Governor pressure flows to the compensator valve to increase compensator pressure, and thereby decrease control pressure. Governor pressure also flows to the 1-2 shift valve governor plug.

D POSITION—HIGH GEAR

The 1-2 shift valve if forced open (to the right), when governor pressure force exceeds the combined spring and reduced throttle pressure force (Fig. 7). When the 1-2 shift valve opens, control pressure flows through it to release the low band and apply the (high) clutch. When the clutch applies, the transmission is in high (second gear).

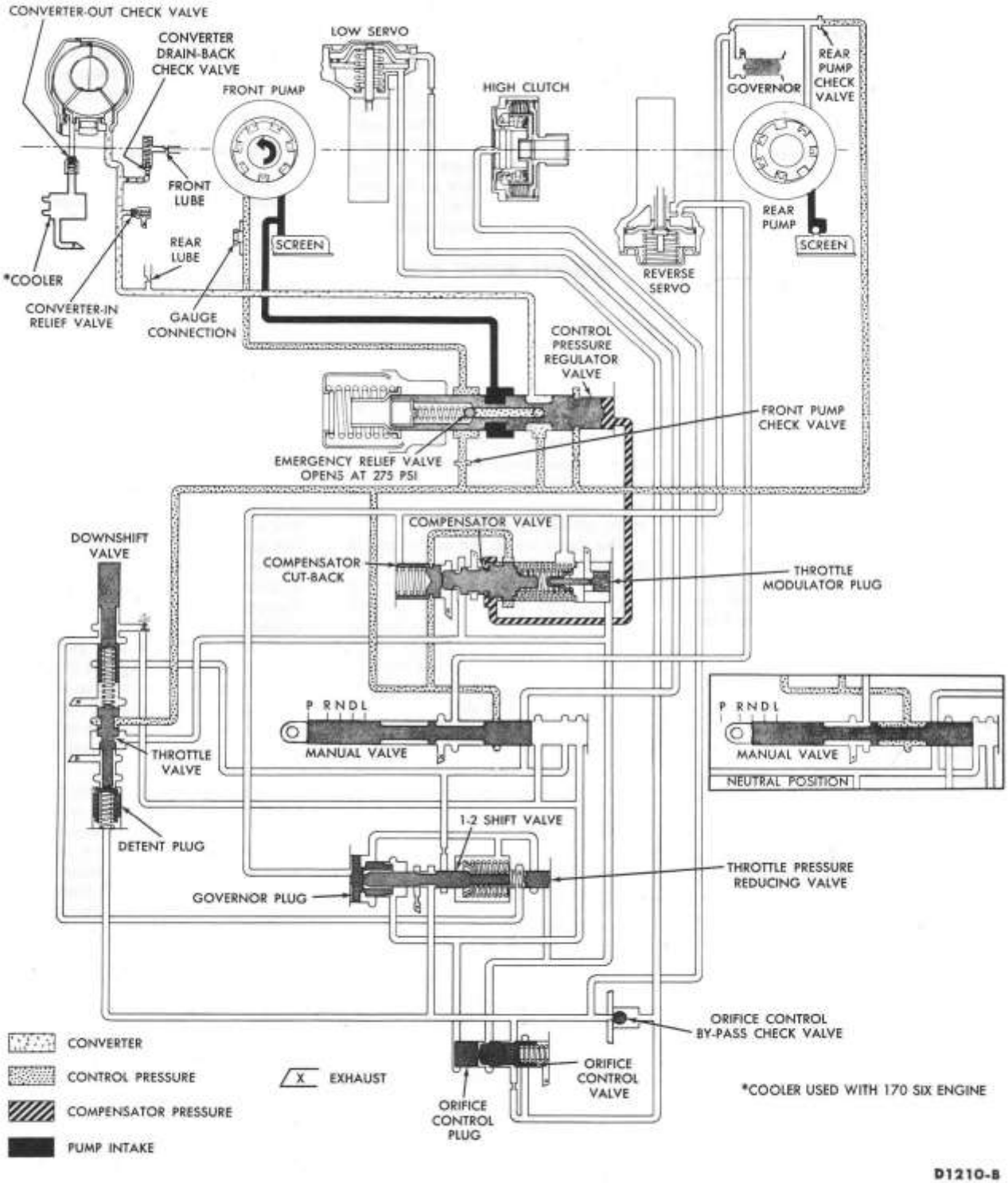


FIG. 7—Hydraulic Control System

Kickdown. When the accelerator pedal is depressed to the floor, control pressure flows through the downshift valve to the spring end of the 1-2 shift valve and a face on the governor plug. Full control pressure working against these areas will close the 1-2 shift valve against governor pressure at speeds below about 50 mph.

When the shift valve closes, it opens an exhaust for the clutch apply and low servo release pressures (Fig. 7). The low band apply pressure, which remained in the apply cavity during high gear operation, now applies the low band. The transmission is now in first (low gear).

On a closed throttle downshift, spring force alone closes the 1-2 shift valve against governor pressure. Since this downshift occurs with zero throttle pressure, the orifice control valve is positioned by its spring. This means that the exhausting fluid from the low servo can flow only through the orifice. A slow exhaust of release pressure means a slow band application.

L POSITION

The hydraulic control system operation and the planetary gear system operation in D position first gear, and L position first gear, are identical with one exception (Fig. 7). In the L position, an additional control pressure circuit is working. In this circuit control pressure flows from the manual valve against the right-hand end of the governor plug, and against the left-hand end of the orifice control valve plug. Another branch of the circuit flows through the downshift valve, and against the spring end of the 1-2 valve and against a face on the governor plug. Against these control pressure forces, governor pressure can never shift the 1-2 valve. Likewise, these forces will always exceed governor pressure force. This means that the transmission will go into first gear whenever it is shifted to L, regardless of road speed.

R POSITION

When the manual selector lever is moved to R, control pressure flows through the manual valve to the reverse servo and applies the reverse band. Control pressure regulation is the same in R as in L and D except for regulation by governor pressure. Since there is no rear pump pressure in reverse, there is no governor pressure.

PART 6-2 LUBRICATION AND ADJUSTMENTS

Section		Page
1	Lubrication	6-10
2	Control Linkage Adjustments	6-10
3	Band Adjustments	6-12

1 LUBRICATION

TRANSMISSION FLUID LEVEL CHECK

1. Make sure that the car is standing level, and then firmly apply the parking brake.

2. Run the engine at normal idle speed. If the transmission fluid is cold, run the engine at fast idle speed (about 1200 rpm) until the fluid reaches its normal operating temperature. When the fluid is warm, slow the engine down to normal idle speed. Do not turn off the engine during the fluid level check.

3. Shift the selector lever through all positions, and place the lever at P.

4. Clean all dirt from the transmission fluid dipstick cap before removing the dipstick from the filler tube.

5. Pull the dipstick out of the tube, wipe it clean, and push it all the way back into the tube.

6. Pull the dipstick out of the tube again, and check the fluid level. If necessary, add fluid to the transmission through the filler tube to raise the fluid level to F (full) mark on the dipstick. Refer to Group 18 for the proper grade of lubricant. **Do not overfill the transmission.**

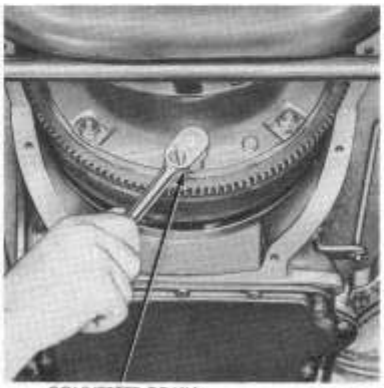


FIG. 1—Converter Drain Plug Removal

TRANSMISSION FLUID CHANGE

1. Remove the cover from the lower front side of the converter housing.

2. Remove one of the converter drain plugs (Fig. 1).

3. Rotate the converter 180° and remove the other plug.

4. When the fluid has stopped draining from the converter, remove transmission oil pan bolts and loosen the front end of the oil pan carefully to allow the fluid to drain. Remove and thoroughly clean the oil pan and screen. Discard the oil pan gasket.

5. Place a new gasket on the oil pan, and install the screen and pan on the transmission.

6. Install both drain plugs in the converter housing, and tighten them to 20-28 ft-lbs torque.

7. Install the converter housing cover.

8. Add 4 quarts of transmission fluid to the transmission through the filler tube.

9. Run the engine at idle speed for about 2 minutes, and add 2 more quarts of fluid. Run the engine at fast idle speed (about 1200 rpm) until it reaches its normal operating temperature. **Do not race the engine.**

10. Shift the selector lever through all the positions, place it at P, and check the fluid level. If necessary, add enough fluid to the transmission to raise the level to the F (full) mark on the dipstick. **Do not overfill the transmission.**

2 CONTROL LINKAGE ADJUSTMENTS

THROTTLE LINKAGE ADJUSTMENT

PRELIMINARY ADJUSTMENT

1. Apply the parking brake, and place the selector lever at N.

2. Run the engine at normal idle speed. If the engine is cold, run the engine at fast idle speed (about 1200 rpm) until it reaches normal operating temperature. When the engine is warm, slow it down to normal idle speed.

3. Connect a tachometer to the engine.

4. Adjust engine idle speed to 475-500 rpm with the transmission selector lever in D.

The carburetor throttle lever must be against the idle adjusting screw at 475-500 rpm in D.

5. Bottom the dashpot plunger against its spring and check the clearance between the bottomed plunger and the throttle lever. The throttle lever must be at its hot idle position. The clearance should be 0.130-0.150 inch. Adjust as required.

6. With the engine stopped, disconnect the throttle control rod at its clevis end (Fig. 2). Loosen the clevis locknut.

7. Push the throttle control rod downward to hold the throttle lever against the stop inside the transmission.

8. With a slight downward pressure on the throttle control rod, adjust its length so that the clevis pin has a free fit. From the free-fit length, **shorten** the throttle control rod by turning the clevis 3½ turns clockwise. Install the clevis pin.

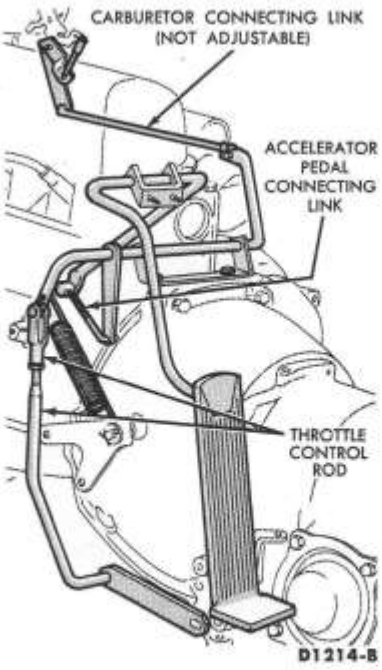


FIG. 2—Throttle Linkage

9. Adjust the accelerator pedal height by turning the threaded trunnion on the accelerator connecting link until the accelerator pedal is 4¼ inches from the floor pan. This measurement is taken from the top rear corner of the pedal to the floor pan.

FINAL ADJUSTMENT—PRESSURE METHOD

1. Apply the parking brake to prevent operation of the rear pump and for safety.

2. Connect a tachometer to the engine.

3. Remove the cap from the pressure line and install the tool shown in Fig. 3. Position the gauge so that it can be read from the driver's seat.

4. Run the engine until the transmission fluid is at normal operating temperature.

5. Apply the service brakes and shift the selector lever to D.

6. Perform the pressure test quickly to avoid overheating the transmission. Increase the engine speed to 1200 rpm and note the gauge reading. If the pressure reading is below specification (Table 1, Part 6-3), the throttle control rod clevis must be rotated to shorten the rod (Fig. 2). If the pressure reading is more than specification, the clevis must be rotated to lengthen the rod.

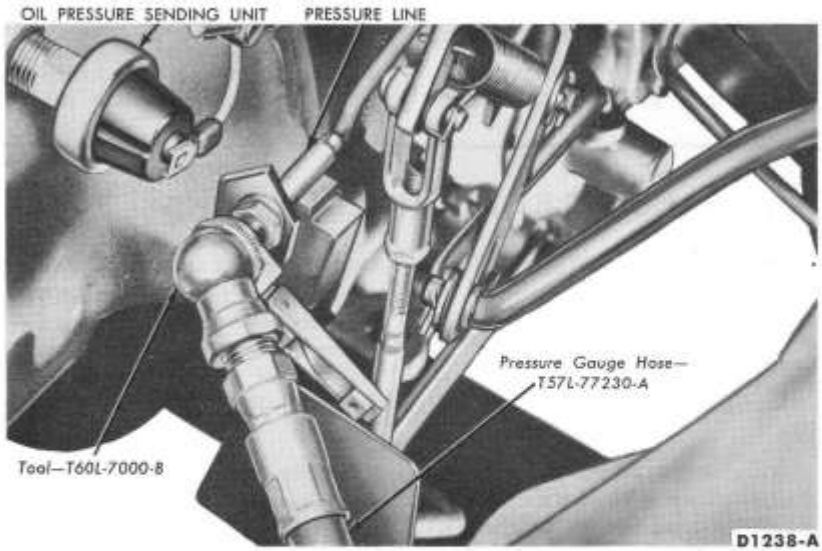


FIG. 3—Pressure Test

From the preliminary adjustment (3½ turns short), the throttle control rod may be lengthened or shortened by 2½ turns. If control pressure cannot be brought into the specified range within 2½ turns longer or shorter, transmission trouble other than throttle linkage adjustment is indicated.

Refer to CONTROL PRESSURE CHECK in Part 6-3.

7. Secure the throttle control rod clevis to the linkage and tighten the locknut to secure the adjustment.

8. Check control pressure at idle and stall speeds (Table 1 Part 6-3).

If gauge readings at idle and stall are not within limits, normal diagnosis procedures must be followed. **Do not operate the car for long periods of time under stall or partial stall conditions. Obtain pressure readings quickly and decrease engine speed to idle.**

MANUAL LINKAGE ADJUSTMENT

1. With the engine stopped, loosen the clamp at the shift lever so that the shift rod is free to slide in the clamp (Fig. 4).

2. Position the selector lever so that the pointer lines up in the D position.

3. Shift the manual lever at the transmission into the D detent position (second from the rear).

FIG. 4—Manual Linkage

FIG. 5—Starter Neutral Switch

4. Tighten the clamp on the shift rod.

5. Check the pointer alignment for all selector lever detent positions.

STARTER NEUTRAL SWITCH ADJUSTMENT

1. Check the starter circuit in all selector lever positions. The circuit must be open in all positions except N and P.

2. To adjust the switch, loosen the neutral switch to steering column attaching screws (Fig. 5). Position the switch so that the starter circuit is closed when the selector lever is at N and P only.

3 BAND ADJUSTMENTS

LOW BAND ADJUSTMENT

The low band adjusting screw is threaded through the left front side of the case (Fig. 6).

1. Loosen the locknut several turns.

2. Tighten the adjusting screw with the tool shown in Fig. 6 until the tool is felt and heard to click. This tool is a pre-set torque wrench which clicks and overruns when torque on the screw reaches 10 ft-lbs.

3. Back off the adjusting screw exactly two turns.

4. Hold the adjusting screw at this position, and then torque the locknut to 35-40 ft-lbs.

REAR BAND ADJUSTMENT

1. Remove the transmission oil pan bolts and loosen the front end of the oil pan carefully to allow the fluid to drain. **If the same fluid is to be used again in the transmission after the band adjustment, filter the fluid through a 100-mesh screen as it drains from the transmission. Reuse the fluid only if it is in good condition.**

2. Remove and thoroughly clean the oil pan and screen. Discard the oil pan gasket.

3. Loosen the rear servo piston rod locknut and adjusting nut (Fig. 7).

4. Place the tool on the rear servo piston rod so that the two forks straddle the band apply lever. The inner fork must engage the flat on the servo piston rod. The outer fork is a ¼ inch spacer and must be inserted between the piston rod seat and the adjusting nut.

5. Back off the piston rod locknut so that the wrench shown in Fig. 7 can engage the adjusting nut. Tighten the adjusting nut until the wrench is felt and heard to click and overrun. This tool is a pre-set torque wrench which clicks and overruns when 45-50 in-lbs torque is applied to the adjusting nut.

6. Back off the adjusting nut exactly 2 turns.

7. Pull the tool (T59P-77409-A) away from the servo rod about one inch. This will permit the adjusting nut to drop into a nut holding slot provided in the tool.

8. Hold the adjusting nut against rotation and torque the locknut to 15-18 ft-lbs.

9. Remove the tool from the servo piston rod.

10. Place a new gasket on the oil pan, and install the screen and pan on the transmission.

11. Fill the transmission.

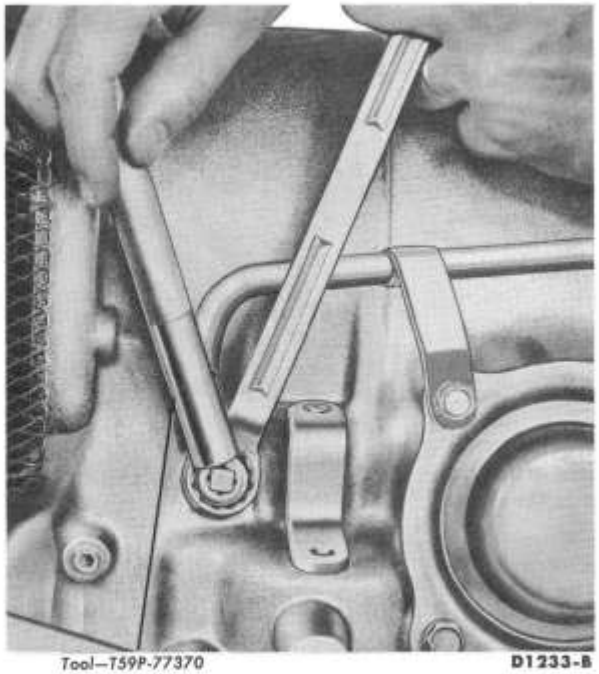


FIG. 6–Low Band Adjustment

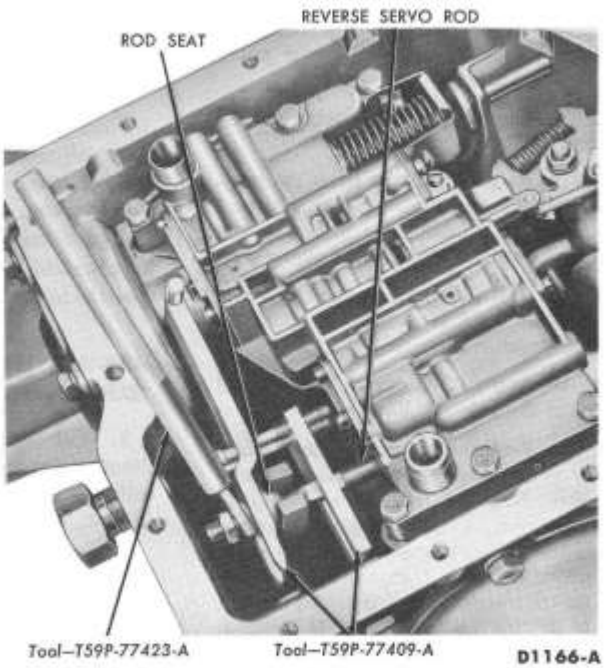


FIG. 7–Reverse Band Adjustment

PART 6-3 TROUBLE SHOOTING

Section		Page
1	Diagnosis Guide	6-13
2	Preliminary Checks	6-14
3	Performance Checks	6-16

1 DIAGNOSIS GUIDE

The Fordomatic Diagnosis Guide lists the most common trouble symptoms that may be found in the transmission, and gives the items that should be checked to find the cause of the trouble.

The items to check for each trouble symptom are arranged in a logical sequence which should be followed for quickest results. The letter symbols for each item are explained in the Key to the Diagnosis Guide.

If items A, B, C, D, E, and the stall test have already been checked during the preliminary checks and adjustments, they need not be repeated when following the Diagnosis Guide.

FORDOMATIC DIAGNOSIS GUIDE

Trouble Symptoms	Items to Check	
	Transmission in Car	Transmission Out of Car
Harsh initial engagement in D, L and R	D B	
Slips or chatters in D or L	A B E H F K	a e
Slips or chatters in R	A B E I F K	b f n
Creeps excessively in D	D	
Engine Overspeeds (Buzz-Up) During 1-2 Shift	A L B E H F G	g j h
Momentary Lockup During 1-2 Shift	A B E H	a j k
Severe 2-1 Shift During Coast-Down	D B G E	
No 1-2 Shift in D	A L B C J Q	a d j p
Delayed 1-2 Shift	B J	d m
Slips Continuously After 1-2 Shift	L A B E F	j g
No 2-1 Forced Downshift (Kickdown)	B G	d
No 2-1 Shift During Coast-Down	G J	
Fluid Forced Out Vent	A M O (P*)	
Transmission Overheats	E R (N*)	
Acceleration is Normal—Maximum Speed About 50 mph		i
Acceleration Very Poor—Operation Above 30 mph at Steady Throttle Normal		i
Engine does not start by pushing car	A C G	c d
Parking lock does not hold, or binds	C	l o

*Transmissions used with 170 six engine, only

KEY TO DIAGNOSIS GUIDE (Continued)

A	Fluid Level
B	Throttle Linkage
C	Manual Linkage
D	Engine Idle Speed
E	Control Pressure Check
F	Air Pressure Check
G	Control Valve Body
H	Low Band Adjustment
I	Reverse Band Adjustment
J	Governor
K	Engine—Transmission Mounts
L	Fluid Odor Check for Burned Clutch Plates
M	Transmission External Vent
N	Cooler Flow Check
O	Fluid Aeration Check
P	Fluid Check for Engine Coolant Contamination
Q	High Clutch Piston
R	Converter Cooling Air Passages

a	Low Servo and Band
b	Reverse Servo and Band
c	Rear Pump
d	Leakage in Control Pressure Main Circuit
e	Leakage in Low Servo Apply Circuit
f	Leakage in Reverse Servo Apply Circuit
g	Leakage in Clutch Apply or Low Servo Release Circuit
h	Planetary Gears
i	Converter One-Way Clutch
j	High Clutch
k	Low Servo Piston Return Spring
l	Parking Linkage
m	Low Servo Piston Check Valve
n	Cracked or Broken Rear Band Anchor
o	Front Band Installed Backwards—Strut out of Position
p	High Clutch Piston

2 PRELIMINARY CHECKS

When transmission trouble is indicated, the following preliminary checks should be made in the order given.

1. Check the fluid level. Check the fluid for burnt clutch plate odor.

2. Check engine idle speed and dashpot adjustments.

3. Check the manual linkage adjustment.

4. Check the throttle linkage for proper adjustment.

STALL TEST

When a transmission stall test is to be made, the following procedure should be observed.

1. Check the engine coolant level and transmission fluid level.

2. If the engine is cold, run it at 1200 rpm with the transmission in N until normal engine temperature is reached.

3. Attach a tachometer to the engine, and position the instrument so that it can be read from the driver's seat.

4. Apply the service and parking brakes firmly.

5. Shift the selector lever to D, L, or R.

6. With a steady pressure, depress the accelerator pedal to the floor. **Hold the pedal at the wide-open throttle position only long enough for the tachometer reading to stabilize. Five seconds is usually adequate time at wide-open throttle to secure an accurate reading.** Between tests, run the engine for at least 2 minutes at 1200 rpm with the transmission in N to reduce the transmission fluid temperature.

7. Stall speed limits for the 144 Six engine are 1645-1845 rpm and 1840-2040 rpm for the 170 Six engine.

8. If tachometer readings exceed the high limit, or engine run-away is apparent, release the accelerator pedal immediately to prevent further damage.

Stall test tachometer readings require careful interpretation. **During a stall test, the engine, the torque converter, and the transmission bands are all under test at the same time.**

STALL TEST—TRANSMISSION BAND CHECK

When the Fordomatic transmission is stall tested in D or L, the low band is applied. When it is stall tested in R, the reverse band is applied.

If the engine runs away on a stall test in D or L, but is held within limits in R, the low band is slipping. If the stall test is normal in R, it is probable that the engine, torque converter and control pressure in the transmission are also normal and that the trouble is confined to the low servo and band. In this case, the band should be checked for proper adjustment, and the stall test repeated in D and L. If the band still slips, attach a pressure gauge and check control pressure before inspecting the servo and band.

If the engine runs away during a stall test in R, but is held within limits in D and L, the reverse band is slipping. Because of the time required to adjust the reverse band,

control pressure should be checked before the oil pan is removed.

The transmission (high) clutch cannot be stall tested since the clutch applies only at road speeds above about 15 mph.

STALL TEST—CONVERTER CHECK

During a normal stall test, the stator one-way clutch locks the stator against counterclockwise rotation (viewed from the front of the car). Should the stator clutch fail to operate properly, the converter will offer much greater resistance to rotation. If this condition is present in the converter, maximum engine speed during a stall test will be about 1200 rpm.

Before changing the converter, the car should be tested on the road. If the stator clutch fails to lock the stator, stall test rpm will be low and acceleration up to about 30 mph will be extremely slow. Above 30 mph acceleration will be nearly normal, and operation at steady speed above 30 mph will be entirely normal.

Remove the converter and check the stator clutch as given in Part 6-6.

Should the opposite condition be present in the converter (the stator clutch does not unlock), stall test rpm will be normal but maximum speed obtainable on the road will be about 50 mph.

CONTROL PRESSURE CHECK—GENERAL INFORMATION

When the above preliminary checks have not indicated the cause of the transmission trouble, control pressure should be checked before the transmission is removed for inspection.

It is impossible to predict all the kinds of gauge readings which will be encountered and give a step by step diagnosis procedure for each kind of reading. The following information is general and may be helpful when interpreting gauge readings.

A gauge connected at the pressure-test line (Fig. 3, Part 6-2) is used to show the pressure between the front pump and the front pump check valve. This pressure is regulated by the control pressure regulator valve and is transmission control pressure.

As long as the car is not moving or the rear wheels are not turning, this pressure is supplied by the front pump only. If the car is driven with the pressure gauge attached, the gauge reading will suddenly fall off to less than 5 psi at about 50 mph.

This sudden pressure drop is entirely normal. It indicates that the rear pump has closed the front pump check valve and has taken over the **complete** fluid supply job in the transmission. A gauge installed at this one location, therefore, can check both front and rear pumps. If this sudden pressure drop does not occur, either the rear pump or the front pump check valve is not operating properly.

Table 1 gives the control pressure limits. These pressure readings are to be taken with the rear wheels stopped so that the front pump alone is supplying the pressure. **In the interest of safety, the rear wheels should not be allowed to run while the car is on stands or a hoist. With the rear wheels running, the transmission may shift and the car may lurch off the stands or hoist.**

CONTROL PRESSURE RISE

During the operation of the engine from idle to wide-open throttle (stall), with the selector lever in the D, L, and R positions, the control pressure should rise as shown in Table 1.

In the D position if this pressure rise does not occur, there are four probable causes, throttle linkage, throttle and compensator pressures, pump capacity, and excessive leakage. Before the control valve body or transmission is removed for inspection, the following checks should be made.

1. Check the pressure rise in D, L, and R. If the pressure rise is normal in any one position, the throttle linkage, throttle and compensator pressures, and pump capacity are probably normal. The probable cause of the no pressure rise is leakage in the hydraulic system upstream from the manual valve.

2. To check the operation of the throttle linkage, the following procedure is suggested. Disconnect the throttle control rod clevis from the accelerator shaft and lever. Place the selector lever in the P position.

Adjust engine speed to 1200 rpm. Pull upward on the throttle control rod and observe the pressure gauge. Control pressure should rise from 40-48 to 53-57 psi in transmissions used with the 144 Six engine and from 46-56 to 77-84 psi in transmissions used with 170 Six engine. If it rises to this range, pump capacity, main system leakage, throttle and compensator pressures, and the throttle linkage are normal. The trouble is probably due to leakage in the low servo apply line.

If the pressure does not rise as the throttle control rod is pulled upward, make the following checks on the transmission throttle linkage. Raise and lower the throttle control rod and feel for compression on the throttle valve spring as the rod moves upward. Check for loose throttle levers on the shaft by pulling the rod upward firmly against the stop inside the transmission.

DELAYED UPSHIFT

After a transmission overhaul, the low servo release piston cavity will be completely dry of fluid and filled with air. If a 1-2 shift occurs under this condition, the air in the release cavity is trapped and must be compressed when fluid enters the cavity. This air compression delays the fill time and thereby delays the shift.

To fill the release cavity with fluid and to remove the trapped air, a ball check valve is installed in the apply side and at the top of the low servo piston (Fig. 22, Part 6-5). Each time pressure enters the apply cavity, a small amount of fluid flows through the check valve before the check ball seats. After about 20 applications (shifts from N to D), the release cavity will be filled. As the fluid flows out through the servo release passage, it takes the trapped air with it. Although the release cavity will stay full of fluid, it will not be under pressure because an exhaust is open at the 1-2 valve (Fig. 7, Part 6-1) in all operations except high gear.

TABLE 1—Fluid Pressure Limits

Engine Speed	Selector Lever Position	Gauge Reading (psi)	
		Transmission Model PBZ-H or J (144 Six Engine)	Transmission Model PCF-A or B (170 Six Engine)
Idle	All	40-48	46-56
1200 rpm	D	53-57	78-82
Stall	D, L and R	135-155	170-192

3 PERFORMANCE CHECKS

Performance checks should be made only after all preliminary checks have been completed and the trouble has not been found. If an unsatisfactory operating condition is found during these checks, stop the checks and proceed to final diagnosis and correction of the trouble.

GOVERNOR PRESSURE CHECK

Table 2 shows **average** control pressure gauge readings at full throttle from zero to 30 mph. Normal readings up to 30 mph indicate that governor pressure in the transmission is normal, and that it is getting to the compensator valve.

This table gives the **average** control pressure at wide-open throttle at 10, 15 and 30 mph. The purpose of the table is to indicate the **rate** at which control pressure decreases with road speed when governor pressure operation is normal.

Reference to the limits given for control pressure in Table 1 will indicate the range of pressure readings which may be observed on normal transmissions.

To read control pressure on the road, the following procedure is suggested.

1. Attach a pressure gauge and hose (T57T-77820-A) at the pressure-test line (Fig. 3, Part 6-2). The hose must be long enough so that the gauge can be brought inside the car through the driver's vent window.

2. Check the gauge reading at stall. It should be within the limits shown in Table 1.

3. Check control pressure on the road at full throttle, at three 10 mph intervals. This can be done by applying the service brakes and at the same time depressing the accelerator pedal to its wide-open position. In D and at less than 10 mph, apply the service brakes and depress the accelerator pedal to its wide-open position. Apply the service brakes to the point that exactly 10 mph is indicated. Hold road speed at 10 mph until a stabilized gauge reading can be taken. Drive the car in a normal manner for several minutes to cool the engine, transmission, and brakes. Now, apply the service brakes and depress the accelerator pedal to its wide-open position. Hold road speed at exactly 15 mph (still at wide-open throttle), until an accurate gauge reading can be taken. Again, drive the car in a normal manner for several minutes, and then take a reading at full-throttle at 30 mph.

If the gauge readings do not drop with road speed, the governor or the compensator valve may not be operating properly. If, however, the readings were normal (car standing) at idle, and stall, the compensator valve is almost certainly operating properly; the reason that readings do not drop is that there is no governor pressure at the compensator valve.

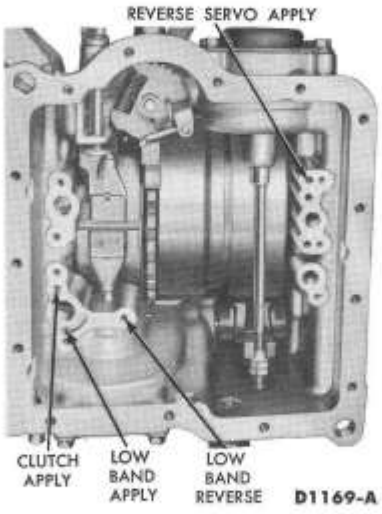


FIG. 1—Clutch and Servo Fluid Passages

NO DRIVE IN ANY RANGE

In trouble shooting a no-drive condition, it must be determined whether the engine is running under load, or is running without load. If the engine is running under load, the transmission is actually locked up, and the converter turbine is at stall. If the engine is running without load, the converter or transmission is actually in neutral.

To determine whether the converter or transmission is causing the no-drive (neutral) condition, follow this procedure:

1. With the engine stopped, torque the low band adjusting screw to 25 ft-lbs and leave it at this torque. This puts the transmission in gear, and by-passes the hydraulic control system as far as first gear engagement is concerned.

2. Apply the parking and service brakes (the transmission is now actually in first gear), and start the engine.

3. Release the brakes and slowly advance the throttle. If the car now appears to have a normal drive in first gear, the torque converter is probably satisfactory, and the trouble is in the transmission. **The car should not be driven, even short distances, under this condition, since there may be no fluid flow in the lubrication system.**

4. To find the transmission trouble, refer to the DIAGNOSIS GUIDE.

AIR PRESSURE CHECKS

A NO DRIVE condition can exist, even with correct transmission fluid pressure, because of inoperative bands or clutch. The inoperative units can be located through a series of checks by substituting air pressure for the fluid pressure to determine the location of the malfunction.

When the selector lever is at D or L, a NO DRIVE condition may be caused by an inoperative low band. A NO DRIVE condition in R may be caused by an inoperative reverse band. Failure to shift into high may

TABLE 2—Control Pressure Variation—With Road Speed

Engine	Axle Ratio	Average Control Pressure (psi) @ Wide Open Throttle		
		10 mph	15 mph	30 mph
144	3.89:1	108	74	74
	3.50:1	112	82	74
	3.10:1	118	95	74
170	3.89:1	148	115	74
	3.50:1	151	124	74
	3.10:1	156	136	74

be caused by excessive leakage in the clutch apply and low band release circuit.

Figure 1 shows the case passages which lead to the clutch and servos.

SHIFT POINT CHECK

Shift points and low gear operation should be checked against the speeds given in Table 1, Part 6-1.

FLUID AERATION CHECK

Fluid foaming will cause erratic operation and, in extreme cases, will force the fluid out the vent. Fluid foaming can be caused by over-filling which permits the clutch drum, reverse ring gear, and planet carrier to run in the fluid. Fluid foaming may be caused by water from the cooling system getting into the transmission fluid of a 170 Six engine installation.

Fluid foaming can also be caused by the pumps aerating the fluid. This happens when the pump or pumps suck air along with the fluid. When the fluid is depressurized, the air expands and blows bubbles in the fluid.

To determine which pump is sucking the air follow this procedure:

1. Run the engine until the engine and transmission are at normal operating temperatures.

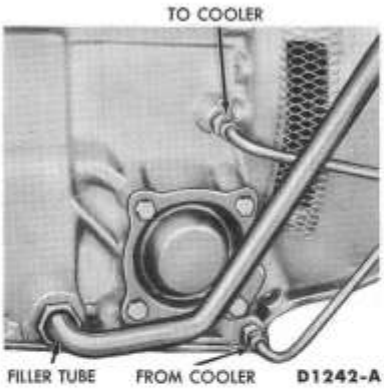


FIG. 2—Cooler Line Connections at Transmission (170 Six Engine)

2. Remove the transmission dipstick and install a funnel in the filler tube.

3. Disconnect the converter-out line from its fitting on the lower right-hand side of the transmission case (Fig. 2). Remove the fitting from the case. Remove the hose from the gauge T57L-77820-A. Connect the hose to the converter-out ⅛-inch pipe thread in the transmission case.

4. Fasten the free end of the hose to the funnel in the filler tube.

5. Firmly apply the parking brake so that the rear wheels do not turn. This keeps the rear pump from turning.

6. Start the engine and run it at 700 rpm with the transmission in N.

7. Observe the fluid flow at the funnel in the filler tube. If the front pump is sucking air, the flow at the funnel will spit much the same as a bleeding brake line which has air in it. If the front pump is not sucking air, the fluid will flow in a solid stream.

8. To check the rear pump, the rear wheels must run. Block the front wheels securely and raise the rear axle on a hoist or support it on stands.

9. Place the selector lever in D and increase the engine speed until the speedometer reads 50 mph.

10. If the flow at the funnel is spitting now and the flow was normal when only the front pump was running, the rear pump is sucking air. If, however, the flow was spitting when only the front pump was running and the flow is normal at speeds above 50 mph, the front pump is sucking air and the rear pump is not.

Transmission pumps will suck air if the normal fluid intake is restricted, for example, by a clogged screen. When the restriction is removed, the pumps will no longer suck air.

PART 6-4 REPLACEMENT

Section		Page
1	Sub-Assembly Replacement —Transmission in Car	6-18
2	Transmission Replacement	6-20

1 SUB-ASSEMBLY REPLACEMENT—TRANSMISSION IN CAR

The control valve body, governor, low servo piston and cover seal, reverse servo cover seal, and extension housing bushing and seal can be removed for servicing without removing the transmission from the car.

CONTROL VALVE BODY REPLACEMENT

1. Raise the car so that the transmission oil pan is accessible.

2. Clean the outside of the oil pan. Remove the transmission oil pan bolts and loosen the front end of the oil pan carefully to allow the fluid to drain. Remove the oil pan and gasket. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Re-use the fluid only if it is in good condition.**

3. Remove the fluid screen retaining clip and the screen.

4. Remove the 6 bolts that attach the control valve body to the transmission case (Fig. 1).

5. Carefully lower the control valve body and work the manual shift link out of the manual valve. For control valve body disassembly, inspection, and assembly, see Part 6-5.

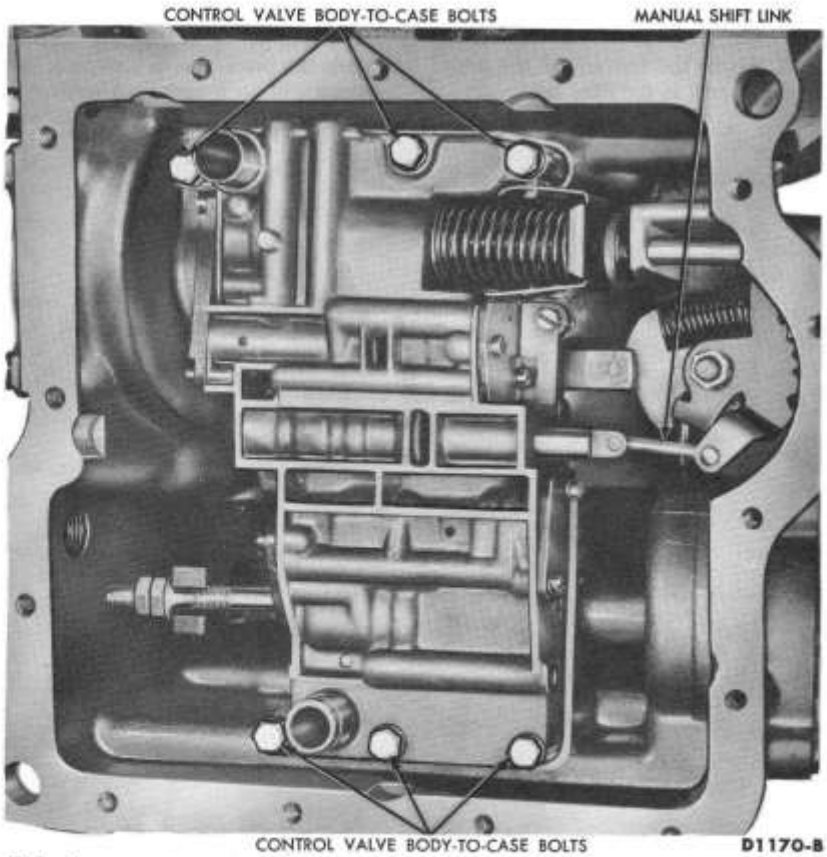


FIG. 1—Control Valve Body Mounted on Transmission Case

6. When the control valve body is installed in the transmission, make sure that the manual shift link is connected to the manual valve and that the throttle lever is located between the downshift valve and the stop plate on the upper body.

7. Install the 6 control valve body to case attaching bolts and torque them to 8-10 ft-lbs.

8. Install the screen and screen retainer clip.

9. Position a new oil pan gasket on the bottom of the transmission case, and install the oil pan. Torque the oil pan screws to 10-13 ft-lbs.

10. Fill the transmission and adjust manual and throttle linkage.

GOVERNOR REPLACEMENT

1. Raise the car so that the transmission extension housing is accessible.

2. Clean exterior of oil pan. Remove the transmission oil pan bolts and loosen the front end of the oil pan carefully to allow the fluid to drain. Remove the oil pan and gasket. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Reuse the fluid only if it is in good condition.**

3. Disconnect the drive shaft at the drive pinion flange and remove it. Remove the bolt that attaches the engine rear support member to the extension housing.

4. Place a transmission jack under the transmission oil pan and raise the transmission until the extension housing is clear of the cross member.

5. Disconnect the speedometer cable.

6. Remove the engine rear support member from the underbody.

7. Lower the transmission for

greater accessibility, and then remove the extension housing to case bolts.

8. Remove the extension housing.

9. Remove the governor.

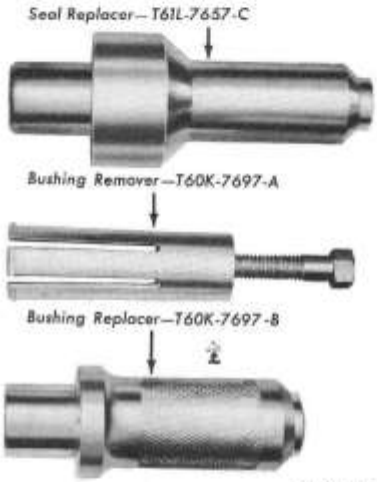
10. To install the governor, reverse the above procedure.

EXTENSION HOUSING BUSHING AND REAR SEAL REPLACEMENT

1. Disconnect the drive shaft from the transmission.

2. Carefully remove the rear seal with a tapered chisel.

3. Remove the bushing using tool shown in Fig. 2. **Use caution when the bushing remover tool is installed so that the spline seal is not damaged.**



D1216-B

FIG. 2—Extension Housing Bushing and Seal Service Tools

4. When installing a new bushing, use the special tool shown in Fig. 2.

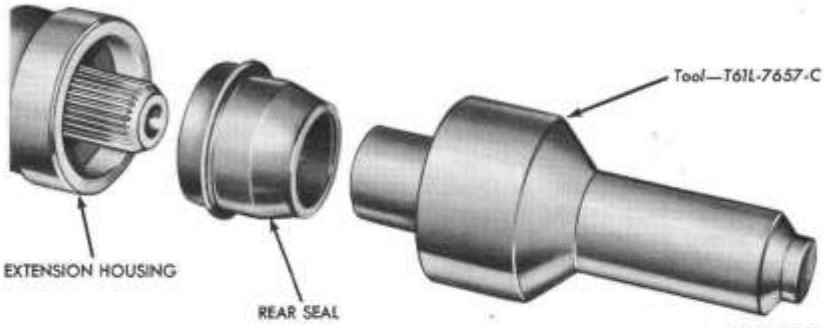
5. Before installing new seal, inspect the sealing surface of the universal joint yoke for scores. If scores are found, replace the yoke.

6. Inspect the counterbore of the housing for burrs. Polish off all burrs with crocus cloth.

7. Drive the seal into the housing with the tool shown in Fig. 3. The seal should be firmly seated in the bore. Install the drive shaft.

LOW SERVO PISTON AND SERVO COVER SEAL REPLACEMENT

1. Thoroughly clean the low servo cover and the portion of the transmission case around the cover. Draining of fluid from the transmission will occur during removal of the low servo cover and piston. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Re-use the fluid only if it is in good condition.**



D1244-A

FIG. 3—Extension Housing Seal Installation

2. Remove the lock nut from the low band adjusting screw.

3. Remove two servo cover retaining bolts, which are 180° apart. Install two 1-inch long bolts (5/16-18) in the holes from which the two regular cover bolts were removed. Run these bolts in until they bottom.

4. Remove the remaining cover bolts by loosening each bolt one turn at a time. As the cover separates from the case, tighten the low band adjusting screw and keep tightening it as the cover (and servo piston) move away from the case. This will cause the strut, between the low servo piston stem and the low band, to wedge against the case and stay in position when the low servo piston stem moves out of the strut (Fig. 6, Part 6-1).

5. Remove the two longer bolts by turning each bolt, one turn at a time. Remove the cover, low servo piston, and spring.

6. Inspect the ball check valve in the low servo piston for free movement and proper seating. If any defect other than foreign material is found in the ball check valve, replace the servo piston.

7. Place a new seal on the servo cover. **Do not twist the seal.**

8. Position the servo spring, servo piston and cover. **The low servo piston ball check valve must be at the top.** Start the two 1-inch bolts.

9. Carefully pull the cover against the case by tightening the two bolts. At the same time, keep loosening the low band adjusting screw as the cover moves closer to the case.

10. After the two regular bolts are securely started, remove the longer bolts and install the two remaining bolts. Torque the cover bolts to 12-15 ft-lbs.

11. Adjust the low band as given in Part 6-2.

12. Fill the transmission with fluid.

REVERSE SERVO COVER SEAL REPLACEMENT

1. Thoroughly clean the reverse servo cover and the portion of the transmission case around the cover. Draining of fluid from the transmission will occur during removal of the reverse servo cover. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Re-use the fluid only if it is in good condition.**

2. Remove any two reverse servo cover retaining bolts that are 180° apart. Install two 1 3/16-inch long bolts into the bolt holes. Run the bolts in until they bottom.

3. Remove the two remaining short bolts and the identification tag. Remove the two longer bolts by turning each bolt one turn at a time. Remove the servo cover and spring.

4. Install a new seal on the servo cover. **Do not twist the seal.**

5. Position the spring and cover. Start two 1 3/16-inch long bolts into any two bolt holes that are 180° apart.

6. Carefully pull the cover against the case by tightening the two long bolts until they bottom.

7. Start the two short bolts and tighten them carefully. Remove the two long bolts and install the two remaining short bolts. Be sure to place the identification tag under the lower rear cover bolt. Torque the cover bolts to 12-15 ft-lbs.

8. Fill the transmission with fluid.

OIL COOLER AND LINES

OIL COOLER FLUSHING PROCEDURE (170 SIX ENGINE)

When a clutch or band failure or other internal trouble has occurred in the transmission, any metal particles or clutch plate or band material that may have been carried into the cooler should be removed from the system by flushing the cooler before the transmission is put back into service.

1. Disconnect the fluid return line from the transmission case (Fig. 2, Part 6-3).

2. Start the engine and drain about two quarts of fluid from the cooler into a pan. Discard the drained fluid. If there is no fluid flow or the fluid does not flow freely from the return line, shut off the engine and disconnect both lines at the cooler and transmission.

3. Use an air hose (with not more than 100 psi air pressure) to reverse flush the lines and the cooler.

4. Connect both lines at the cooler, and the pressure line at the transmission.

5. Start the engine and check the fluid flow. If the fluid flows freely, connect the return line at the transmission and fill the transmission with new fluid to the specified level. If there is no fluid flow or if the flow is restricted, replace the radiator. **Do not attempt to correct cooler or cooling line leaks by closing off the lines.**

OIL COOLER REPLACEMENT

When fluid leakage is found at the oil cooler, the entire radiator must be replaced. **The oil cooler cannot be removed from the radiator for replacement.**

STEEL TUBE REPLACEMENT

When one or more of the oil cooler steel tubes must be replaced, each replacement tube must be fabricated from the same size steel tubing as the original line.

Using the old tube as a guide, bend the new tube as required. Add the necessary fittings, and install the tube.

After the fittings have been tightened, add fluid as needed, and check for fluid leaks.

2 TRANSMISSION REPLACEMENT

REMOVAL

1. Drive the car onto a hoist, but do not raise it at this time.

2. From under the hood, remove the two bolts which attach the throttle linkage bracket to the converter housing.

3. Remove the starter.

4. Refer to Part 8-4 for hoisting procedures, and then raise the car.

5. Remove the cover from the bottom of the converter housing.

6. Remove one of the converter drain plugs. Then rotate the converter 180° and remove the other plug.

Do not attempt to turn the flywheel with a wrench on the converter to flywheel stud nuts.

7. Drain the transmission.

8. Disconnect the oil cooler lines from the transmission (170 Six engine).

9. Disconnect the drive shaft at the rear axle pinion flange, and remove the drive shaft. Install the extension housing seal replacer in the extension housing seal.

10. Disconnect the manual and throttle linkage and the pressure gauge line at the transmission.

11. Disconnect the speedometer cable at the extension housing.

12. Disconnect the oil filler tube and pressure-test line.

13. On a car, remove the bolt that attaches the engine rear support to the extension housing. On a station wagon or Ranchero, remove the nuts from the insulator retaining bolts.

14. Disconnect the parking brake cable from the rear support.

15. Position a transmission jack under the transmission and raise it slightly to take the weight off the engine rear support member.

16. Remove the bolts which attach the engine rear support to the underbody. Move the support aside.

17. Lower the transmission and engine and support the rear of the engine.

18. Remove the four stud nuts which attach the converter to the flywheel. Move the converter away from the flywheel as far as it will go.

19. Remove the 4 converter housing to engine block bolts.

20. Work the converter housing off the engine block dowel pins, and work the converter pilot out of the engine crankshaft.

21. Secure the converter to the converter housing and lower the transmission (Fig. 4).

INSTALLATION

1. Secure the converter to the transmission (Fig. 4).

2. Mount the transmission on the jack and position it under the car.

3. Raise the transmission and start the converter housing on the engine block dowel pins.

4. Start the 4 converter housing to engine block bolts. As these bolts are tightened, be sure the converter pilot enters the crankshaft and that the converter drive studs and drain plugs enter the openings in the flywheel.

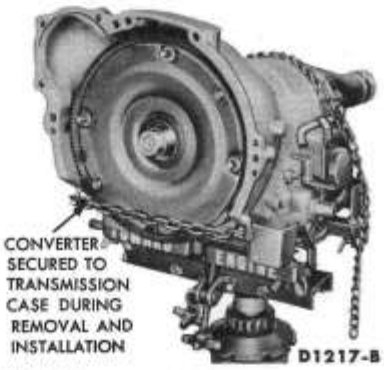


FIG. 4—Transmission Mounted in Jack

5. Raise the transmission and install the engine rear support.

6. Lower the transmission onto the engine rear support and remove the jack.

7. On a car, install the bolt which attaches the engine rear support to the extension housing. On a station wagon or Ranchero, install the nuts on the insulator retaining bolts.

8. Install the stud nuts which attach the converter to the flywheel. Torque nuts to 23-28 ft-lbs. **Do not attempt to turn the flywheel with a wrench on the converter to flywheel stud nuts.** Torque the converter drain plugs to 20-28 ft-lbs.

9. Install the converter housing lower cover.

10. Connect the oil cooler outlet and inlet lines at the transmission case.

11. Install the filler tube and pressure-test line.

12. Connect the throttle and manual linkage and the pressure gauge line.

13. Connect the speedometer cable. Connect and adjust the parking brake.

14. Lubricate the front universal joint yoke with Ford Lubricant B8A-19589-A and install the drive shaft.

15. Install the throttle linkage bracket on the converter housing.

16. Install the starter.

17. Lower the car to the floor.

18. Fill the transmission with fluid. Then check the fluid level with the transmission at normal operating temperature.

19. With the engine running at idle speed, shift the selector lever from N to D and from D back to N for at least 20 times. The repeated shifting of the selector lever will fill the low servo release cavity with fluid and expel the trapped air.

20. Adjust the manual and throttle linkage.

PART 6-5 TRANSMISSION OVERHAUL

Section		Page
1	Removal of Sub-Assemblies.	6-22
2	Overhaul of Sub-Assemblies.	6-23
3	Transmission Case and Linkage Repair	6-32
4	Installation of Sub-Assemblies	6-35

1 REMOVAL OF SUB-ASSEMBLIES

REMOVAL OF OIL PAN AND CONTROL VALVE BODY

1. Before removing any of the transmission sub-assemblies, thoroughly clean the outside of the transmission case to prevent dirt from getting inside the mechanism.

2. After the transmission has been removed from the car, remove the converter and place the assembly in the transmission holder shown in Fig. 1.

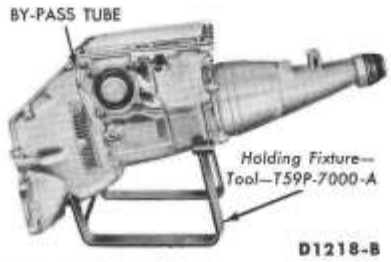


FIG. 1—Transmission Mounted in Overhaul Fixture

3. Remove the oil pan and gasket.

4. Remove the screen retaining clip, and then remove the screen.

5. Remove the 6 bolts that attach the control valve body to the case (Fig. 1, Part 6-4). Remove the control valve body.

TRANSMISSION END PLAY CHECK

1. Mount a dial indicator on the transmission case so that the contact rests on the end of the primary sun gear (turbine) shaft as shown in Fig. 2.

2. Install the extension housing seal replacer or a front universal joint yoke on the output shaft spline to align the output shaft.

3. Pry the reverse ring gear (Fig. 2) forward with a large screwdriver. Set the dial indicator at zero while maintaining a slight pressure on the screwdriver.

4. Now pry the clutch drum to the rear (Fig. 2). Record the indicator reading for use during transmission assembly. End play should be between 0.020 and 0.039 inch.

5. Remove the indicator and the seal replacer or yoke.

REMOVAL OF CASE AND EXTENSION HOUSING PARTS

1. If the extension housing seal or bushing is to be replaced, use the tools shown in Fig. 2, Part 6-4.

2. Remove 5 extension housing to case bolts. Remove the extension housing.

3. Remove the governor (Fig. 3) and the governor drive ball.

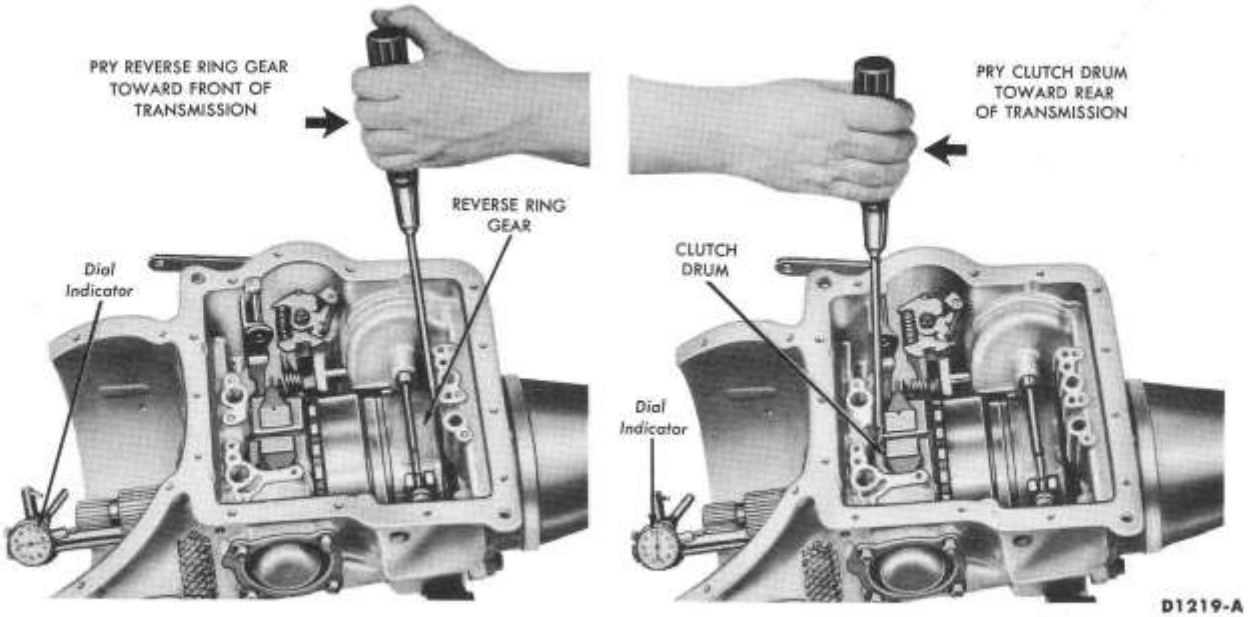


FIG. 2—Transmission End Play Check

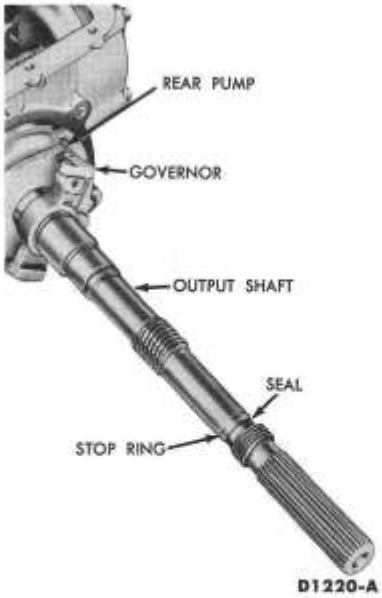


FIG. 3—Output Shaft and Governor

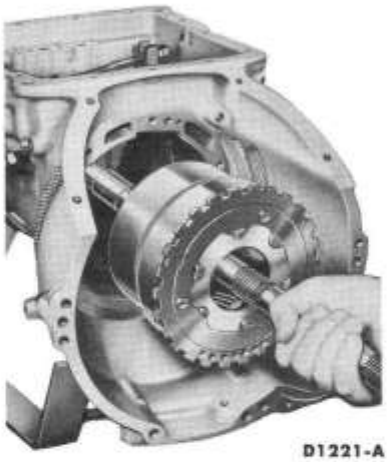


FIG. 4—Output Shaft Removal or Installation

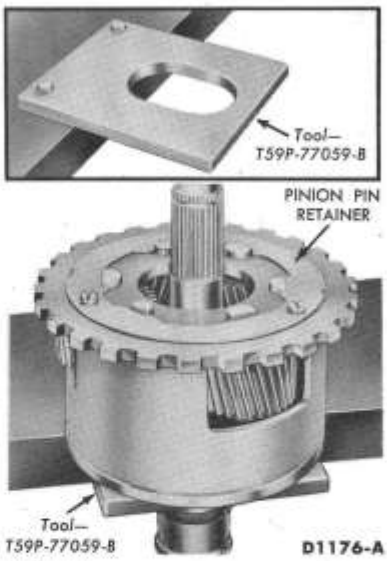


FIG. 5—Output Shaft Mounted in Bench Fixture

4. Remove the 7 bolts that attach the front pump housing to the transmission case. Remove the front pump and stator support assembly.

5. Loosen the low band adjusting screw. Remove the low band struts. Remove the seal ring from the primary sun gear (turbine) shaft and then remove the clutch drum. Now, remove the low band.

6. Pull on the primary sun gear (turbine) shaft and remove the integral pinion carrier and output shaft, and the reverse ring gear (Fig. 4) from the case.

7. Remove the governor pressure seal rings from the output shaft (Fig. 3).

8. Place the integral output shaft and pinion carrier in the bench fixture shown in Fig. 5.

9. Remove the reverse ring gear thrust washer from the case.

10. Remove the 4 rear pump attaching bolts and remove the rear pump from the case.

11. Remove the reverse band from the case.

2 OVERHAUL OF SUB-ASSEMBLIES

During the repair of the sub-assemblies, certain general instructions which apply to all units of the transmissions must be followed. These instructions are given here to avoid unnecessary repetition.

Handle all transmission parts carefully to avoid nicking or burring the bearing or mating surfaces.

Lubricate all internal parts of the transmission before assembly with automatic transmission fluid. **Do not use any other lubricants.** Gaskets and thrust washers may be coated with vaseline to facilitate assembly. Always install new gaskets when assembling the transmission.

Tighten all bolts and screws to the recommended torque.

FRONT PUMP AND STATOR SUPPORT

1. Remove the 5 bolts that attach the stator support to the front pump housing. Remove the stator support shaft from the pump housing (Fig. 6).

2. Inspect the clutch drum journal (Fig. 6) for wear and roughness.

3. Check the side clearances between the clutch apply pressure seal rings and their grooves in the stator support. These clearances should be between 0.0035 and 0.0045 inch.

4. Remove the clutch apply rings and install them in their normal running position in the clutch drum. Then check the ring gaps. Manufacturing tolerance on this ring gap is 0.002-0.009 inch.

5. Inspect the clutch drum front (selective) thrust washer for wear. Inspect the primary sun gear (turbine) shaft bushing in the stator support shaft.

6. **Note the spacing of the 5 slippers in the rotor.** Lift the rotor and slippers and slipper springs from the front pump housing. Check the pump housing and slippers for excessive wear.

7. The converter pressure relief valve and converter-out check valve may be removed from the pump housing (Fig. 6).

8. Inspect the converter pump drive hub bushing in the front pump housing. Inspect the pump drive hub seal in the pump housing. If a new seal is to be installed, use the tool shown in Fig. 7.

If the converter stator to impeller clearance is to be checked, refer to Part 6-6 for the proper procedure before the front pump is assembled.

9. To assemble the front pump, place the rotor in the pump housing with the flat side up.

10. Install the 5 slippers and springs between the rotor and pump housing. **Position the slippers and springs so that any slot of the rotor, and either of the two slots diametrically opposite to it, are without slippers.** Make sure each spring bottoms in the spring hole in the slipper.

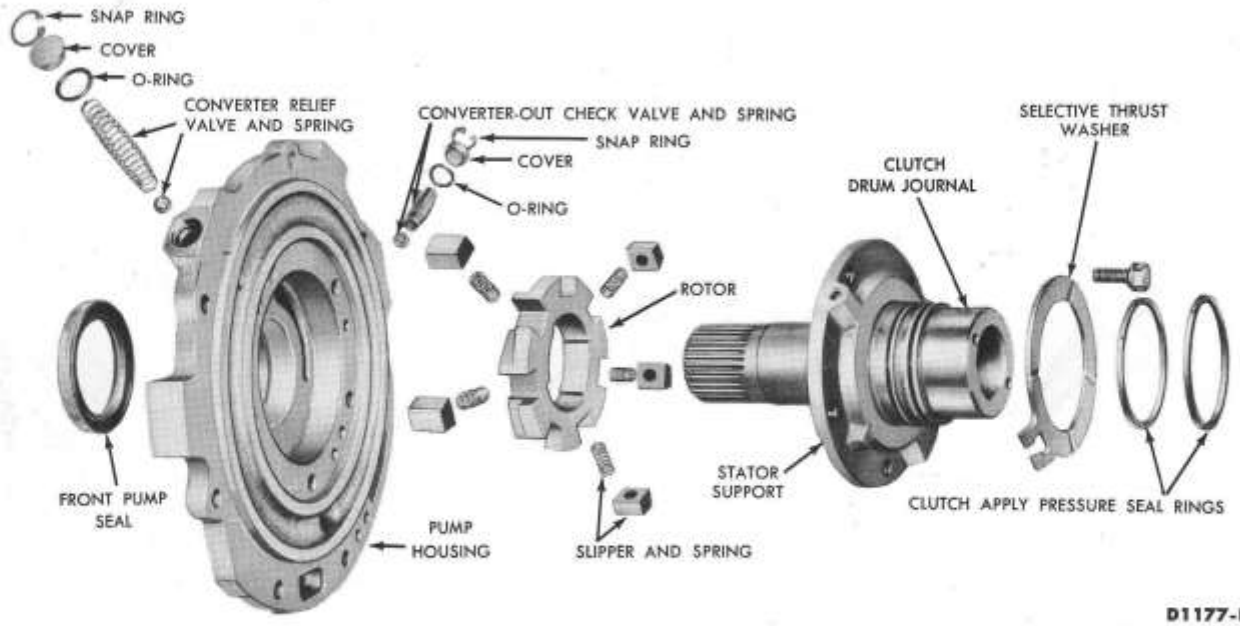


FIG. 6—Front Pump and Stator Support

11. Place the stator support in the pump housing and install the 5 bolts. Torque the bolts to 12-17 ft-lbs.

12. Check the pump for rotation by placing it on the converter pump drive hub in normal running position and turning the pump housing.

FIG. 7—Front Pump Seal Installation

REAR PUMP

1. Remove the screws that attach the rear pump cover plate to the housing. Remove the cover plate (Fig. 8). **Note the spacing of the 5 slippers in the rotor.**

2. Remove the rotor, slippers and springs.

3. Inspect the output shaft support bronze bushing in the rear pump housing for wear. Inspect the rear area of the housing I D for governor pressure seal ring wear.

4. Install the governor pressure seal rings in the pump housing and check the ring gap. Manufacturing tolerance for this ring gap is 0.001-0.006 inch.

5. Check the governor pressure orifice for obstruction.

6. Inspect the slippers and pump housing for wear. The pump housing, slippers, and rotor must be replaced as a matched assembly. The slippers may be replaced as a set in the old housing and rotor.

7. To assemble the rear pump, place the rotor in the pump housing with the flat side up. Turn the rotor so that the flat surface on the I D is toward the bottom of the pump housing. Install the 5 slippers and springs between the rotor and housing (Fig. 8).

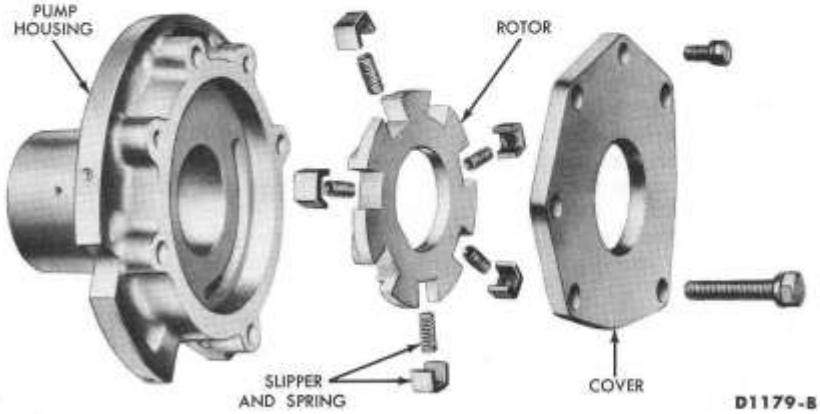


FIG. 8—Rear Pump—Disassembled

8. Place the cover on the pump housing and torque the screws to 50-60 inch-pounds.

9. Install the pump on the output shaft in its normal running position. Check the pump for free rotation by turning the pump housing.

Before removing the pump from the output shaft, make sure that the flat surface on the pump rotor I.D. is toward the bottom of the pump housing.

GOVERNOR

1. Remove the two screws that attach the governor cover end plate to the housing (Fig. 9).

2. Remove the governor valve from the housing.

3. Inspect the governor valve and housing for wear. **Crocus cloth may be used to polish the valve if care is taken to avoid rounding the sharp edges of the valve.**

4. Install the governor valve in the valve body and check the valve for free movement. The valve should fall of its own weight when dry.

5. Install the governor body end plate cover, and torque the screws to 20-30 inch-pounds.

HIGH CLUTCH

1. Remove the snap ring that retains the forward sun gear and flange in the clutch drum (Fig. 10). Lift the gear and flange out of the drum.

2. Remove the clutch plate pack and the clutch hub.

3. Place the tool shown in Fig. 11 on the clutch piston return spring retainer, and then place the clutch drum under a press. Compress the spring and remove the snap ring. **Guide the spring retainer as the press ram rises, so that the retainer does not slide into the snap ring groove.**

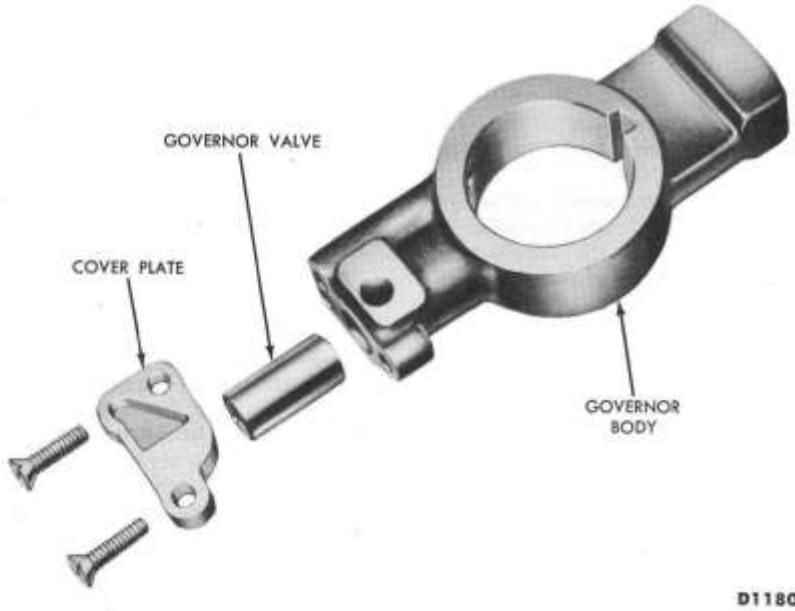


FIG. 9—Governor—Disassembled

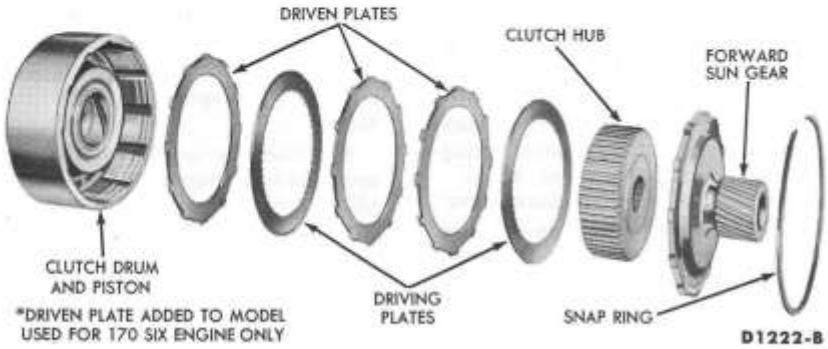


FIG. 10—Clutch Plate Pack Assembly

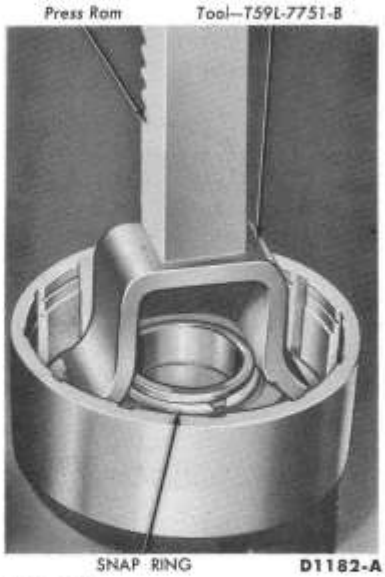


FIG. 11—Clutch Spring Snap Ring Removal

4. Place the clutch drum on the completely assembled stator support shaft and front pump housing (Fig. 12). Apply air pressure at the point shown to force the piston out of the clutch drum.

5. Remove the piston outer seal from the piston and the piston inner seal from the drum (Fig. 13).

6. Inspect the drive plates for damage (Fig. 10). These plates should be flat. If there is any visible dish in them, they must be replaced. If the old plates are to be reused, they must **not** be cleaned in a vapor degreaser or cleaned with any sort of detergent solution. Wipe them clean with lint-free towels.

If new drive plates are to be installed, soak them in automatic transmission fluid for at least 15 minutes

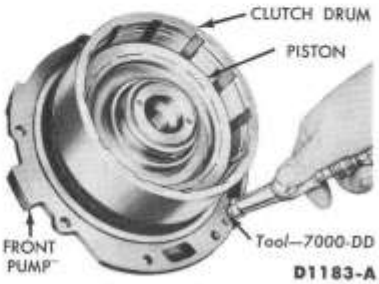


FIG. 12—Clutch Piston Removal

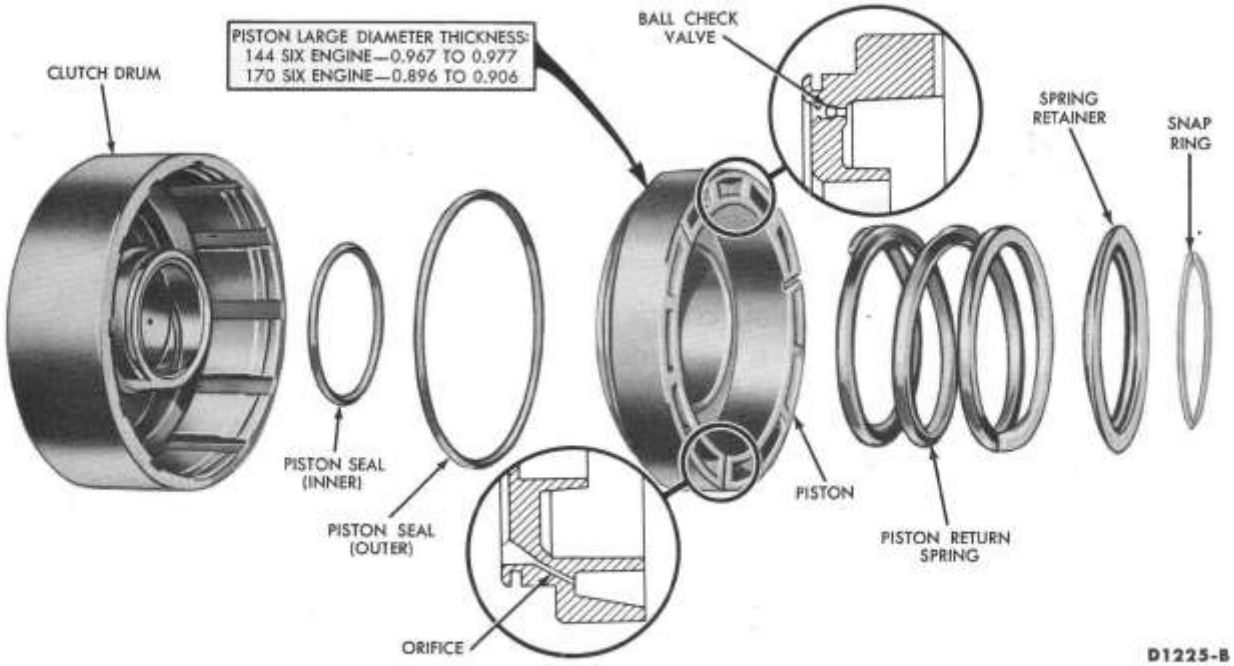


FIG. 13—Clutch Drum and Piston

before assembling them in the clutch drum. This soaking prevents damage to the plates during the transmission fluid fill period and initial "running-in".

7. Inspect the steel driven clutch plates. These clutch plates should also be flat. If there is any visible dish in the driven plates, they should be replaced.

8. Inspect the clutch piston ball check valve for free movement and proper seating (Fig. 13). Make sure the orifice in the clutch piston is open.

9. Inspect the clutch drum bushing for wear.

10. Install a new piston inner seal in the clutch drum (Fig. 13). Install a new outer seal on the clutch piston. Lubricate the piston seals with automatic transmission fluid, and install the piston in the clutch drum.

11. Place the clutch piston return spring and spring retainer on the piston. Place the clutch drum under a press (Fig. 11) and install the spring retainer snap ring.

12. To assemble the clutch (for the 144 Six engine), install the two drive and two driven plates alternately in the clutch drum, starting with a steel plate (next to the piston).

To assemble the clutch (for the 170 Six engine), begin by installing a steel (driven) plate next to the piston, a non metallic (driving) plate, **two** steel plates, and a non-metallic plate. The last plate in either clutch pack (top of the pack) should be a non-metallic drive plate.

13. After the correct number of clutch plates has been installed in the drum, install the clutch hub. **There is no washer between the clutch hub and the forward sun gear flange.**

14. Install the integral forward sun gear and flange in the clutch drum, and then install the snap ring.

CONTROL VALVE BODY

DISASSEMBLY

Two different control valve bodies are used in the Falcon Fordomatic transmission. Even though the control valve bodies are similar in appearance, one is calibrated for the 144 Six engine and the other for the 170 Six engine. Each valve body is identified by a number stamped on the lower body (Fig. 16).

1. Remove the manual valve (Fig. 14).

2. Remove the control pressure regulator valve spring retainer, spring (Table 1), and spring seat. Remove the control pressure regulator valve.

3. Remove the hold-down plate near the compensator cut-back valve cover, and then remove the cover plate. Remove the compensator cut-back valve spring and valve from the lower body.

4. Remove the 1-2 shift valve governor plug cover plate, and then remove the plug.

5. Remove the compensator valve cover plate. Maintain pressure on this cover against the spring force until all the screws are removed.

6. Remove the throttle modulator plug and sleeve, the governor pressure plug, throttle modulator plug pin, and the pin guide.

7. Remove the compensator valve springs. Remove the compensator valve. Install the hold-down plate and screw so that the separator plate is held on the upper body.

8. Remove the 1-2 shift valve and orifice control valve cover plate. Remove the throttle pressure reducing valve and spring from the lower body. Remove the orifice control valve spring, valve, and the orifice control valve plug.

9. From the upper body (Fig. 14), remove the throttle lever stop plate.

10. Remove the downshift valve, throttle valve spring, and throttle valve.

11. From the opposite end of the upper body, remove the hold-down plate, and then remove the cover plate for the downshift detent plug. Remove the downshift detent plug spring and plug.

12. Remove the three screws (10-24) and five bolts (¼-20) which hold the upper body, separator plate, and lower body together.

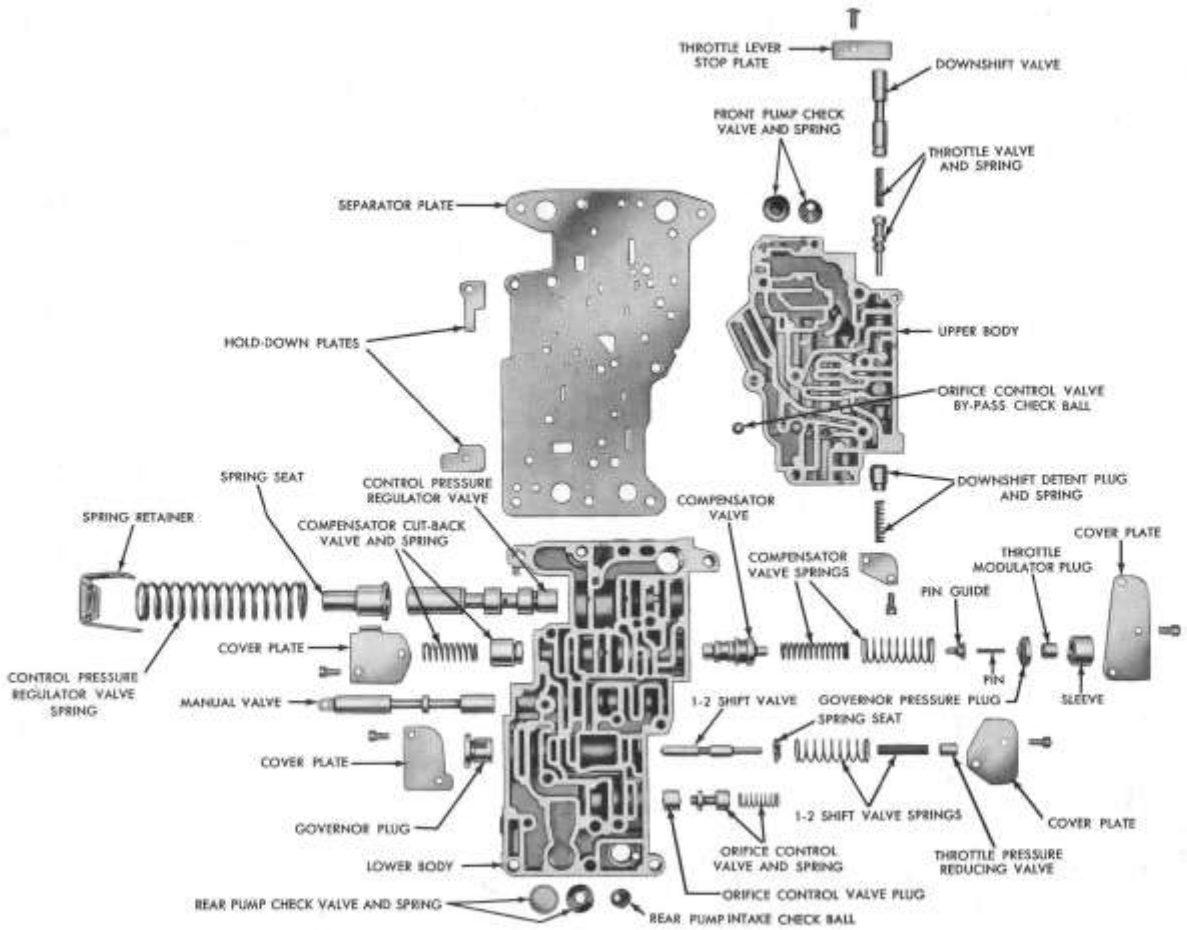


FIG. 14—Control Valve Body

TABLE 1 –Control Valve Body Spring Identification

Spring Description	Free Height (inches)	Total No. of Coils	Wire Diameter (inches)	Outside Diameter (Inches) Min.	Max.
Control Pressure Regulator Valve*	4.20	14.75	.092	1.034	1.064
Control Pressure Regulator Valve†	3.82	14.75	.092	1.034	1.064
Orifice Control Valve	.93	8.75	.0258	.380	.400
Front and Rear Pump Check Valve (Conical)	.717	5.25	.0286	.360 .710	.390 .740
Compensator Valve—Inner	1.74	13.75	.0475	.465	.485
Compensator Valve—Outer	1.84	10.75	.041	.690	.710
Throttle Pressure Reducing Valve†	1.23	20.25	.032	.278	.290
Throttle Pressure Reducing Valve*	1.21	21.25	.0286	.267	.287
Downshift Detent Plug	1.14	13.25	.041	.29	.31
Throttle Valve	1.050	17.	.0348	.247	.257
Compensator Cut-Back Valve†	1.09	9.25	.054	.51	.53
Compensator Cut-Back Valve*	.95	9.25	.054	.51	.53
1-2 Shift Valve*	2.00	10.25	.041	.637	.657
1-2 Shift Valve†	1.85	11.25	.041	.637	.657

†Used with 144 Six Engine.
*Used with 170 Six Engine.

13. Lift the upper body and separator plate from the lower body. Remove the rear pump check valve and spring. Remove the rear pump intake check ball from the lower body.

14. To remove the 1-2 valve from the lower body, compress the 1-2 valve outer spring in the direction of the throttle reducing valve, and then remove the spring seat with needle nose pliers. With the spring seat removed, the 1-2 valve can be pushed out the throttle pressure reducing valve end. Remove the 1-2 valve outer spring.

15. Turn the upper body and separator plate over so that the separator plate is up. Remove the hold-down plate and screw. Lift the separator plate from the upper body.

16. From the upper body, remove the front pump check valve and spring. Remove the orifice control valve by-pass check ball.

INSPECTION

1. Clean all parts thoroughly in clean solvent, then blow dry with moisture-free compressed air.

2. Inspect all valve and plug bores for scores. Check all fluid passages for obstruction. Inspect the check valves for free movement. Inspect all mating surfaces for burrs or distortion. Inspect all plugs and valves for burrs and scores. **Crocus cloth can be used to polish valves and plugs if care is taken to avoid rounding the sharp edges of the valves and plugs.**

3. Inspect all springs for distortion. Check all valves and plugs for free movement in their respective bores. Valves and plugs, when dry, must fall from their own weight in their respective bores.

ASSEMBLY

The assembly procedure given below permits installing each valve, except the 1-2 valve, in its respective bore with the upper and lower bodies attached together at normal torque. The 1-2 valve must be installed before the bodies are bolted together. This valve can be checked for proper fit after the bodies are assembled as shown in Figs. 15 and 16. Refer to Table 1 for the proper spring application for the two control valve bodies that are used.

1. Place the orifice control valve by-pass check ball in the upper body (Fig. 15).

2. Install the front pump check valve and spring.

3. Place the separator plate on the upper body and retain it in proper position by installing the hold-down plate and screw.

4. Assemble the 1-2 valve spring, 1-2 valve, and the 1-2 valve spring seat in the lower body. Place the rear pump check valve and the rear pump intake check ball in the lower body.

5. Place the upper control valve body and separator plate assembly on the lower body. Install the 5 bolts (¼-20) which attach the upper and lower control valve bodies. Install the 3 screws (10-24) which also attach the upper and lower control valve bodies. Torque the bolts and screws (Fig. 15).

6. With the upper and lower control valve bodies at normal assembled torque, check the 1-2 valve for free movement (Fig. 15). Check and adjust the bolt and screw torque as required, to obtain free movement on the 1-2 shift valve.

7. In the upper body, install the downshift detent plug, spring, and cover plate (Fig. 16). Install the hold-down plate and screw. Torque the hold-down plate and cover screws to 20-30 inch-pounds.

8. At the opposite end of the upper body, install the throttle valve and spring, and the downshift valve. Install the throttle lever stop. Torque the transmission throttle lever stop screw to 20-30 inch-pounds.

9. In the lower body, install the compensator valve and springs (refer to Table 1 for proper spring installation). Install the throttle pressure plug spring guide, governor pressure plug and pin. **The governor pressure plug is installed with the flat side up.** Install the throttle pressure plug sleeve, and throttle pressure plug. Install the cover plate. Hold the cover plate down against the lower body, until the cover plate screws are tight.

10. Install the 1-2 shift valve inner spring and the throttle pressure reducing valve.

11. Install the orifice control valve plug, orifice control valve and spring. Install the cover plate for the throttle reducing valve and orifice control valve. Torque the screws to 20-30 inch-pounds (Fig. 16).

12. In the lower body, install the 1-2 valve governor plug. Install the cover plate, and torque the screws to 20-30 inch-pounds.

13. Install the compensator cutback valve and spring. Refer to Table 1 for proper spring application. Install the cover plate, and torque the attaching screws to 20-30 inch-pounds.

14. Install the control pressure regulator valve, spring seat and spring. Compress the control pressure regulator valve spring and install the spring retainer.

PLANETARY GEAR SYSTEM

The primary sun gear must be removed from the pinion carrier to inspect the primary sun gear front thrust bearing and race, the primary sun gear rear thrust washer, and the primary sun gear pilot bushing. To

remove the primary sun gear from the pinion carrier, the short pinions must be removed from the pinion carrier housing.

PINION CARRIER DISASSEMBLY

1. Mark the pinion shafts so that they can be reassembled in the same locations.

2. Remove the screws that attach the pinion shaft retainer to the pinion carrier (Fig. 5). Turn the retainer counterclockwise until the shafts are unlocked. The overhaul fixture shown in Fig. 5 permits removing only one piston shaft at one time.

3. With the tool shown in Fig. 17, push a short pinion shaft up from the bottom until the tool clears the

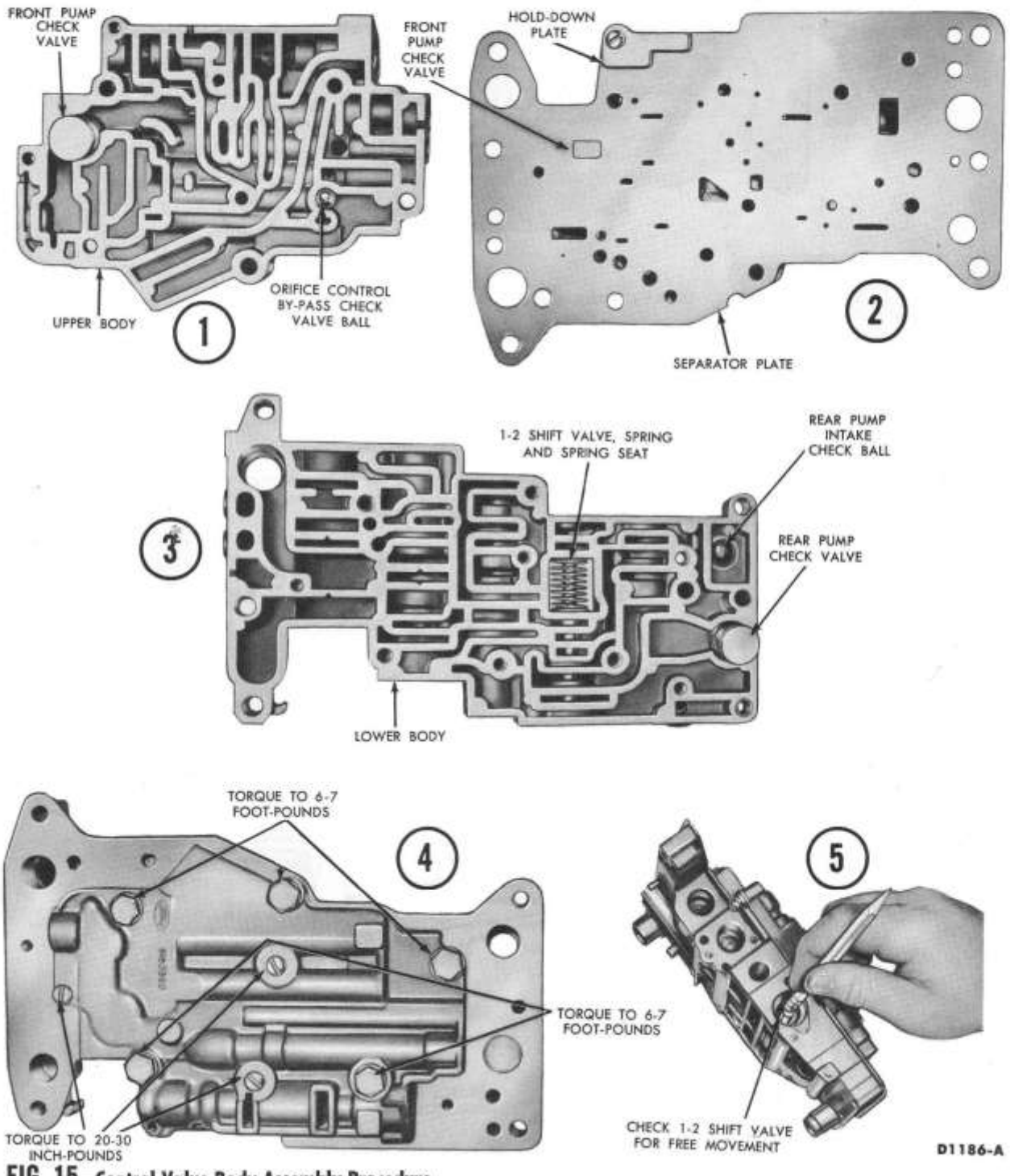


FIG. 15—Control Valve Body Assembly Procedure

top of the gear spacer. Now, slide the short pinion and its upper and lower thrust washers out the pinion carrier window. **To avoid loss of needle bearings, carefully keep both washers in position against the pinion.** Retain the needle bearings and spacer in the short pinion by pushing the tool out with the removed shaft. Remove the gear spacer.

4. Remove the 2 remaining short pinions and spacers, using the same procedure.

5. Remove the integral primary sun gear and shaft (Fig. 18).

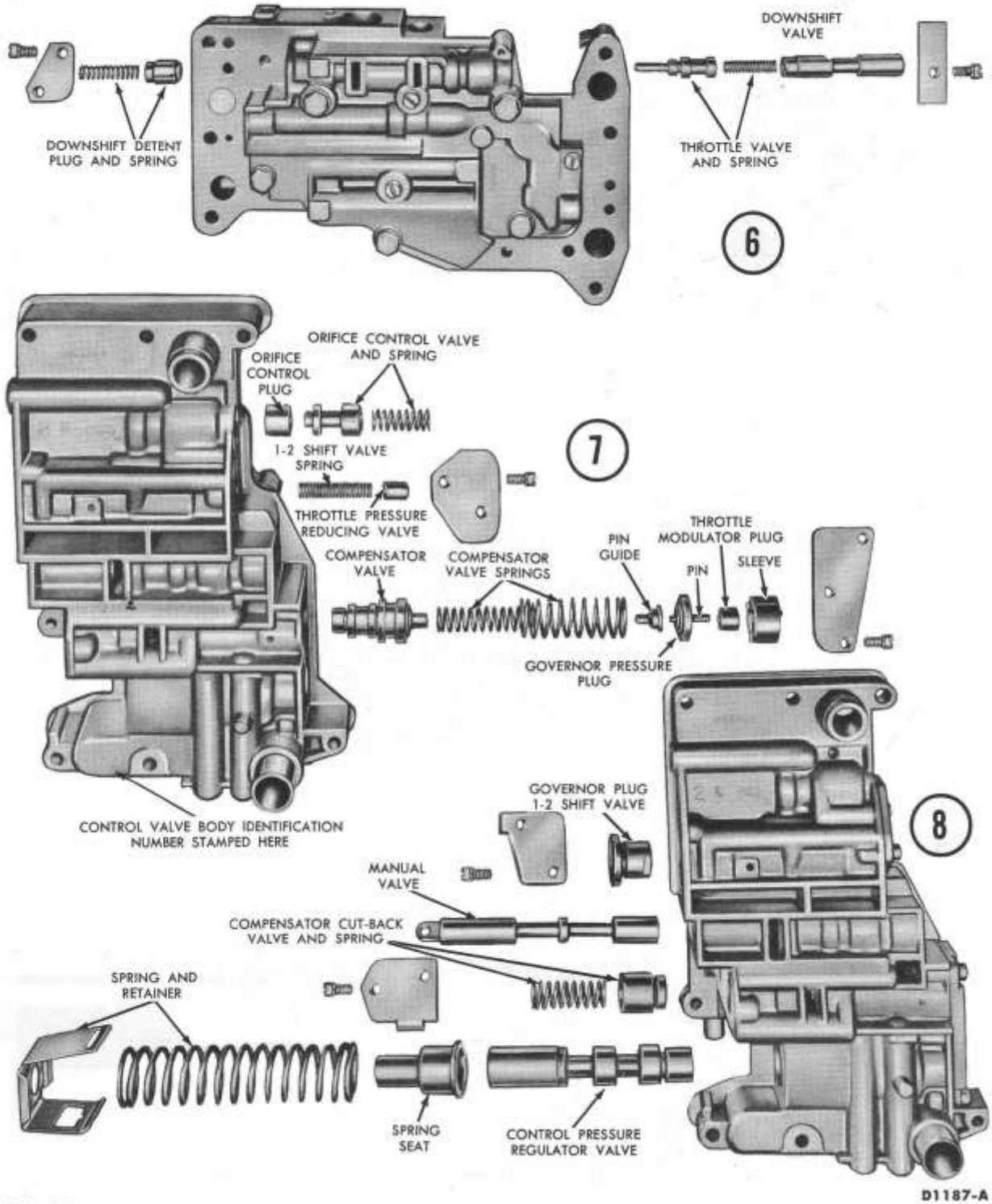


FIG. 16–Control Valve Body Assembly Procedure

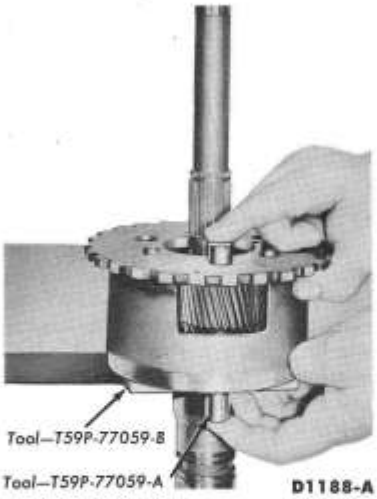


FIG. 17–Short Pinion Removal or Installation

6. With the tool shown in Fig. 19, push a long pinion shaft up until the tool just clears the pinion carrier bottom plate. Remove the long pinion gear with its top and bottom thrust washers out the center of the pinion carrier. With the pinion shaft, push the tool out of the gear. The shaft will hold the needle bearings, spacer, and thrust washers in position.

7. Remove the remaining 2 long pinion gears, using the same procedure.

PINION CARRIER INSPECTION

1. Inspect the pilot journal on the primary sun gear shaft and the pilot bushing in the output shaft.

2. Inspect the primary sun gear rear bronze thrust washer. Inspect the primary sun gear front thrust bearing and bearing race.

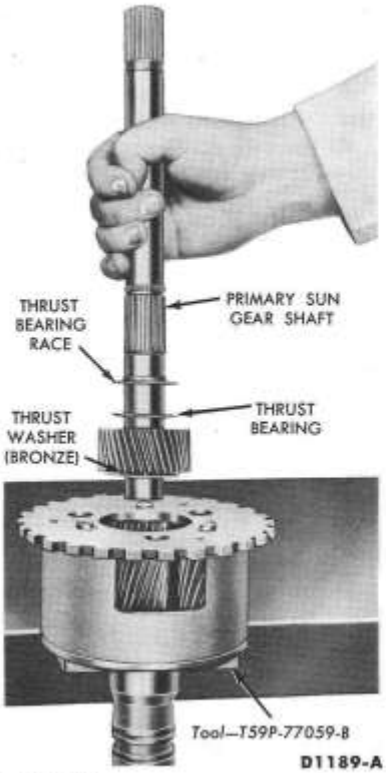


FIG. 18–Primary Sun Gear Removal or Installation

3. Inspect the converter-out pressure seal ring groove, which is machined in the primary sun gear shaft at the clutch hub spline. Excessive leakage at this ring will permit converter-out fluid to by-pass the cooling system and return to sump through the clutch and planetary gears.

4. Inspect the needle bearing

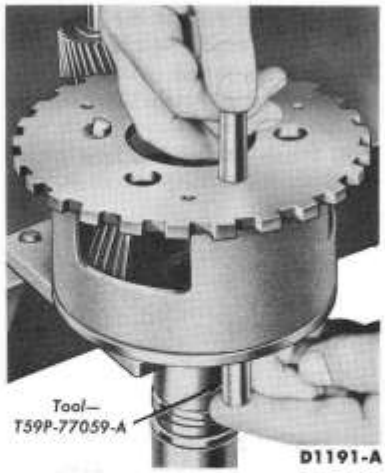


FIG. 19–Long Pinion Removal or Installation

thrust washers. Inspect the needle bearings for wear and roughness.

5. Inspect the planet carrier for excessive wear at the thrust washer locations.

6. Inspect the pinion shafts for wear, roughness, and for burred locking notches.

7. Inspect all gear teeth for burrs, cracks, and nicks.

8. Inspect the pinion carrier teeth that are engaged by the parking pawl.

9. Inspect the governor pressure seal ring grooves in the output shaft.

10. Inspect the rubber seal at the front of the output shaft spline for wear or damage.

PINION CARRIER ASSEMBLY

1. Place a spacer (Fig. 20) in a long pinion, and then insert the dummy shaft (Fig. 19) through the long pinion and needle bearing spacer.

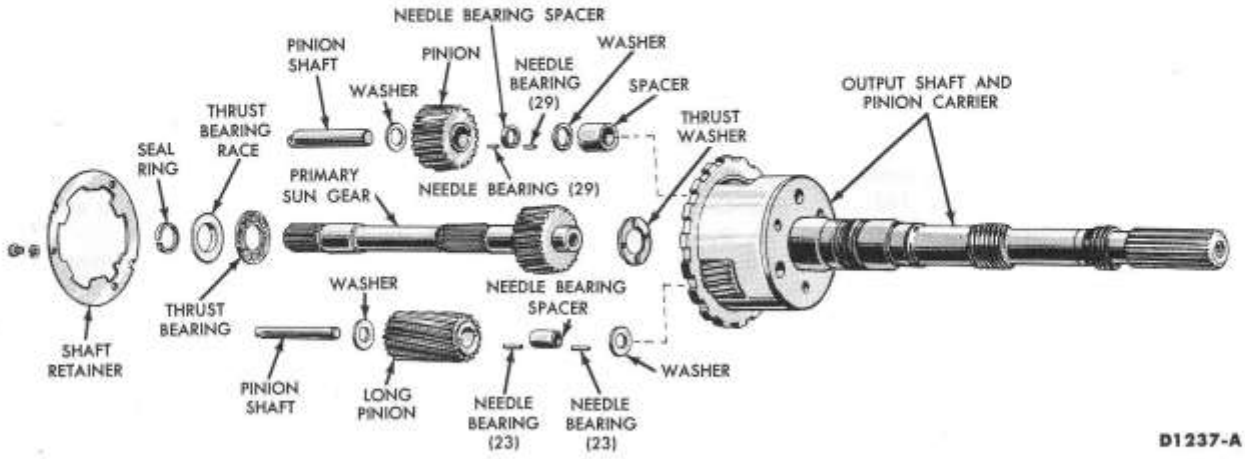


FIG. 20–Pinion Carrier and Primary Sun Gear

2. At each end of the gear, add a row of 23 needle bearings.

3. Place a thrust washer on each end of the gear. Retain the washer to the gear with vaseline.

4. While holding the long pinion assembly together, place it in position in the pinion carrier. Use the marked shaft for this location to push the dummy shaft out the bottom.

5. Using the same procedure, install the remaining long pinions.

6. Place the primary sun gear front thrust bearing and thrust bearing race on the primary sun gear shaft (Fig. 20). Place the bronze thrust washer on the pilot at the rear of the primary sun gear. Hold the washer in place with vaseline. **Make sure the concave side of this dished washer is toward the rear of the transmission.**

7. Place the primary sun gear shaft in the pinion carrier (Fig. 18).

8. Place a spacer (Fig. 20) in a short pinion, and then insert a dummy shaft (Tool T59P-77059-A) through the gear and needle bearing spacer. Install a row of 29 needle bearings and a thrust washer at each end of the gear. Retain the washers in place with vaseline.

9. Place a short pinion spacer (Fig. 20) in the pinion carrier. **To maintain pinion carrier balance, the short pinion spacers must be of the same material.** Insert an extra pinion shaft (upside down) through the bottom of the pinion carrier and into the spacer. Hold the shaft so that it is flush with the top of the spacer.

10. Use the marked shaft for this location to push the dummy shaft and extra pinion shaft out the bottom (Fig. 17).

11. Install the remaining 2 short pinions, using the same procedure.

12. Position the pinion shaft retainer (Fig. 5) on the pinion carrier and turn retainer clockwise to lock the pinion shafts in place. Install the retainer to pinion carrier screws and torque them to 20-30 in-lbs.

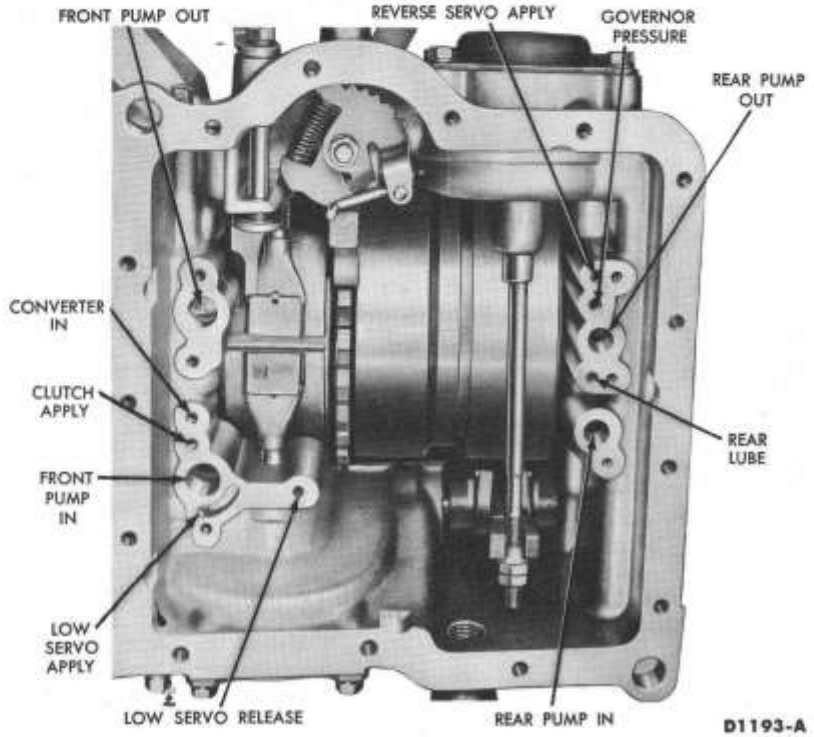


FIG. 21—Transmission Case Fluid Passages

3 TRANSMISSION CASE AND LINKAGE REPAIR

REVERSE SERVO

1. Remove the lock nut, adjusting nut, and the rod seat (half-ball) from the reverse servo piston rod (Fig. 24).

2. Remove the strut between the apply lever and band. Turn the band to unhook it from its anchor and remove the band.

3. Remove any two reverse servo cover to case bolts that are 180° apart. Install two 1 3/16-inch long bolts. Run the bolts in until they bottom.

4. Remove the two remaining short bolts and the identification tag. Remove the cover, piston return spring, and servo piston rod.

5. Apply air pressure at the reverse servo apply passage in the case (Fig. 21), and force the reverse servo piston out of the case.

6. Remove the servo piston outer seal. The servo piston guide may be removed from the piston by removing the lock ring on the piston guide.

7. Inspect the servo piston and piston bore for wear and roughness.

8. Install a new seal on the servo piston. Install the piston in the case. Insert the piston rod through the servo and into the case.

9. Place a new seal on the servo cover. **Do not twist the seal.**

10. Position the return spring and the cover. Start two 1 3/16-inch long bolts into any two bolt holes that are 180° apart.

11. Carefully pull the cover against the case by tightening the two long bolts until they bottom.

12. Start the two short bolts and tighten them carefully. Remove the two long bolts and install the two remaining short bolts. Be sure to place the identification tag on the lower rear cover bolt. Torque the cover bolts to 12-15 ft-lbs.

LOW SERVO

1. Remove 2 low servo cover retaining bolts which are nearest to 180° apart (Fig. 22). Install two 1-inch long bolts (5/16-18), or any two front pump attaching bolts, into the bolt holes. Run the bolts in until they bottom.

2. Remove the remaining cover bolts, then remove the two longer bolts, by turning each bolt one turn at a time. Remove the servo cover, piston, and spring.

3. Inspect the servo piston and piston bore for excessive wear and roughness.

4. Check the low servo piston re-

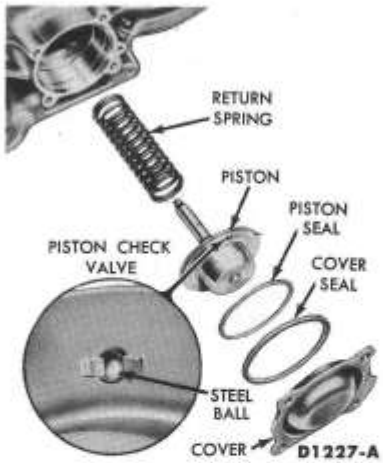


FIG. 22—Low Servo Assembly

turn spring against the specifications given in Table 2. **If the proper spring is not installed, the low band release will not be synchronized with clutch application and the shift will be rough.**

5. Install a new seal on the low servo piston. Install a new seal on the servo cover.

6. Place the piston return spring, piston, and cover in position in the case. **The low servo piston ball check valve (Fig. 22) must be at the top, when the transmission is in normal running position.** Start the two 1-inch long bolts in bolt holes 180° apart.

7. Carefully pull the cover against the case by tightening the two bolts until they bottom.

8. Start the two regular bolts and tighten them carefully. Remove the two long bolts and install remaining bolts. Torque the cover bolts to 12-15 ft-lbs.

THROTTLE LINKAGE

1. Remove the nut and lockwasher from the throttle lever shaft (Fig. 23). Remove the outer throttle lever from the shaft.

2. Remove the shaft and inner throttle lever from inside the case. Then remove the conical spring.

3. Remove the O-ring from the counterbore at the outer end of the throttle lever shaft hole. Install a new O-ring.

4. Place the conical spring on the throttle lever shaft with the large end of the spring against the inner throttle lever.

5. Insert the throttle lever shaft into the case. Install the outer lever on the shaft, and then install the lockwasher and nut. Torque the nut to 17-20 ft-lbs.

TABLE 2—Low Servo Return Spring Specifications

Engine Model	Free Height (inches)	Total Coils	Wire Diameter (inches)
144 Six	4.01	12	0.177
170 Six	3.17	9.75	0.207

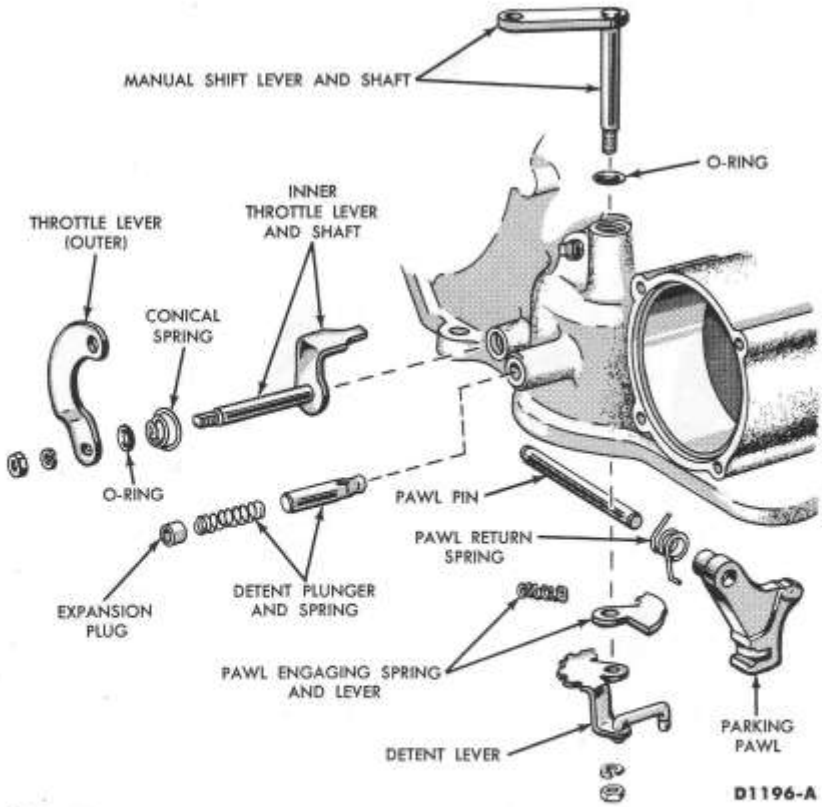


FIG. 23—Throttle and Manual Linkage

MANUAL LINKAGE

DISASSEMBLY

1. Remove the nut and lockwasher from the manual lever shaft (Fig. 23).

2. Remove the detent lever, detent plunger and spring, and the parking pawl engaging lever to detent lever spring. Remove the parking pawl engaging lever.

3. Remove the manual lever shaft from the case. Remove the O-ring at the outer shaft hole counterbore.

4. Release the parking pawl return spring tension. Slide the parking pawl pin out of the front of the case. Remove the parking pawl and pawl spring.

ASSEMBLY

1. Place a new O-ring in the manual lever shaft hole counterbore. Install the manual lever and shaft in the case (Fig. 23).

2. Place the parking pawl engaging lever on the shaft.

3. Place the detent spring and plunger in the case, and then install the detent lever on the shaft. Install the lockwasher and nut on the shaft. Torque the nut to 17-20 ft-lbs.

4. Compress the pawl engaging lever to detent lever spring and install it between the levers.

5. Place the parking pawl and spring in position in the case, and then insert the pawl pin. Hook the spring to the pawl.

REVERSE BAND APPLY LINKAGE

1. Drill a 5/16-inch hole through the expansion plug at the back of the reverse band anchor and apply lever pin (Fig. 24).

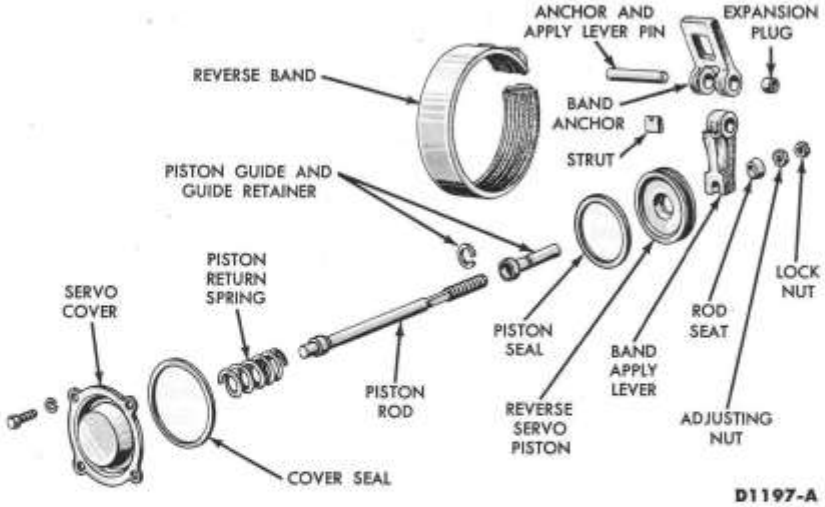


FIG. 24—Reverse Servo Piston and Band Apply Linkage

2. Thread a ¼-20 bolt (through the drilled hole) into the apply lever pin. If the pin and plug cannot be pulled out by hand, attach tool T50T-7140-B to the bolt head, and then attach slide hammer T-59L-100-B to the tool.

3. Remove the apply lever and anchor from the case.

4. To assemble the reverse band apply linkage, place the lever and anchor in position, insert the pin, and install a new expansion plug.

THREAD REPAIR

Figure 25 shows the procedure for repairing damaged threads. The repair system shown has been developed by the Heli-Coil Corporation of Danbury, Connecticut.

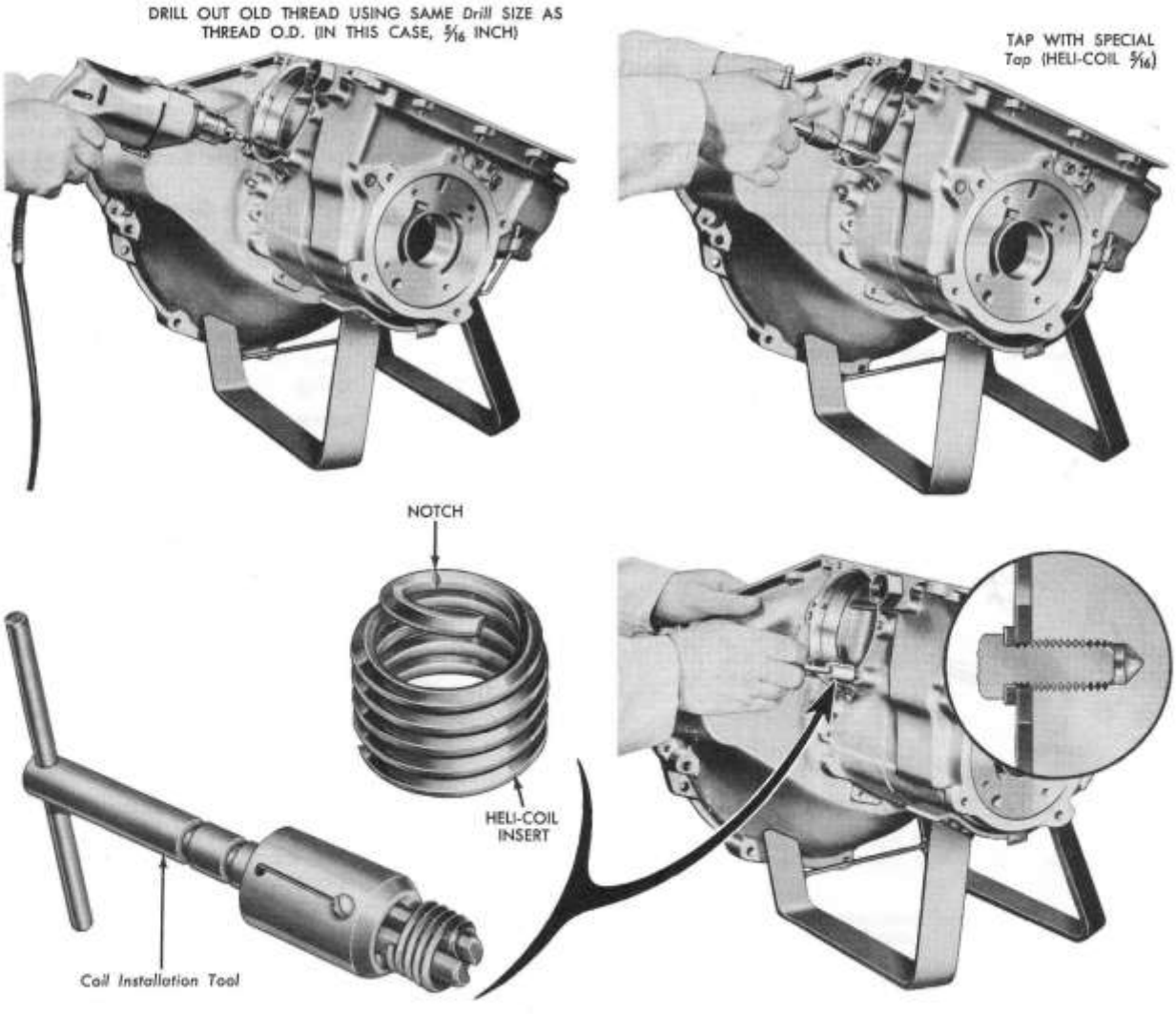


FIG. 25—Thread Repair Procedure

Thread service kits may be purchased from local jobbers or the Heli-Coil Corporation.

To repair a damaged thread, the following procedures should be carefully followed.

1. Drill out the damaged threads, **using the same drill size as the thread O.D.** For example, use a 5/16-inch drill for a 5/16-18 thread.

2. Select the proper **special** tap and tap the drilled hole. The tap is marked for the size of the thread being repaired. Thus, the special tap marked 5/16-18 will not cut the same thread as a standard 5/16-18 tap. It does cut a thread large enough to accommodate the insert, and after the insert is installed the original thread size (5/16-18) is restored.

3. Select the proper coil inserting tool. These tools are marked with the thread size being repaired. Place the insert on the tool (Fig. 25) and adjust the sleeve to the length of the insert being used.

Press the insert against the face of the tapped hole. Turn the tool clockwise and wind the insert into the hole until the insert is ½ turn below the face.

4. Working through the insert, bend the insert tang straight up and down until it breaks off at the notch (Fig. 25).

5. If the inserts are not properly installed, they can be removed with the extractor tool. Place the extractor tool in the insert so that the blade rests against the top coil ¼ to ½ turn away from the end of the coil. Tap the tool sharply with a hammer so that the blade cuts into the insert. Exert downward pressure on the tool and turn it counterclockwise until the insert is removed.

4 INSTALLATION OF SUB-ASSEMBLIES

TRANSMISSION CASE

1. Install the rear oil pump in the case. Install but do not tighten the pump attaching (4) bolts.

2. Place the reverse band in the case. **The band end having a guide pin for the strut goes toward the apply lever strut.** Make sure the anchor end of the band engages the band anchor. (Fig. 24). Compress the band and install the strut between the band apply lever and the band.

3. Position the reverse servo apply rod in the band apply lever. Start the rod seat (half-ball), adjusting nut, and locknut on the apply rod.

4. Place the reverse ring gear rear thrust washer on the rear pump extension at the rear of the case.

5. Install the reverse ring gear on the rear pump extension.

GEAR TRAIN INSTALLATION

1. Place the reverse ring gear front thrust washer on the output shaft and against the flange at the pinion carrier.

2. Install the governor pressure seal rings on the output shaft. The ring gaps should be at the top as the output shaft is installed. As the output shaft is installed, the flat surface which drives the rear pump must engage the rotor (Fig. 26).

3. Install the output shaft in the case (Fig. 4). Some difficulty may be experienced in starting the output shaft flat surface into the rear pump rotor. The flat on the output shaft and the flat in the rotor should be up (actually toward the bottom of the transmission). The slipper springs will position the rotor in the center. Its normal running position is off-center and toward the bottom of the transmission. When the flat on the output shaft comes in contact with the rotor, lift upward on the rotor with a small screwdriver while keeping steady pressure on the output shaft. When the flats align, the output shaft will slip into position.

If the rotor and output shaft will not align, remove the pump cover plate, rotor and slippers. Slide the output shaft into normal running position. Assemble the rotor on the output shaft and in the pump housing. Install the slippers and slipper springs (Fig. 8). Install the cover plate and attaching bolts and screws.

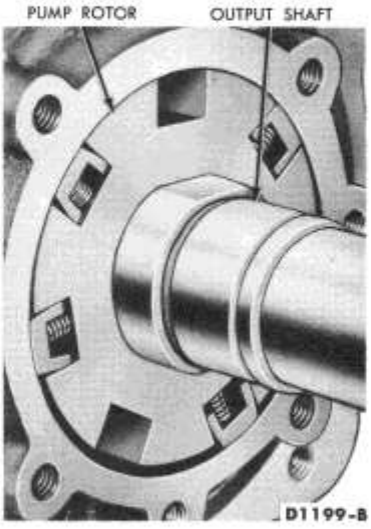


FIG. 26—Rear Pump Rotor Alignment

As the bolts are tightened, check the pump for free rotation. Torque the bolts to 12-15 ft-lbs. Torque the screws to 50-60 inch-pounds.

4. Install the low band, inserting it through the front of the transmission case. **The end of the band having a guide pin for the strut goes to the adjusting screw side.** Install the band struts.

5. Install the clutch in the case and on the primary sun gear (turbine shaft). Mesh the forward sun gear with the short pinion and then bottom the forward sun gear on the primary sun gear front thrust bearing and race.

6. Install the converter-out pressure seal ring on the primary sun gear shaft. This ring groove is in the clutch hub spline.

7. Using the end play reading which was taken during disassembly, select the proper selective thrust washer to be installed on the stator support shaft (Fig. 6). Selective thrust washers are available in thicknesses of 0.067-0.069, 0.074-0.076, 0.083-0.085, and 0.092-0.094 inch.

8. Install the clutch apply pressure seal rings on the stator support shaft.

9. Place a new gasket on the pump housing, and then install the pump in the case. Be careful not to break the converter-out pressure ring seal. Torque the bolts to 18-22 ft-lbs.

10. Install the governor ball, governor, and retaining ring on the output shaft (Fig. 3).

11. Place a new gasket on the transmission case, and install the extension housing. Torque the housing to case bolts to 28-38 ft-lbs.

12. Install the extension housing seal replacer tool in the extension housing to align the output shaft. Check the gear train end play, using the procedure given in Section 1 of this part.

13. If the end play is not within 0.020-0.039 inch, change the selective washer to bring the end play within these limits.

BAND ADJUSTMENTS

LOW BAND

1. Tighten the low band adjusting screw with the special torque wrench (Fig. 6, Part 6-2) until the wrench is felt and heard to click. This tool is a pre-set torque wrench which clicks and overruns when torque on the screw reaches 10 ft-lbs.

2. At the point the wrench overruns, back off the adjusting screw exactly 2 turns.

3. Hold the adjusting screw at this position and torque the locknut to 35-40 ft-lbs.

REVERSE BAND

1. Place the tool (Fig. 7, Part 6-2) on the rear servo piston rod so that the two forks straddle the band apply lever. The inner fork must engage the flat on the servo piston rod. The outer fork must be inserted between the rod seat (half-ball) and the adjusting nut. This fork provides a ¼-inch spacer between the rod seat and the adjusting nut.

2. Tighten the adjusting nut until the wrench is felt and heard to click and overrun. This tool is a pre-set torque wrench which clicks and overruns when 45-50 inch-pounds torque is applied to the adjusting nut.

3. Back off the adjusting nut exactly 2 turns.

4. Pull the tool (T59P-77423-A) away from the servo rod about one inch. This will permit the adjusting nut to drop into a nut holding slot provided in the tool.

5. Hold the adjusting nut against rotation and tighten the locknut against it to 15-18 ft-lbs torque.

6. Remove the tool from the piston rod.

CONTROL VALVE BODY AND OIL PAN INSTALLATION

1. Position the control valve body on the case. Be sure the inner throttle lever is between its stop on the upper body and the downshift valve. Connect the detent plate link to the manual valve.

2. Install the 6 control valve body to case bolts and torque them to 8-10 ft-lbs.

3. Install the oil screen and screen clip.

4. Place a new gasket on the transmission case and install the oil pan. Torque the pan bolts to 10-13 ft-lbs.

PART 6-6 CONVERTER CHECKS

The torque converter is permanently enclosed in a welded steel housing and cannot be disassembled for servicing.

A special tool (Fig. 1) must be used to check the condition of the converter. This special tool is used to check the turbine and stator end play and the operation of the one-way stator clutch.

TURBINE AND STATOR END PLAY CHECK

1. Insert the tool into the converter pump drive hub until it bottoms.

2. Install the guide over the converter pump drive hub.

3. Expand the split fiber bushing in the turbine spline by tightening the adjusting nut. Tighten the adjusting nut until the tool is securely locked to the turbine spline.

4. Attach a dial indicator to the tool (Fig. 2). Position the indicator button on a converter pump drive hub lug, and set the dial face at 0 (zero).

5. Lift the tool upward as far as it will go and note the indicator reading. The indicator reading is the total end play which the turbine and stator share. If the total end play exceeds 0.060 inch, replace the converter.

6. Loosen the adjusting nut to free the split bushing, and then remove the tool from the converter.

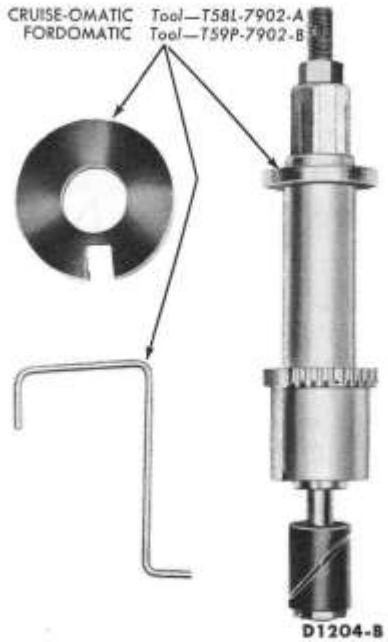


FIG. 1—Converter Checking Tool

STATOR ONE-WAY CLUTCH CHECK

1. Install the stator outer race holding tool in one of the holes provided in the stator.

2. Insert the tool in the converter pump drive hub.

3. As the tool enters the converter, the spline on the tool (Fig. 1) will engage the stator clutch inner race spline.

4. Place a torque wrench on the tool (Fig. 3). The tool (and stator inner race) should turn freely clockwise (from the pump drive hub side of the converter). It should lockup and hold a 10 ft-lb pull when the wrench is turned counterclockwise. Try the clutch for lockup and hold in at least five different locations around the converter. If the clutch fails to lockup and hold a 10 ft-lb torque, replace the converter unit.

5. Remove tools from the converter.

FIG. 2—Turbine and Stator End Play Check

STATOR TO IMPELLER INTERFERENCE CHECK

1. Position a stator support shaft on the bench with the spline end of the stator shaft pointing up (Fig. 4).

2. Place the front pump rotor over the stator shaft with the flat side of the rotor down.

3. Place the converter over the stator support shaft so that the front pump driving lugs are in normal (running) engagement with the pump rotor. The converter pump driving hub will bottom on the rotor.

4. While holding the stator shaft stationary, try to rotate the converter counterclockwise. The converter should rotate freely without any signs of interference or scraping within the converter assembly.

5. If there is an indication of scraping, the trailing edges of the stator blades may be interfering with the leading edges of the impeller

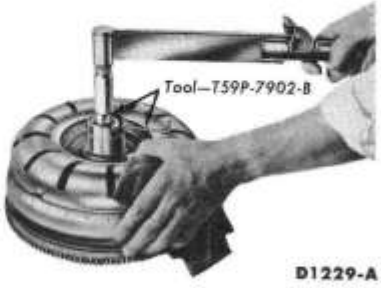


FIG. 3—Stator One-Way Clutch Check

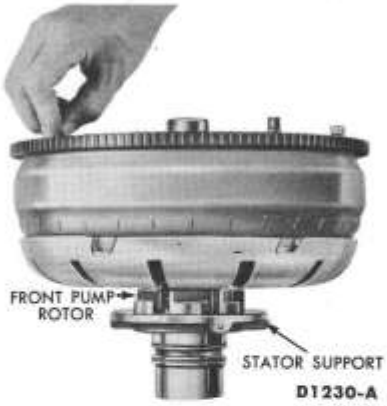


FIG. 4—Stator to Impeller Interference Check

blades. In such cases, replace the converter.

STATOR TO TURBINE INTERFERENCE CHECK

1. Position the converter, front side down, on the bench.

2. Install the front pump assembly (complete) to engage the mating splines of the stator support and stator, and pump drive gear lugs.

3. Install the input shaft, engaging the splines with the turbine hub (Fig. 5).

4. While holding the pump stationary, attempt to rotate the turbine with the input shaft. The turbine should rotate freely in both directions without any signs of interference or scraping noise.

5. If interference exists, the stator front thrust washer may be worn, allowing the stator to hit the turbine. In such cases, the converter must be replaced.

CONVERTER CLEANING

The converter cannot be disassembled for cleaning. If there is reason to believe that the converter has an excessive amount of foreign material in it, the following cleaning procedure should be used.

1. With the converter on the bench, remove both drain plugs and tilt the converter in all directions to drain as much fluid as possible.

2. Install the drain plugs and fill the converter through the pump drive hub with a light-body oil such as kerosene, or a cleaning solvent suitable for transmission cleaning.

3. Install the tool shown in Fig. 1 in the converter. Expand the bushing in the turbine spline. Rotate the tool to circulate the fluid in the converter.

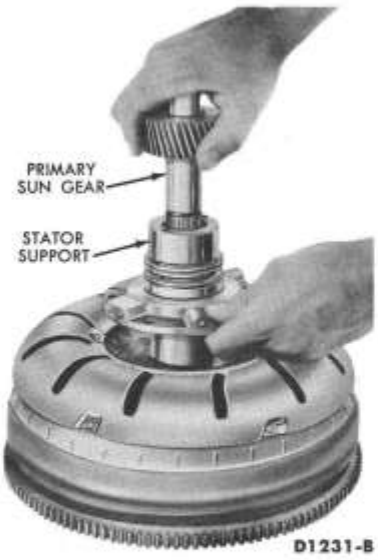


FIG. 5—Stator to Turbine Interference Check

4. Remove both drain plugs and thoroughly drain the converter.

5. Repeat the procedure given in steps 2, 3, and 4, as required, to remove excessive foreign material.

6. Install the drain plugs.

LEAKAGE CHECK

If there are indications that the welds on the torque converter housing are leaking, the following check should be made before the unit is replaced.

Figure 6 shows how a leak checking tool can be made from standard parts.

1. Install the plug in the converter and expand it by tightening the wing nut. Attach the safety chains.

2. Install the air valve in one of the drain plug threads.

3. Introduce air pressure into the converter housing. Check the pressure with a tire gauge and adjust it to 20 psi (Fig. 7).

4. Place the converter in a tank of water. Observe the weld areas for bubbles. If no bubbles are observed, it may be assumed that the welds are not leaking.

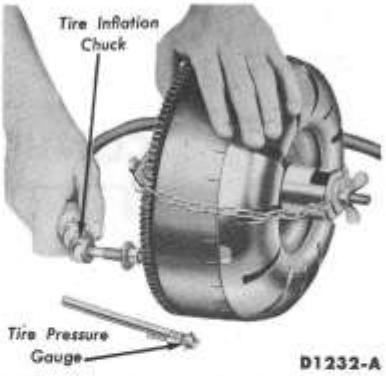


FIG. 7—Leak Checking Tool Installation

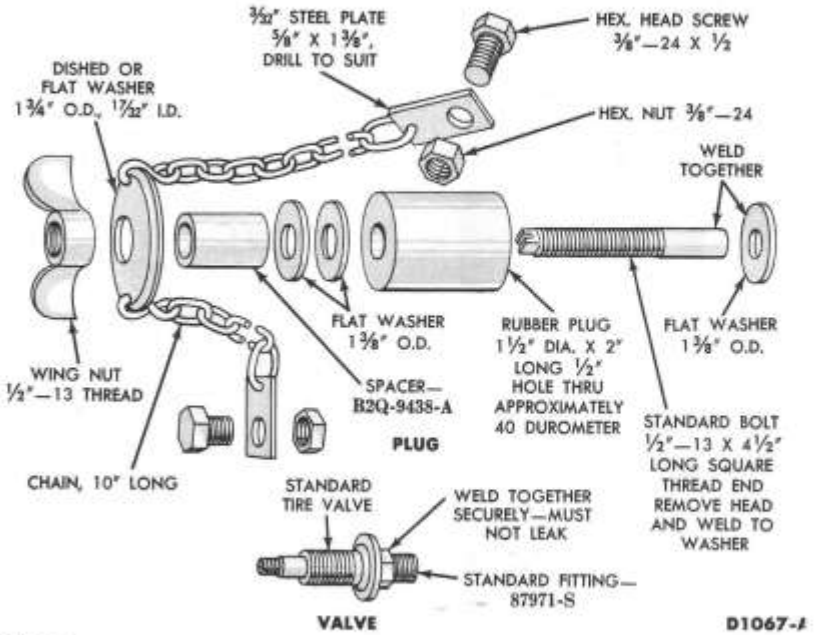


FIG. 6—Converter Leak Checking Tool

1961 FORD FALCON SHOP MANUAL

GROUP 7

REAR AXLE AND DRIVE LINE

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PART 7-1 REAR AXLE TROUBLE SHOOTING AND MINOR REPAIRS

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2	Rear Axle Shaft, Wheel Bearing, and Oil Seal Replacement	7-3
3	Drive Pinion Oil Seal Replacement	7-3
4	Drive Line Repair	7-3

The rear axle housing and carrier are cast into one integral assembly. The axle shafts and bearings can be pulled out of the housing ends. The differential assembly and then the drive pinion can be removed from the integral housing and carrier casting after the cover is removed from the carrier casting rear face. The pinion is located by a shim between the rear bearing cone and the pinion gear. Pinion bearing preload is adjusted by a collapsible spacer between the front and rear bearing cones.

1 TROUBLE SHOOTING

Certain rear axle and drive line trouble symptoms are also common to the engine, transmission, tires, and other parts of the car. For this reason, be sure that the cause of the trouble is in the rear axle or drive line before adjusting, repairing, or replacing any of the axle parts.

Since gears are in mesh, some rear axle noise is normal. However, excessive noise often indicates the beginning of other troubles in the axle.

A road test can help determine whether the noise is being caused by trouble in the rear axle or in other parts of the car. **Before road-testing the car, make sure that the tire pressures and the rear axle lubricant level are normal. Then drive the car far enough to warm the axle lubricant to its normal operating temperature.**

With the car stopped and the transmission in neutral, run the engine at various speeds. If the noise still exists during this test, it probably comes from the engine or the exhaust system.

To determine if the noise is being caused by the rear axle or the tires, drive the car over several different types of road surfaces. Smooth asphalt or black-top roads minimize tire noises. Tire noises may be eliminated by cross-switching the tires. Snow tires often cause noises not heard with conventional tires.

REAR AXLE TROUBLE SYMPTOMS AND POSSIBLE CAUSES

EXCESSIVE REAR AXLE NOISE	Noise caused by a worn or damaged wheel bearing is often loudest when the car is coasting at low speeds, and it usually stops when the brakes are gently applied. To find the noisy bearing, jack up each wheel and check each bearing for roughness while the wheel is rotating.	If all possible external sources of noise have been checked and eliminated, and the noise still exists, road-test the rear axle under all four driving conditions—drive, cruise, float, and coast. Then remove, disassemble, and inspect the axle.
EXCESSIVE REAR AXLE BACKLASH	Excessive backlash in the axle driving parts may be caused by worn axle shaft splines, loose axle shaft flange nuts, loose U-joint flange mountings, excessive backlash between the drive	pinion and drive gear, excessive backlash in the differential gears, or bearings which are worn or out of adjustment.
DRIVE LINE NOISE OR VIBRATION	Excessive noise or vibration may be caused by lack of lubrication, worn U-joint bearings, missing drive shaft balance weight, and sprung or	damaged drive lines. Make the necessary repairs as required. Undercoating on the drive shaft can destroy the balance and cause vibration.

2 REAR AXLE SHAFT, WHEEL BEARING, AND OIL SEAL REPLACEMENT

1. Remove the wheel and tire from the brake drum.

2. Back-off the rear brake shoe adjustments. Remove the nuts that secure the brake drum to the axle flange, and then remove the drum from the flange.

3. Working through the hole provided in the axle shaft flange, remove the nuts that secure the wheel bearing retainer. Then pull the axle shaft assembly out of the axle housing (Fig. 1). **The brake carrier plate must not be dislodged. Install one nut to hold the plate in place after the axle shaft is removed.**

4. If the rear wheel bearing is to be replaced, loosen the inner retainer. The retainer will become loose on the shaft, if it is nicked deeply in several places with a chisel.

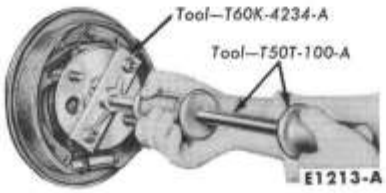

FIG. 1—Axle Shaft Removal

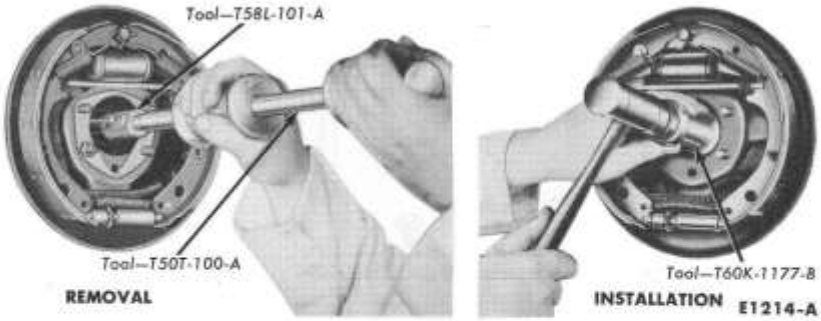

FIG. 2—Axle Shaft Seal Removal and Installation

5. Remove the bearing from the axle shaft with the tool shown in Fig. 3.

6. Inspect the machined surface of the axle shaft and the axle housing for rough spots or other irregularities which would affect the sealing action of the oil seal. Carefully remove any burrs or rough spots.

7. With the tool shown in Fig. 3, press a new rear wheel bearing on the axle shaft. **The bearing should seat firmly against the shaft shoulder.**

8. With the bearing installation tool, press the bearing inner retainer on the shaft until the retainer seats firmly against the bearing.

9. If the axle shaft oil seal is to be replaced, remove and replace the seal with the tools shown in Fig. 2. **Installation without use of the proper tool will distort the seal and cause leakage.**

10. Place a new gasket on the brake carrier plate, and then slide the axle shaft into the housing. Start the axle splines into the side gear, and push the shaft in until the bearing bottoms in the housing.

11. Install the bearing retainer and the nuts that secure it. Torque the nuts to 30-35 foot-pounds.

12. Install the brake drum and retaining nuts. Adjust the brakes.

13. Install the wheel and tire.

3 DRIVE PINION OIL SEAL REPLACEMENT

The rear axle lubricant must be drained to replace the pinion oil seal.

1. Loosen but do not remove the carrier casting rear cover to drain the lubricant.

2. Disconnect the drive shaft from the drive pinion flange. Pull the drive shaft toward the rear of the car until the front U-joint yoke clears the transmission extension housing. Install tool T60K-7657-A in the extension housing seal to prevent lubricant leakage.

3. Mark the pinion shaft nut, the end of the pinion shaft, and the pinion flange splines for realignment.

4. Hold the flange with the tool shown in Fig. 9, Part 7-2. Remove the pinion shaft nut and washer.

5. Remove the pinion flange with the tool shown in Fig. 10, Part 7-2.

6. Remove the pinion oil seal with tool 1175AB.

7. Clean the oil seal seat. The seal lubricant—return passage must be clear.

8. Coat the outer edge of the new seal with oil-resistant sealer, and install the seal, using the tool shown in Fig. 16, Part 7-2.

9. Align the pinion flange spline mark with the pinion shaft spline mark, and install the flange.

10. Install the flat washer and the pinion shaft nut. Tighten the nut until the marks are aligned.

11. Remove tool T60K-7657-A and install the front U-joint yoke to the transmission output shaft. Connect the rear yoke of the drive shaft to the pinion flange.

12. Install a new gasket under the carrier casting rear cover and install the cover bolts. Coat both sides of the gasket and the bolt threads with sealer.

13. Torque the rear cover bolts to 20-25 foot-pounds.

14. Fill the axle with new lubricant (Group 16).

4 DRIVE LINE REPAIR

To inspect or replace U-joints, follow this procedure.

1. Disconnect the rear U-joint from the drive pinion flange. Pull the drive shaft toward the rear of the car until the front U-joint yoke clears the transmission extension housing and output shaft. Install the extension housing seal driver in the seal to prevent lubricant leakage.

2. Remove the snap rings which retain the bearings in the yoke and drive shaft.

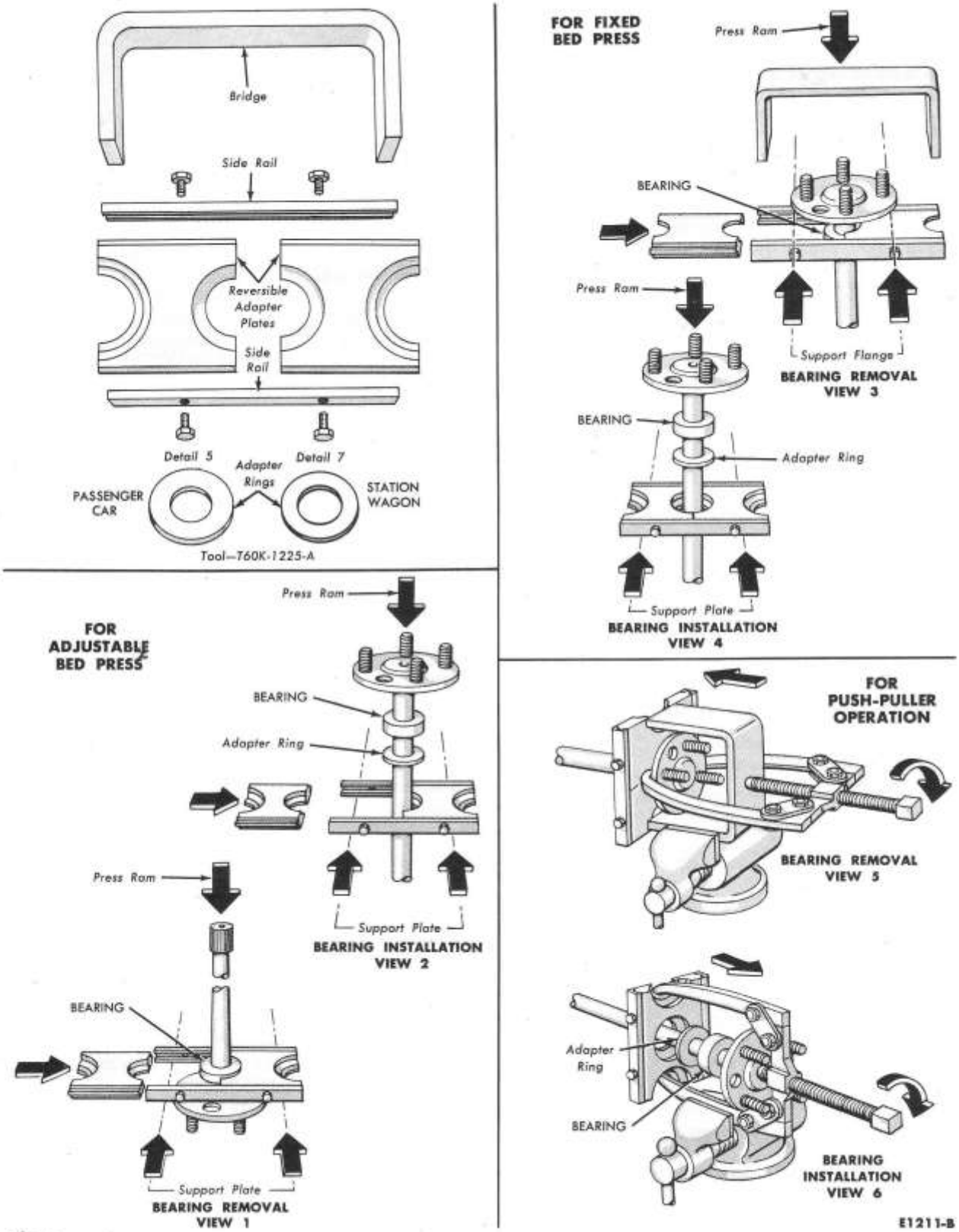

FIG. 3—Rear Wheel Bearing Removal and Installation

3. Place the U-joint in a vise or under a press.

4. Select a socket slightly smaller in its outside diameter than the U-joint bearings. Select another socket slightly larger in its inside diameter than the bearing outside diameter.

5. Place the sockets at opposite bearings so that the smaller socket becomes a bearing driver and the larger socket becomes a bearing receiver, when the vise jaws come together (Fig. 4).

6. Close the vise jaws until both bearings are free of the yoke. Remove the yoke from the drive shaft, then remove the bearings from the spider.

7. Turn the shaft and spider ¼ turn and use the same procedure to press the bearings out of the shaft.

8. Check the new bearings for adequate grease.

9. With the smaller socket press one bearing part way into place in the drive shaft.

10. Position the new spider in the newly installed bearing.

11. Press the second bearing into place in the drive shaft. Press the first bearing all the way in. Install the bearing retaining snap rings.

12. Press one new bearing part way into the yoke.

13. Install the yoke on the spider and press the second yoke bearing into place. Press the first bearing all the way in. Install the snap rings.

14. Use the same procedure to remove and replace the rear U-joint spider and bearings.

Check the joints for freedom of movement. If a bind has resulted from misalignment during the foregoing procedures, tap the ears of the driveshaft sharply to relieve the bind. Do not install the driveshaft unless the universal joints are free of bind.

15. If the rubber bellows-type seal installed on the end of the transmission extension housing is damaged in any manner, install a new seal.

16. On a manual-shift transmission, lubricate the yoke spline with conventional transmission lubricant (Group 16). On an automatic transmission, lubricate the yoke spline with special spline lubricant (Group 16). This spline is sealed so that the transmission fluid does not "wash" away the spline lubricant. Install the yoke on the transmission output shaft.

17. Install the U-bolts and nuts which attach the U-joint to the drive pinion flange. Tighten the U-bolts evenly to prevent binding U-joint bearings.

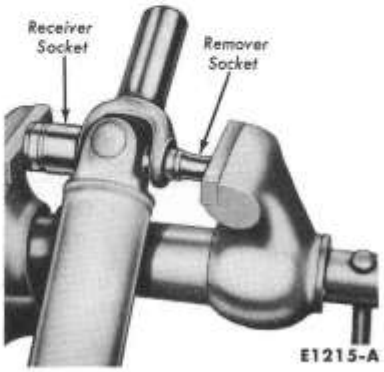

FIG. 4—U-Joint Removal

PART 7-2 REAR AXLE OVERHAUL

Section		Page
1	Differential Case and Drive Pinion Overhaul	7-6
2	Axle Housing Replacement	7-16

1 DIFFERENTIAL CASE AND DRIVE PINION OVERHAUL—HOUSING IN CAR

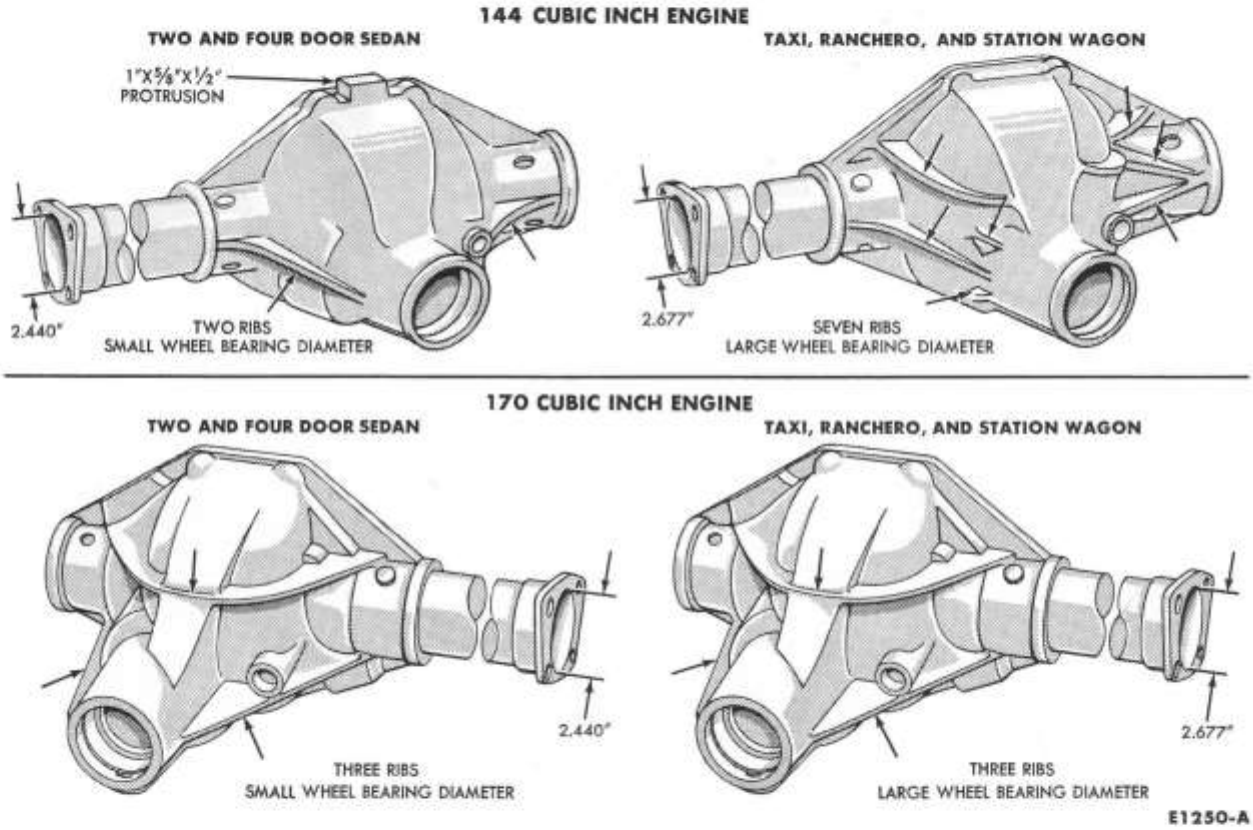

FIG. 1—1961 Falcon Rear Axle Housings

AXLE PARTS COMBINATION AND IDENTIFICATION

Four rear axle housings are used in the 1961 Falcon. The model and engine application of each housing is indicated in Fig. 1.

Three different size pinion and drive gear sets are used as indicated by the drive gear diameter in Table 1. The gear set with the 6¾-inch diameter drive gear is used only in 2- and 4-door sedans with the 144-cubic inch engine (upper left hand housing in Fig. 1). The gear set with the 7-inch diameter drive gear is used only in taxis, rancheros and station wagons with the 144-cubic inch engine (upper right hand housing in Fig. 1). All models with the 170-cubic inch engine (two lower housings in Fig. 1) use the gear set with the 7¼-inch diameter drive gear.

Three types of differential case are used as shown in Fig. 2. The two-window type is used only in 2 and 4-door sedan models with the 144-cubic inch engine (upper left hand housing in Fig. 1), and is used in this housing only with a 3.10:1 ratio. The one-window case and the two-piece case are used in all four housings in combination with the various ratios as shown in Table 1.

Two sizes of differential case pinion and side gears are used in the three cases as shown in Fig. 3. The pinion gears and side gears are not interchangeable as between the two-window case and the other two types. Pinion gear thrust washers are also not interchangeable. The side

TABLE 1 – Falcon Rear Axle Part Combinations

144 CU. INCH ENGINE					
2 AND 4 DOOR SEDAN			TAXI, RANCHERO, AND STATION WAGON		
HOUSING	2 RIBS 2.440-Inch Bearing Diam.		HOUSING	7 RIBS 2.677-Inch Bearing Diam.	
DRIVE GEAR	6¾-Inch Diam.		DRIVE GEAR	7-Inch Diam.	
PINION BEARING SPACER			1½-INCH LENGTH		
DIFFERENTIAL CASE	Type	Ratio Used With	DIFFERENTIAL CASE	Type	Ratio Used With
	2-Window	3.10:1		1-Window	3.50:1 4.00:1
	1-Window	3.50:1		2-Piece	3.50:1 4.00:1
	2-Piece	3.50:1			
170 CU. INCH ENGINE					
2 AND 4 DOOR SEDAN			RANCHERO, STATION WAGON		
HOUSING	3 RIBS 2.440-Inch Bearing Diam.		HOUSING	3 RIBS 2.667-Inch Bearing Diam.	
DRIVE GEAR	7¼-Inch Diam.		DRIVE GEAR	7¼-Inch Diam.	
PINION BEARING SPACER			2-INCH LENGTH		
DIFFERENTIAL CASE	Type	Ratio Used With	DIFFERENTIAL CASE	Type	Ratio Used With
	1-Window	3.20:1 3.50:1		1-Window	3.50:1
	2-Piece	3.10:1 3.50:1		2-Piece	3.50:1

FIG. 2 – 1961 Falcon Differential Cases

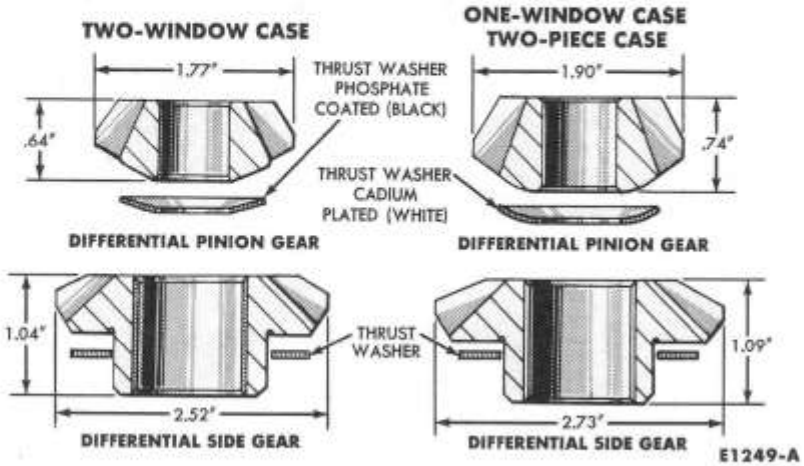

FIG. 3 – Differential Pinion and Side Gear Identification

gear thrust washers, however, are interchangeable between all differential cases, (Fig. 3).

The gear ratio code for each car is stamped under the word "axle" on the patent plate. The code symbols and the gear ratios they identify are:

Gear	Ratio Code
3	3.10 to 1
J	3.50 to 1
4	4.00 to 1
5	3.20 to 1

REMOVAL AND DISASSEMBLY

All service operations on the differential case assembly and the drive pinion assembly can be performed with the housing in the car (Fig. 4).

AXLE SHAFT, DRIVE SHAFT, AND COVER REMOVAL

1. Raise the car and support it on the underbody, so that the rear axle drops down as far as the springs and shock absorbers permit.

2. Remove the cover from the carrier casting rear face and drain the lubricant.

3. Remove both rear wheels.

4. Back-off the rear brake shoe adjustments, and then remove the brake drums.

5. Working through the hole pro-

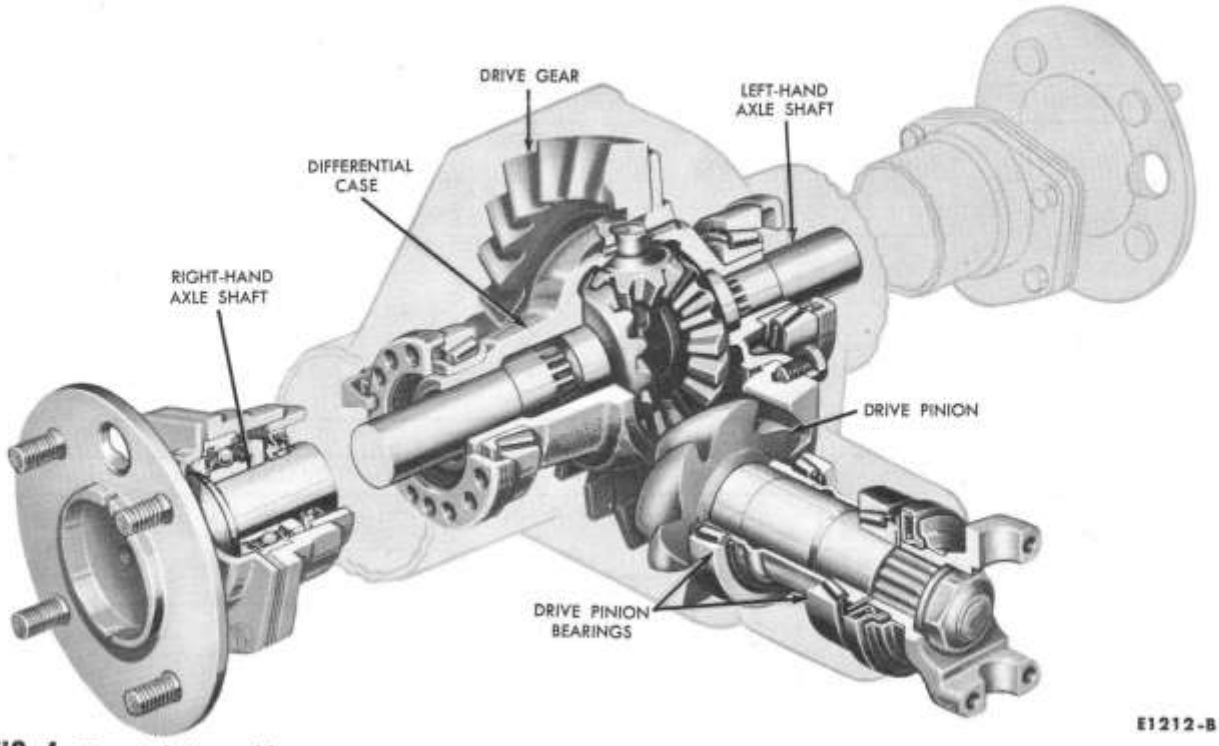

FIG. 4—Rear Axle Assembly

vided in the axle shaft flange, remove the nuts that attach the wheel bearing retainers to the axle housing.

6. Pull the axle shafts with the tool shown in Fig. 1, Part 7-1.

7. Disconnect the drive shaft at the drive pinion flange and at the transmission. In order to prevent loss of lubricant, install tool T60K-7657-A in the transmission seal.

INSPECTION BEFORE REMOVAL

The differential case assembly and the drive pinion should be inspected before they are removed from the housing. These inspections can help to find the cause of the trouble and to determine the corrections needed.

Wipe the lubricant from the internal working parts, and visually inspect the parts for wear or damage.

Rotate the gears to see if there is any roughness which would indicate defective bearings or chipped gears. Check the gear teeth for scoring or signs of abnormal wear.

Check the differential case and the drive pinion for end play.

Set up a dial indicator (Fig. 5) and check the backlash at several points around the drive gear. Backlash should be between 0.005 and 0.007 inch.

If no obvious defect is noted, check the gear tooth contact. Paint the gear teeth with suitable gear marking compound, such as a paste made with dry red lead and oil. A mixture that is too wet will run and smear. Too dry a mixture cannot be pressed out from between the teeth. Wrap a cloth around the drive pinion flange to act as a brake. Rotate the drive gear back and forth (use a box wrench on the drive gear attaching bolts for a lever) until a clear tooth contact pattern is obtained.

Certain types of gear tooth contact patterns on the drive gear indicate incorrect adjustment. Noise caused by incorrect adjustment can often be corrected by readjusting the gears. Typical patterns and the necessary corrections are explained in the assembly procedures.

Gear tooth runout can sometimes be detected by an erratic pattern on the teeth. However, a dial indicator should be used to measure the runout of the back face of the drive gear, as shown in Fig. 5. This runout should not exceed 0.002 inch.

DIFFERENTIAL CASE AND DRIVE PINION REMOVAL

1. Remove the differential bearing adjusting nut locks (Fig. 6).

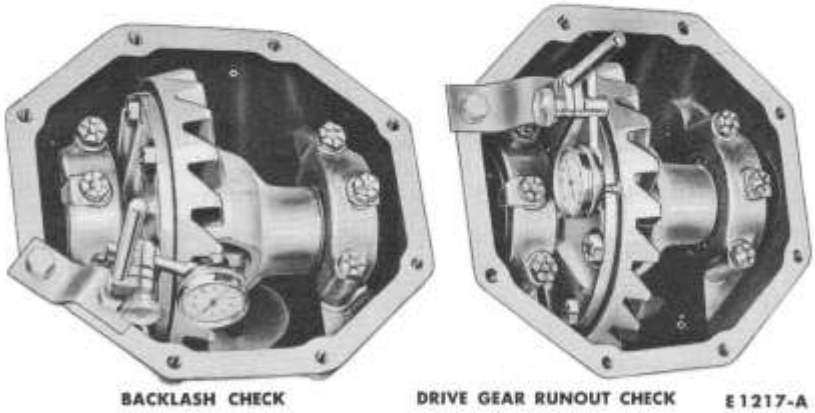

FIG. 5—Drive Gear Backlash and Runout Checks

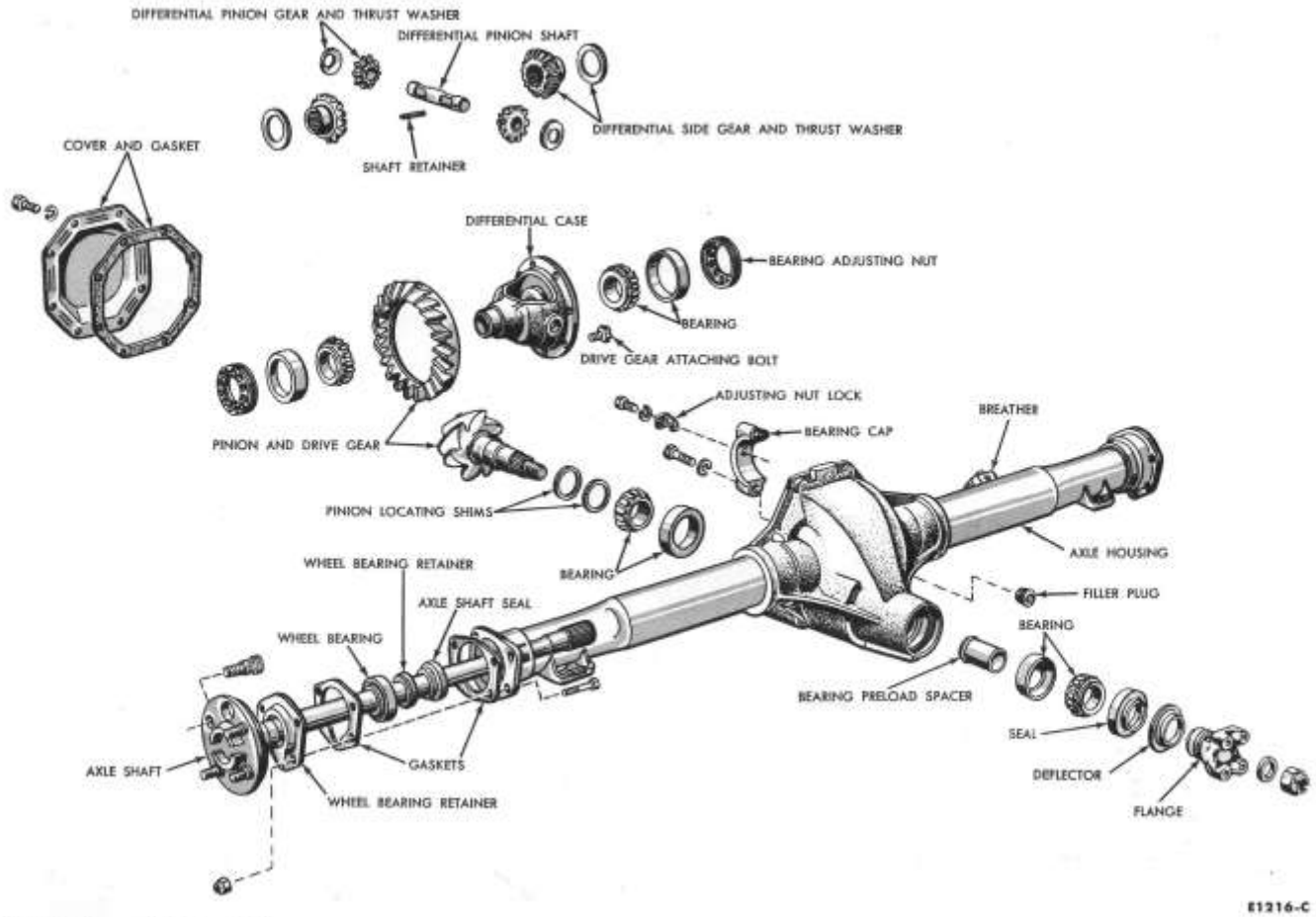

FIG. 6—Disassembled Rear Axle

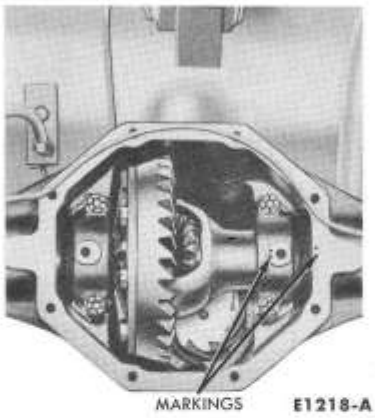

FIG. 7—Differential Bearing Cap Marking

2. Mark one differential bearing cap and the case (Fig. 7) to help position the parts properly during assembly.

3. Remove the differential bearing cap bolts and bearing caps. **Hold the differential case assembly in the housing after the caps are removed.**

4. Remove the differential case and bearing cups (Fig. 8).

5. Hold the drive pinion flange and remove the pinion nut (Fig. 9). Remove the flat washer.

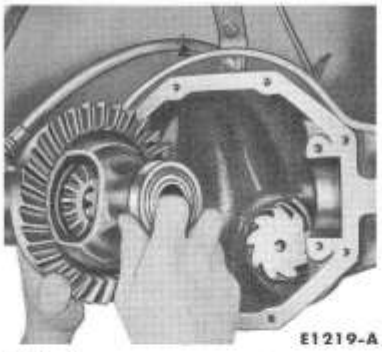

FIG. 8—Differential Case Removal

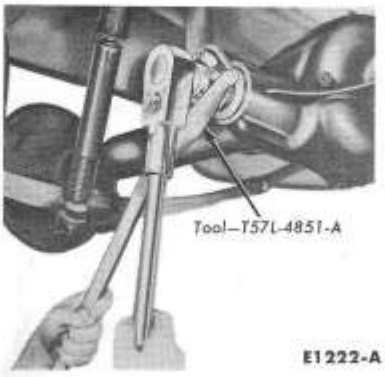

FIG. 9—Drive Pinion Shaft Nut Removal

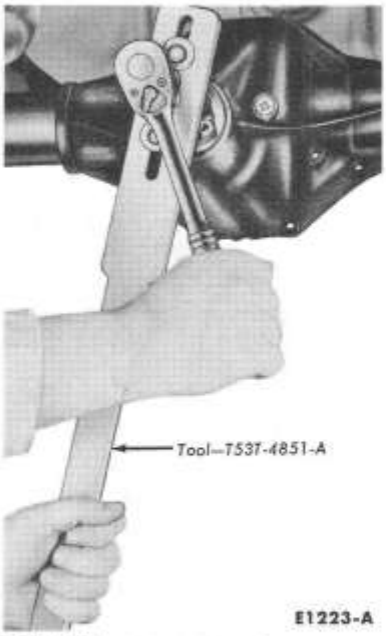

FIG. 10—Drive Pinion Flange Removal

6. Remove the pinion flange (Fig. 10).

7. With a soft-faced hammer, drive the pinion out of the front bearing cone and remove it through the rear of the carrier casting.

8. Drive against the pinion front bearing cone, and drive the pinion flange seal and the bearing cone out of the front of the carrier casting.

9. If the pinion bearings cups are to be replaced, drive them out of the carrier casting with a drift. Install the new cups with the tool shown in Fig. 11. Make sure the cups are properly seated in their bores. If a 0.0015 inch feeler gauge can be inserted between a cup and the bottom of its bore at any point around the cup, the cup is not properly seated.

10. Remove the pinion rear bearing cone (Fig. 12).

11. Measure the shim which is found under the bearing cone with a micrometer.

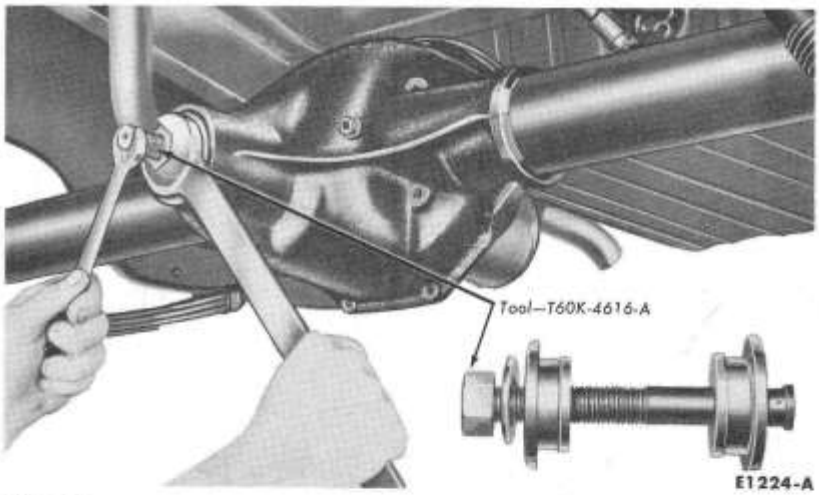

FIG. 11—Pinion Bearing Cup Installation

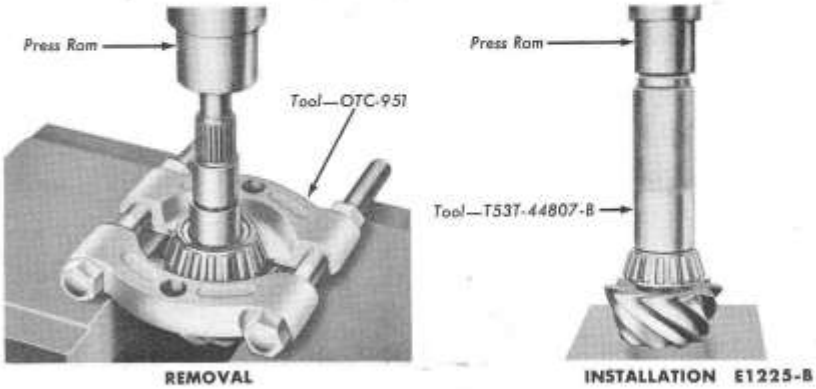

FIG. 12—Pinion Rear Bearing Cone Removal and Installation

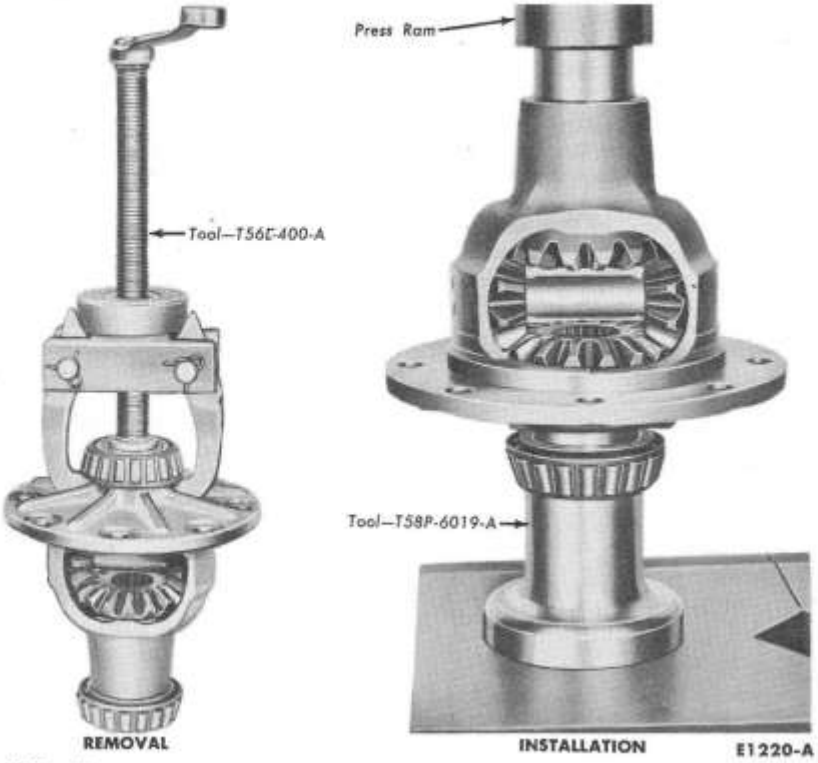

FIG. 13—Differential Bearing Removal and Installation

FIG. 14—Differential Pinion Shaft Retainer Removal

DIFFERENTIAL CASE DISASSEMBLY

ONE-WINDOW AND TWO-WINDOW TYPES

1. If the differential bearings are to be removed, use the tools shown in Fig. 13 to remove the old bearing and install the new bearings.

2. Remove the bolts that attach the drive gear to the differential case. Press the drive gear from the case or tap it off with a soft-faced hammer.

3. With a drift, drive out the differential pinion shaft retainer (Fig. 14).

4. Drive out the pinion shaft with a drift. Remove the gears and thrust washers (Fig. 6).

TWO-PIECE TYPE

1. Follow steps 1 and 2 under ONE-WINDOW AND TWO-WINDOW TYPES.

2. With a drift, drive out the differential pinion shaft retainer (Fig. 13), then separate the two-piece differential case (Fig. 2).

3. Drive out the pinion shaft with a brass drift. Remove the gears and thrust washers.

INSPECTION AFTER REMOVAL AND DISASSEMBLY

Thoroughly clean all parts. **Always use new solvent when cleaning** bearings. Oil the bearings immediately to prevent rusting. Inspect the parts for any major defects. Clean the inside of the housing before rebuilding and installing the parts. Inspect individual parts as outlined below.

GEARS

The pattern taken during disassembly should be helpful in judging if gears can be reused. Worn gears cannot be rebuilt to correct a noisy condition. Gear scoring is the result of excessive shock loading or the use of an incorrect lubricant. Scored gears cannot be reused.

Examine the teeth and thrust surfaces of the differential gears. Wear on the hub of the differential side gear can cause a "chucking" noise known as "chuckle" when the car is driven at low speeds. Wear of splines, thrust surfaces, or thrust washers can contribute to excessive drive line backlash.

BEARING CUPS

Check bearing cups for rings, scores, galling, or erratic wear patterns. Pinion bearing cups must be solidly seated. Check by attempting to insert a 0.0015-inch feeler between these cups and the bottoms of their bores.

CONE AND ROLLER ASSEMBLIES

When operated in the cups, bearing rollers must turn without roughness. Examine the roller ends for wear. Step-wear on the roller ends indicates the bearings were not preloaded properly or the rollers were slightly misaligned.

DIFFERENTIAL BEARING ADJUSTING NUTS

Temporarily install the bearing caps and test the fit of the adjusting nuts in their threads. The faces of the nuts that contact the bearing cups must be smooth and square. Polish these with a fine abrasive on a flat surface. Replace the nuts or examine the threads in the carrier, if their fit is not proper. Be sure that the bearing caps are on the side they were machined to fit.

DRIVE PINION FLANGE

Be sure that the ears of the flange have not been damaged in removing the drive shaft or in removing the flange from the pinion. The end of the flange that contacts the bearing cone must be smooth. Polish this face if necessary. Roughness aggravates backlash noises, and causes wear of the flange with a resultant loss in pinion bearing preload.

CARRIER CASTING

Make sure that the differential bearing bores are smooth and the threads are not damaged.

DIFFERENTIAL CASE

Carefully examine the case hubs, which may have been damaged when the bearings were removed. The bearing assemblies will fail if they do not seat firmly on the hubs.

DRIVE PINION ASSEMBLY AND INSTALLATION

SHIM SELECTION

Individual differences in machining the carrier casting and the gear set require a shim between the pinion rear bearing cone and the pinion gear to locate the pinion for correct tooth contact with the drive gear. In order to adjust the shim pack to the correct thickness for a given gear set, each pinion gear is marked with an adjustment number such as the +2 marking in Fig. 15.

When replacing a drive gear and pinion it should be noted that the **original** factory installed shim is of the correct thickness to adjust for individual variations in **both** the carrier casting dimension and in the original gear set dimension; therefore, to select the correct shim thickness for the new gear set to be installed, follow these steps:

1. Measure the thickness of the **original shim** with a micrometer.

2. Note the shim adjustment number on both the old pinion and the new pinion.

3. Refer to Table 2 to determine the correct amount of shim thickness change. The amount shown in Table 2 under the old pinion shim adjustment number and in line with the new pinion number is the amount of **change** that should be made to the **original** shim thickness.

If the old pinion is marked +4, for example, and the new pinion is marked −2, the table indicates that 0.006 inch of shim stock should be added to the **original** shim pack.

If the **original** shim pack was lost or if a new carrier casting is being installed, substitute a **nominal** 0.018 inch shim for the **original,** and follow the foregoing procedure for a trial build-up. If any further shim change is necessary, it will be indicated in the tooth pattern check.

A new drive gear and pinion should always be installed in an axle as a matched set (never separately). **Be sure that the same matching number appears on both the drive pinion and the drive gear.** Note the number "818" in Fig. 15.

ASSEMBLY AND INSTALLATION

1. Place the shim and pinion rear bearing cone on the pinion shaft. Press the bearing and shim firmly

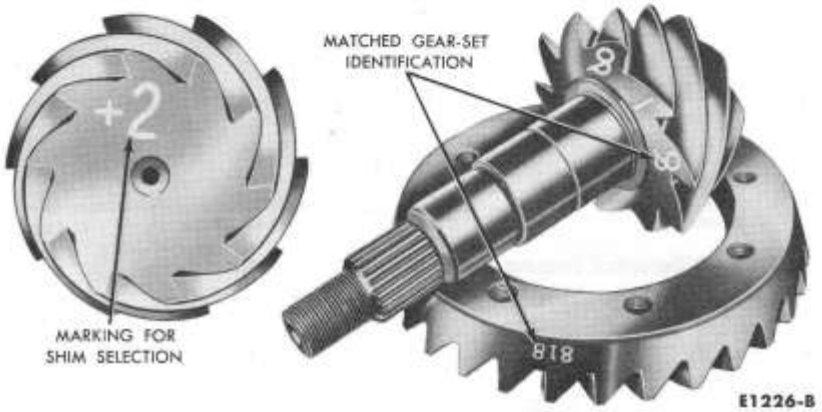

FIG. 15—Gear Set Markings

TABLE 2—Drive Pinion Adjusting Shim Thickness Changes—Inches

Old Pinion Marking	New Pinion Marking								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

against the pinion shaft shoulder (Fig. 12).

2. Place a **new** pinion bearing preload spacer on the pinion shaft.

3. Lubricate the pinion rear bearing with axle lubricant.

4. Lubricate the pinion front bearing cone and place it in the housing.

5. Coat the outside edge of a new oil seal with an oil resistant sealer and install it in the carrier casting (Fig. 16).

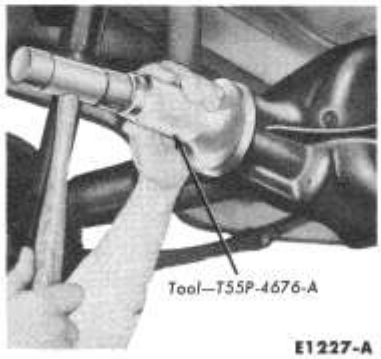

FIG. 16—Drive Pinion Flange Seal Installation

6. Insert the drive pinion shaft flange into the seal and hold it firmly against the pinion front bearing cone. From the rear of the carrier casting, insert the pinion shaft into the flange.

7. Place the flat washer on the pinion shaft and start the nut. Use a new nut. Hold the flange with the tool shown in Fig. 9, and tighten the pinion shaft nut. As the pinion shaft nut is tightened, the pinion shaft is pulled into the front bearing cone and into the flange.

As the pinion shaft is pulled into the front bearing cone, pinion shaft end play is reduced. While there is still end play in the pinion shaft, the flange and cone will be felt to bottom. This indicates that the bearing cone and flange have bottomed on the collapsible spacer.

From this point, a much greater torque must be applied to turn the pinion shaft nut, since the spacer must be collapsed. From this point, also, the nut should be tightened very slowly and the pinion shaft end play checked often, so that the pinion bearing preload does not exceed the limits.

If the pinion shaft nut is tightened to the point that pinion bearing preload exceeds the limits, the pinion shaft must be removed and a new collapsible spacer installed. **Do not decrease the preload by loosening the pinion shaft nut.** This will remove the compression between the pinion front bearing cone and the collapsible spacer and may permit the front bearing cone to turn on the pinion shaft.

8. As soon as there is preload on the bearings, **turn the pinion shaft in both directions several times to seat the bearing rollers.**

9. Adjust the preload on used bearings to 10-16 inch pounds torque. On new bearings, adjust the preload to 17-27 inch pounds. Measure the preload with the tool shown in Fig. 17.

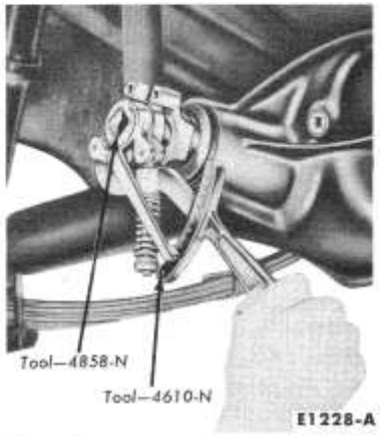

FIG. 17—Pinion Bearing Preload Check

DIFFERENTIAL CASE ASSEMBLY AND INSTALLATION

ASSEMBLY OF ONE-WINDOW AND TWO-WINDOW TYPES

1. Lubricate all the differential parts with axle lubricant, before they are installed in the case.

2. Place the side gears and thrust washers in the case.

3. Place the two pinion gears and thrust washers exactly opposite each other in the case openings and in mesh with the side gears.

4. Turn the pinions and thrust washers until the holes in the pinion gears align with the pinion shaft holes in the case.

5. Start the pinion shaft into the differential case. Carefully align the shaft retaining pin hole with the pin hole in the case. Drive the shaft into place and install the retaining pin (Fig. 14).

6. Place the drive gear on the differential case and install the bolts. Torque the bolts to 40-50 foot-pounds.

ASSEMBLY OF TWO-PIECE TYPE

1. Place a thrust washer and a side gear in the differential case bore. **Lubricate all differential parts with axle lubricant during assembly.**

2. With a soft-face hammer, drive the pinion shaft into the case far enough to support a pinion thrust washer and pinion gear. Install the washer and slide the pinion gear onto the shaft and in mesh with the side gear.

3. Place the second pinion gear and thrust washer in position, and drive the pinion shaft all the way into place. **Be sure to align the shaft retainer holes as the shaft is being driven in.**

4. Place the second side gear on top of the two pinion gears. Position the thrust washer and install the differential case cover so that the shaft retainer hole in the cover is aligned with its corresponding hole in the case.

5. Install the pinion shaft retainer pin with a drift. A pinion or axle shaft spline can be inserted in the side gear spline to check for free rotation of the differential gears.

6. Place the drive gear on the differential case and install the bolts. Torque the bolts to 40-50 ft-lbs.

INSTALLATION—ALL TYPES

1. Wipe a thin coating of lubricant on the bearing bores so that the differential bearing cups will move easily.

2. Place the cups on the bearings and set the differential case assembly in the carrier casting (Fig. 8). Slide the assembly along the bores until a

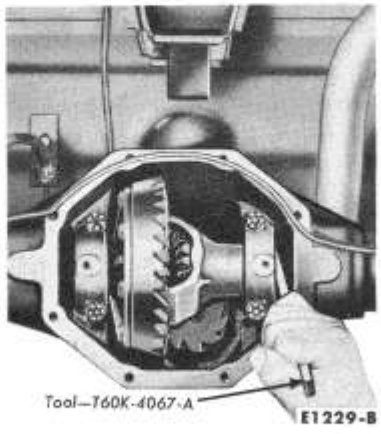

FIG. 18—Backlash and Bearing Preload Adjustment

slight amount of backlash is felt between the gear teeth. Hold the differential case in place.

3. Set the adjusting nuts in the bores so that they just contact the bearing cups.

4. Carefully position the bearing caps on the carrier casting. Match the marks made when the caps were removed.

5. Install the bearing cap bolts and lockwashers. As the bolts are tightened, turn the adjusting nut with the tool shown in Fig. 18.

6. If the adjusting nuts do not turn freely as the cap bolts are tightened, remove the bearing caps and again inspect for damaged threads or incorrectly positioned caps. Tightening the bolts to the specified torque is done to be sure that the cups and adjusting nuts are seated. Loosen the cap bolts, and torque them to only 5 foot-pounds before making adjustments.

7. Loosen the right-hand nut until it is away from the cup. Tighten the left-hand nut until the drive gear is just forced into the pinion with no backlash. (Recheck the right-hand nut at this time to be sure that it is still loose.) **The left-hand adjusting nut is on the drive gear side of the carrier. The right-hand nut is on the pinion side. Tightening the left-hand nut moves the drive gear into the pinion to decrease backlash, and tightening the right-hand nut moves the drive gear away.**

8. Loosen the left hand adjusting nut 1 to 1½ notches.

9. Tighten the right-hand nut two notches beyond the position where it first contacts the bearing cup. Rotate the drive gear several revolutions in each direction while the bearings are loaded, to seat the bearings in their cups. **This step is important.**

10. Again loosen the right-hand nut to release the pre-load. If there is any backlash between the gears, tighten the left-hand nut just enough to remove this backlash. At this time, make sure that one of the slots in the left-hand nut is so located that the lock can be installed without turning the nut. Carefully tighten the right-hand nut until it just contacts the cup. Set preload of 2½ to 4 notches tight by the right-hand nut. As preload is applied from the right-hand side, the drive gear is forced away from the pinion and usually results in the correct backlash. The specified backlash for new gears is 0.005 to 0.007 inch.

11. Torque the differential cap bolts to 40 to 50 foot-pounds.

Measure the backlash as shown in Fig. 5. Measure the backlash on several teeth around the drive gear. If the measurements vary more than 0.002 inch, there is excessive runout in the gears or their mountings, which must be corrected to obtain a satisfactory unit. If the backlash is out of specification, loosen one adjusting nut and tighten the opposite nut an equal amount, to move the drive gear away from or toward the pinion. **When moving the adjusting nuts, the final movement should always be made in a tightening direction. For example, if the left-hand nut had to be loosened one notch, loosen the nut two notches, then tighten it one. This insures that the nut is contacting the bearing cup, and that the cup cannot shift after being put in service.**

GEAR TOOTH CONTACT PATTERN CHECK

Paint the gear teeth and roll a contact pattern. Figure 19 shows some drive and coast patterns and indicates the changes required to obtain the correct operating positions of the gears.

The desirable patterns shown in Fig. 19 are patterns in which **there is no load on the gears.** Under load, the patterns (tooth contact) will spread out over most of the tooth.

The patterns may vary from gear to gear. It should be understood, therefore, that only the general outline or shape of the patterns should be considered when servicing the rear axle. The location of the pattern can vary ± 0.200 inch on any tooth.

The movement of tooth contact patterns with changes in gear locations can be summarized as follows:

1. Thinner shim with the backlash constant moves the pinion further from the drive gear:

a. Drive pattern moves toward the top of the tooth (face contact) and toward the heel.

b. Coast pattern moves toward the top of the tooth and slightly toward the toe.

2. Thicker shim with the backlash constant moves the pinion closer to the drive gear:

a. Drive pattern moves deeper on the tooth (flank contact) and slightly toward the toe.

b. Coast pattern moves deeper on the tooth and toward the heel.

3. Decreasing backlash moves the drive gear closer to the pinion:

a. Drive pattern (convex side of gear) moves slightly lower and toward the toe.

b. Coast pattern (concave side of gear) moves lower and toward the toe.

4. Increasing backlash moves the drive gear away from the pinion:

a. Drive pattern moves slightly higher and toward the heel.

b. Coast pattern moves higher and toward the heel.

If the patterns are not correct, make the changes as indicated.

When the pattern is correct, remove the marking compound from the gear teeth.

Install the differential bearing adjusting nut locks and bolts. Torque the bolts to 12-20 foot-pounds.

AXLE SHAFT, DRIVE SHAFT AND REAR COVER INSTALLATION

1. Install the axle shafts. Refer to Part 7-1, Section 2 for proper procedure.

2. Remove tool T60K-7657-A, and connect the drive shaft at the drive pinion flange and at the transmission output shaft.

3. Install the cover and a **new** gasket on the carrier casting rear race. Coat both sides of the gasket and the bolt threads with sealer.

4. Torque the cover bolts to 15-25 foot-pounds.

5. Fill the axle with the proper grade of lubricant (Group 16). The lubricant level is the bottom of the filler plug hole with the axle in normal running position.

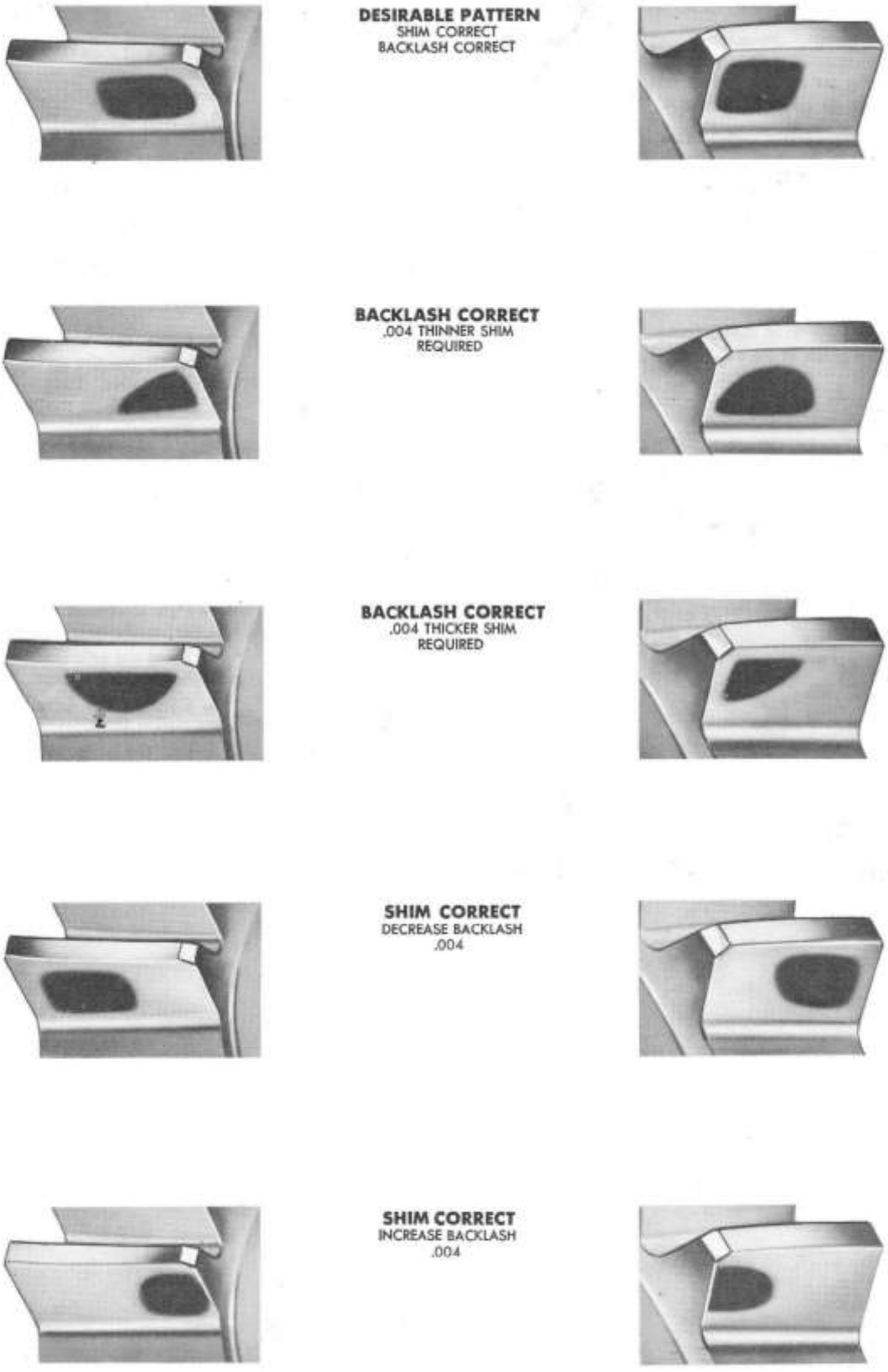

FIG. 19—Typical Gear Tooth Contact Patterns

2 AXLE HOUSING REPLACEMENT

REMOVAL

1. Raise the car and support it on the underbody as given in Part 8-4.

2. Loosen the carrier casting rear cover and drain the lubricant. Discard the old lubricant.

3. Disconnect the drive shaft at the drive pinion flange.

4. Disconnect the shock absorbers at the axle housing (Fig. 20).

5. Remove both axle shafts using the procedure given in Part 7-1, Section 2.

6. Remove the hydraulic brake "T" connection from the axle housing. **Do not open the hydraulic brake system lines.** Remove the hydraulic brake line from its retaining clip on the axle housing.

7. Remove both brake carrier plates from the axle housing and suspend them above the housing with mechanics' wire. The hydraulic brake lines and the parking brake cables are still attached to the brake carrier plates.

8. Support the rear axle housing on a jack, and then remove the spring clip nuts. Remove the spring clip plates.

9. Lower the axle housing and remove it from under the car.

10. If the old drive pinion and differential case assemblies are to be installed in a new housing, refer to the previous section for removal and installation procedures.

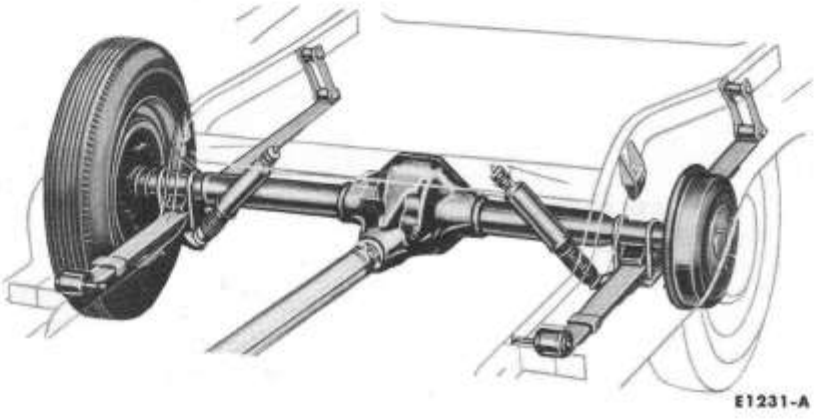

FIG. 20—Rear Axle Installation

INSTALLATION

1. Raise the axle housing into position so that the spring clip plates can be installed. Torque the spring clip nuts to 13-20 foot-pounds.

2. Place the brake carrier plates in their normal position on the axle housing. Use new gaskets on each side of the brake carrier plates.

3. Install the axle shafts, brake drums and wheels.

4. Attach the hydraulic brake line "T" fitting to the axle housing, and secure the hydraulic brake line in its retainer on the axle housing.

5. Raise the axle housing and connect the shock absorbers.

6. Connect the drive shaft at the drive pinion shaft.

7. Fill the axle with the proper grade and amount of lubricant (Group 16).

8. Road test the car.

1961 FORD FALCON SHOP MANUAL

GROUP 8

WHEELS, TIRES, CHASSIS SUSPENSION, AND UNDERBODY

		PAGE
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PART 8-2	WHEELS AND TIRES	8-5
PART 8-3	FRONT AND REAR SUSPENSION	8-7
PART 8-4	UNDERBODY	8-13

PART 8-1 FRONT WHEELS, TIRES AND BEARINGS

Section		Page
1	Preliminary Front End Inspection	8-2
2	Front Wheel Alignment Inspection	8-2
3	Front Wheel Alignment Adjustments	8-3

Front wheel alignment (caster, camber, and toe-in) inspection and adjustment operations should be performed by someone thoroughly familiar with alignment work and with the checking equipment being used.

For necessary hoisting and jacking procedures, see Part 8-4.

1 PRELIMINARY FRONT END INSPECTION

Do not check and adjust front wheel alignment without first making the following inspection for front-end maladjustment, damage, or wear.

1. Check for specified air pressures in all 4 tires.

2. Raise the front of the car off the floor. **The lower arms must be used as supports.** Shake each front wheel. Check the front suspension ball joints and mountings for looseness, wear, and damage. **Grasp the front tire at the top and bottom surfaces when checking for spindle ball joint wear.** Check the brake backing plate mountings. Torque all loose nuts and bolts to specifications. Replace all worn parts.

3. Check the steering gear mountings and all steering linkage connections for looseness. Torque all mountings to specifications. If any of the linkage is worn or bent, replace the parts.

4. Check the front wheel bearings. If any in-and-out free play is noticed, adjust the bearings to eliminate the free-play. Replace worn or damaged bearings.

5. Spin each front wheel with a wheel spinner, and check and balance each wheel as required.

6. Check the shock absorbers (Part 8-3). If the shock absorbers are not in good condition, the car may not settle in a normal, level position, and front wheel alignment may be affected.

2 FRONT WHEEL ALIGNMENT INSPECTION

Do not attempt to check and adjust front wheel alignment without first making a preliminary inspection of the front-end parts.

EQUIPMENT INSTALLATION

Equipment used for front wheel alignment inspection must be accurate. If portable equipment is being used, perform all inspection operations on a level floor.

1. Drive the car in a straight line far enough to establish the straight-ahead position of the front wheels, and then mark the steering wheel hub and the steering column collar (Fig. 1). **Do not adjust the steering wheel spoke position at this time.** If the front wheels are turned at any time during the inspection, align the marks to bring the wheels back to the straight-ahead position.

2. Install the wheel alignment equipment on the car. Whichever type of equipment is used, follow the installation and inspection instructions provided by the equipment manufacturer.

INSPECTION

Check all the factors of front wheel alignment except toe-out on turns before making any adjustments. Toe-out on turns should be checked only after caster, camber, and toe-in have been adjusted to specifications.

CASTER

Check the caster angle at each front wheel. The caster angle is measured between a true vertical line and the center line through the upper and lower ball joints.The correct caster angle, or backward (positive) tilt, is + ½° ± ½°. The maximum difference between both front wheel caster angles should not exceed ½°.

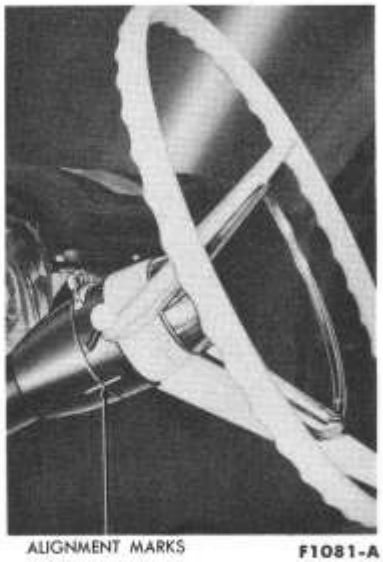


FIG. 1— Straight-Ahead Position Marks

CAMBER

Check the camber angle at each front wheel. The camber angle is measured between a true vertical line and the centerline through the plane of the wheel and tire. The correct camber angle, or outward (positive) tilt, is $+\frac{1}{2}° \pm \frac{1}{2}°$. The maximum difference between both front wheel camber angles should not exceed ½°. However, a difference of not more than ¼° is preferred.

TOE-IN

Check the toe-in with the front wheels in the straight-ahead position. Toe-in is measured between the extreme front of both front wheels and between the extreme rear of both wheels, and is the difference between the two distances. Correct toe-in, or inward pointing of both front wheels at the front, is ¼-5/16 inch.

TOE-OUT ON TURNS

After caster, camber, and toe-in have been adjusted to specifications, check the toe-out on a left turn. When the outside wheel (outer wheel on a turn) is turned inward 20°, the inside wheel should turn outward 20¾°. If this angle is not correct, the spindle arm on the inside wheel is probably bent and should be replaced.

3 FRONT WHEEL ALIGNMENT ADJUSTMENTS

After front wheel alignment factors have been checked, make the necessary adjustments. **Do not attempt to adjust front wheel alignment by bending the suspension or steering parts.**

CASTER AND CAMBER ADJUSTMENTS

Caster and camber can be adjusted by removing or installing shims between the inner shaft of the front suspension upper arm and the underbody (Fig. 2).

Both caster and camber adjustments can be made at the same time by loosening the nuts on the two bolts that fasten the inner shaft to the underbody. After the required shims have been removed or installed, torque the nuts to specification. Caster and camber adjusting shims are available in 1/32-inch and 1/16-inch thicknesses.

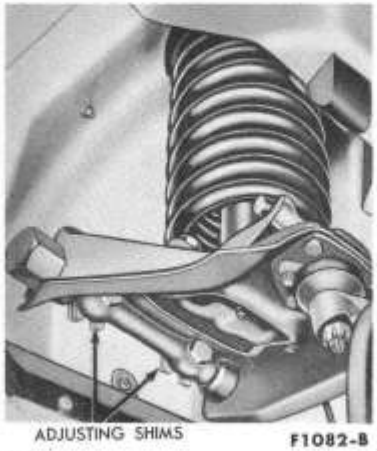


FIG. 2—Upper Arm Assembly

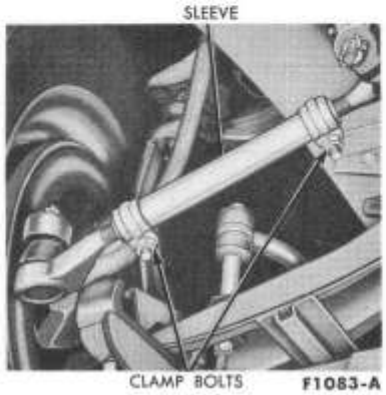


FIG. 3—Spindle Connecting Rod Sleeve

The 1/32 inch shims should be placed against the fender housing sheet metal or between the 1/16 inch shims.

CASTER

To adjust caster, remove or install shims at either the front bolt or the rear bolt (Fig. 2).

The removal of shims at the front bolt or the installation of shims at the rear bolt will cause the upper ball joint to move forward. The removal of shims at the rear bolt or the installation of shims at the front bolt will cause the ball joint to move rearward. A 1/32-inch change of shim thickness at either bolt will change the caster angle approximately ½°. The difference between the shim stack thickness at the two bolts should not exceed 1/16 inch (Fig. 2).

CAMBER

To adjust camber, remove or install equal shim thicknesses at both bolts (Fig. 2).

The removal of equal shims at both bolts will move the upper ball joint inward. The installation of equal shims at both bolts will move the ball joint outward. A 1/16-inch change of shim thickness at both bolts will change the camber angle ⅓°. The total shim stack thickness at each bolt should not exceed 9/16-inch (Fig. 2).

TOE-IN AND STEERING WHEEL ALIGNMENT ADJUSTMENTS

Check the steering wheel spoke position when the front wheels are in the straight-ahead position. If the spokes are not in their normal position, they can be properly adjusted while toe-in is being adjusted.

1. Loosen the two clamp bolts on each spindle connecting rod sleeve (Fig. 3).
2. Adjust toe-in. If the steering wheel spokes are in their normal position, lengthen or shorten both rods equally to obtain correct toe-in (Fig.

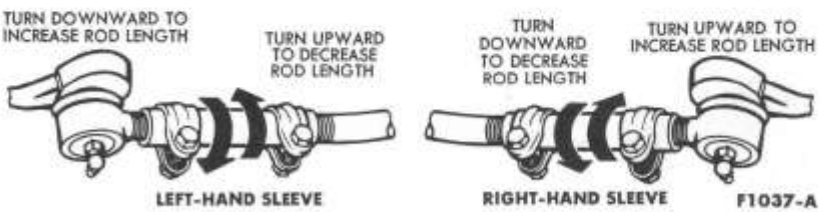


FIG. 4—Spindle Connecting Rod Adjustments

4). If the steering wheel spokes are not in their normal position, make the necessary rod adjustments to obtain correct toe-in and steering wheel spoke alignment (Fig. 5).

3. Recheck toe-in and steering wheel spoke alignment. If toe-in is correct and the steering wheel spokes are still not in their normal position, turn both connecting rod sleeves upward or downward the same number of turns to move the steering wheel spokes (Fig. 5).

4. When toe-in and steering wheel spoke alignment are both correct torque the clamp bolts on both connecting rod sleeves to specification. **The sleeve position should not be changed when the clamp bolts are tightened.**

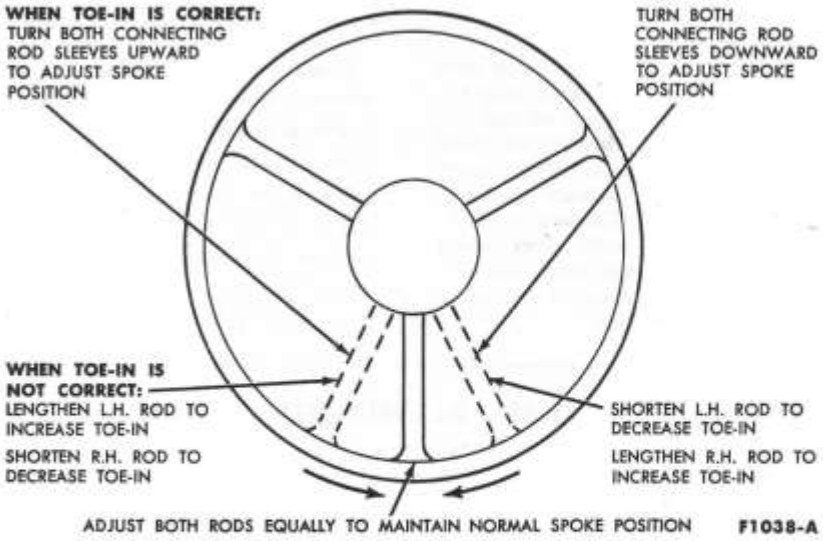


FIG. 5—Toe-in and Steering Wheel Spoke Alignment Adjustments

PART 8-2 WHEELS AND TIRES

Section Page
1 Wheel and Tire Maintenance and Replacement 8-5
2 Hubs, Bearings, and Oil Seals or Grease Retainers ...8-5

1 WHEEL AND TIRE MAINTENANCE AND REPLACEMENT

WHEEL INSPECTION AND MAINTENANCE

Wheel stud nuts should be inspected and tightened regularly (Group 16). Loose wheel stud nuts may cause shimmy and vibration. Elongated stud holes in the wheels may also result from loose stud nuts.

Keep the wheels and hubs clean. Stones wedged between the wheel and drum and lumps of mud or grease can unbalance a wheel and tire.

Check for damage that would affect the runout of the wheels. Wobble or shimmy caused by a damaged wheel will eventually damage the wheel bearings. Inspect the wheel rims for dents that could permit air to leak from the tires.

WHEEL REPLACEMENT

1. Pry off the wheel cover and loosen but do not remove the wheel stud nuts.
2. Raise the car until the wheel and tire clear the floor.
3. Remove the wheel stud nuts and the wheel and tire from the hub and drum.
4. Clean all dirt from the hub and drum. Be sure that the replacement wheel and tire are clean.
5. Position the wheel and tire on the hub and drum, and install the wheel stud nuts. For proper balance, line up the notch on the drum with the valve stem on the wheel. Tighten the nuts enough to hold the wheel firmly in place. **Always tighten alternate nuts to draw the wheel evenly against the hub and drum.**
6. Lower the car to the floor, and torque the wheel stud nuts to specification.

TIRE ROTATION

For longer tire life, all five tires should be cross-switched as shown in Fig. 1. See Part 16-1 for the specified interval.

When removing a tire from a wheel, **position the outer side of the wheel down in order to pry the beads over the wheel rim.**

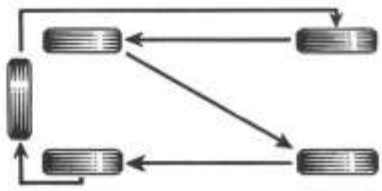


FIG. 1— Tire Cross-Switching Diagram

2 HUBS, BEARINGS, AND OIL SEALS OR GREASE RETAINERS

The front hubs are attached to the front brake drums. The front wheel bearing cones and rollers rotate in bearing cups which are pressed into each hub. Grease retainers are installed at the inner ends of the hubs to prevent lubricant from leaking into the brake drums.

The rear hubs and bearings are installed on the rear axle shafts, and the oil seals are installed in the axle housing between the axle housing and the axle shafts. **All service procedures for rear hubs, bearings and oil seals are given in Part 7-1.**

FRONT WHEEL BEARING ADJUSTMENT

The front wheel bearings should be adjusted if the wheel is loose on the spindle or if the wheel does not rotate freely. End play should be within 0.001" to 0.010".

1. Raise the car until the wheel and tire clear the floor.
2. Pry off the wheel cover and remove the grease cap (Fig. 2) from the hub.
3. Rotate the front wheel hub and drum assembly, torque the adjusting nut from 11½ to 12½ ft-lbs. **Take the reading while the wheel slowly rotates.** Back off the adjusting nut at

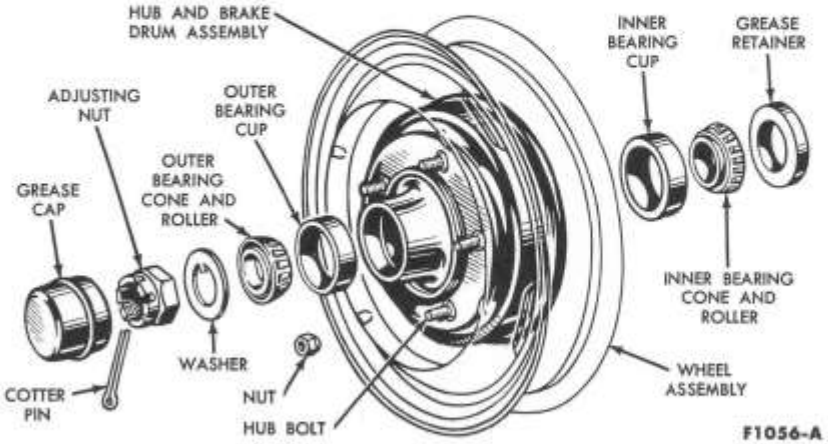


FIG. 2—Front Hub, Bearings, and Grease Retainer

least one castellation, but not more than two.

4. Loosen the adjusting nut just enough to line up the nearest slot in the nut with the cotter pin hole in the spindle. Install a new cotter pin.

5. Check the front wheel rotation. If the wheel rotates properly, install the grease cap and the hub cap or wheel cover. If the wheel is still loose, or it rotates roughly or noisily, the bearing cones and rollers and the cups are worn or dirty and should be cleaned or replaced.

FRONT WHEEL BEARING REPLACEMENT

If the front wheel rotates roughly or noisily and cannot be properly adjusted to rotate freely without looseness, the bearing cones and rollers and the cups should be inspected and, if necessary, replaced.

1. Remove the wheel and tire as an assembly.

2. Back off the brake shoe adjusting screw so that the shoes do not contact the brake drum.

3. After removing the grease cap from the hub, remove the cotter pin and adjusting nut from the spindle, and then remove the flat washer and the outer bearing cone and roller.

4. Pull the wheel, hub, and drum off the wheel spindle. **Be careful not to damage the grease retainer.** If necessary, remove the grease retainer, the inner bearing cone and roller from the hub.

5. Remove the bearing cup(s).

6. If a new grease retainer is to be installed, soak it in light engine oil for at least 30 minutes before installation. Thoroughly clean the spindle and the inside of the hub.

7. Install the inner and outer bearing cup(s) in the hub with the tool shown in Fig. 3. **Be sure to seat the cups properly in the hub.**

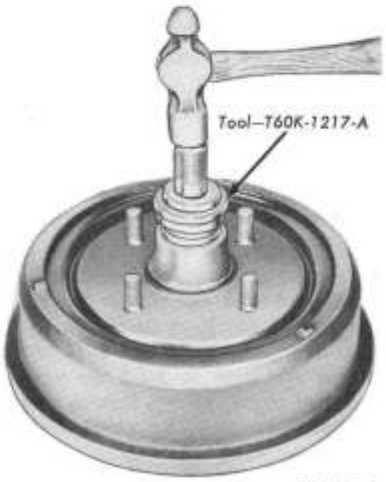


FIG. 3–Front Wheel Bearing Cup Installation

8. Pack the inside of the hub with wheel bearing grease. Fill the hub until the grease is flush with the inside diameter of both bearing cups.

9. Pack the bearing cones and rollers with wheel bearing grease. A bearing packer is desirable for this operation. If a packer is not available, work as much lubricant as possible between the rollers and cages. Lubricate the cone surfaces with grease.

10. If it was removed, place the inner bearing cone and roller in the inner cup, and install the grease retainer with the reverse end of the tool shown in Fig. 3. **Be sure that the retainer is properly seated.**

11. Install the wheel, hub, and drum on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

12. After installing the outer bearing cone and roller and the flat washer on the spindle, install the adjusting nut.

13. Adjust the wheel bearings, and install a new cotter pin. **Bend the ends of the cotter pin away from the end of the spindle and back over the flat side of the nut to prevent interference with the radio static collector in the grease cap.**

14. Install the grease cap, torque the stud nuts to specifications, and install the wheel cover.

PART 8-3 FRONT AND REAR SUSPENSION

Section		Page
1	Trouble Diagnosis	8-7
2	Front Suspension Repair	8-7
3	Rear Suspension Repair	8-11
4	Shock Absorber Replacement	8-12

1 TROUBLE DIAGNOSIS

PRELIMINARY CHECKS

Before performing any trouble shooting operations, check for specified tire pressures in all tires.

SYMPTOMS AND CAUSES

Table 1 lists various front and rear suspension trouble symptoms and possible causes. Several of these symptoms are also common to wheel and tire and steering troubles. For this reason, be sure that the cause of the trouble is in the front or rear suspension before adjusting, repairing, or replacing any of the suspension parts.

TABLE 1—Front and Rear Suspension Trouble Symptoms and Possible Causes

POSSIBLE CAUSES OF TROUBLE SYMPTOMS	Trouble Symptoms							
	Abnormal or Irregular Tire Wear	Squeals, Thumps, or Rattles	Sag at One Wheel	Hard or Rough Ride	Shimmy or Wheel Tramp	Side-to-Side Wander	Pull to One Side	Body Sway or Roll
Incorrect Tire Pressure	x		x	x	x	x	x	x
Incorrect Front Wheel Alignment	x	x			x	x	x	
Incorrect Front Wheel Bearing Adjustment	x	x			x		x	
Tire Sizes Not Uniform	x		x				x	
Wheel Out of Balance	x	x		x	x			
Out-of-Round Wheel or Brake Drum	x	x		x	x			
Unequal Brake Adjustment	x	x					x	
Sagging or Broken Spring	x	x	x	x	x	x	x	x
Overloaded Spring or Tire	x		x	x				
Loose or Worn Shock Absorber		x	x	x				x
Loose or Worn Suspension Arm Bushings	x	x			x			
Lack of Lubrication		x		x				

2 FRONT SUSPENSION REPAIR

For necessary hoisting and jacking procedures, see Part 8-4.

The 1961 Falcon front suspension assembly is shown in Fig. 1.

Whenever any part of the front suspension has been removed and installed, front wheel alignment must be checked.

BALL JOINT CHECK

To determine if excessive wear or looseness indicates ball joint replacement, perform the following procedure.

1. Raise the car, and remove the wheel cover and dust cap.

2. Remove the cotter pin, and tighten the wheel bearing adjusting

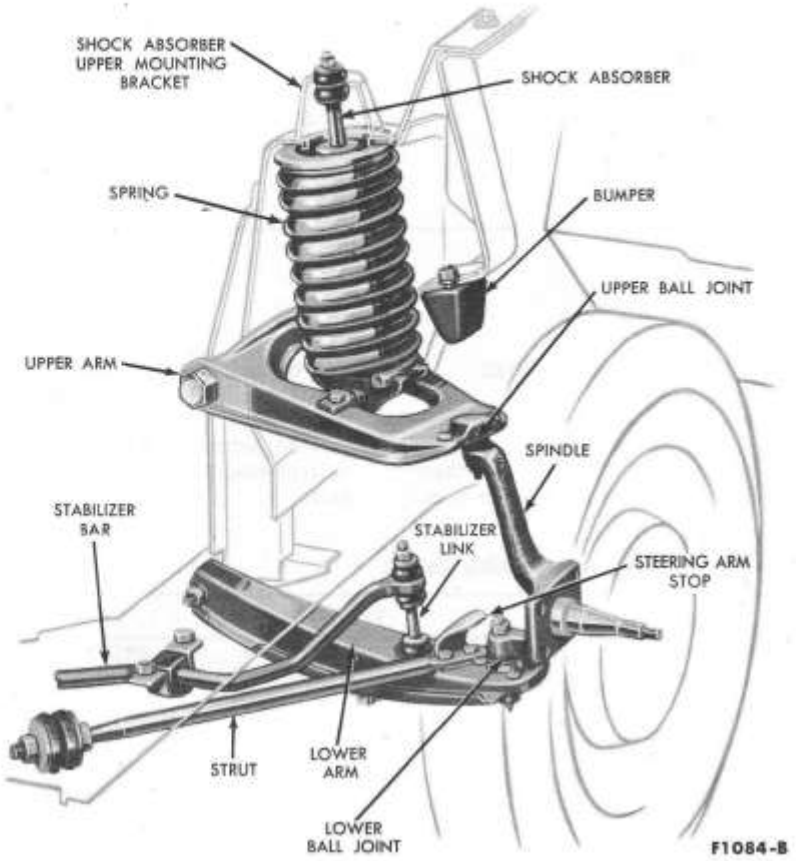


FIG. 1—Front Suspension Assembly

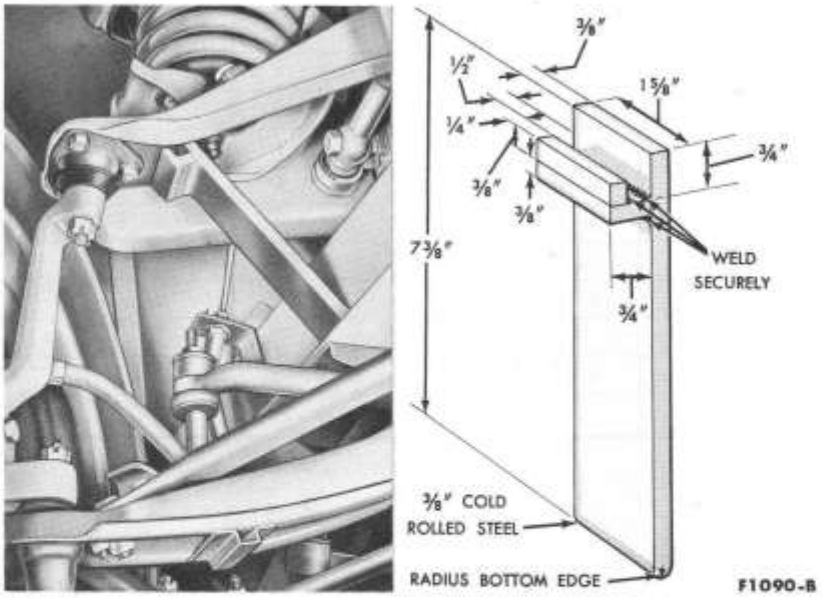


FIG. 2—Upper Arm Support

nut to remove all bearing looseness.

3. To check the upper ball joint, fasten a dial indicator to the upper suspension arm. To check the lower ball joint, fasten the dial indicator to the lower suspension arm. Position the indicator so that the plunger rests against the wheel rim adjacent to the ball joint being checked.

4. With one hand at the top and the other hand at the bottom of the tire, slowly move the wheel and tire in and out; and, at the same time, observe the reading on the dial indicator.

5. If the reading exceeds 0.250 inch, replace the ball joint.

UPPER BALL JOINT REPLACEMENT—ARM IN CAR

1. Position a support between the upper arm and frame side rail as shown in Fig. 2, then raise the car and position safety stands.

2. Remove the wheel and tire.

3. Using a large chisel, cut off the three upper ball joint retaining rivets.

4. Remove the cotter pin and nut from the upper ball joint stud.

5. Position the ball joint remover tool (T60K 3006-A with T57P 3006-A) as shown in Fig. 3. **The tool should seat firmly against the ends of both studs, and not against the lower stud nut.** It may be necessary to remove the lower ball joint cotter pin if it prevents the tool from seating on the lower stud.

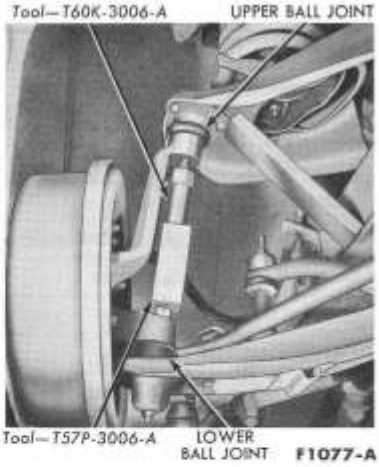


FIG. 3—Loosening Ball Joint Stud in Spindle

6. Turn the tool with a wrench until both studs are under tension, and then, with a hammer, tap the spindle near the upper stud to loosen the stud from the spindle. **Do not loosen the stud with tool pressure alone.** Remove the ball joint.

7. Clean the end of the arm, and remove all burrs from the hole edges.

Check for cracks in the metal at the holes, and replace the arm if it is cracked.

8. Attach the new ball joint to the upper arm. **Use only the specified bolts, nuts, and washers. Do not rivet the new ball joint to the arm.** Torque the nuts to 12-18 ft-lbs.

9. Position the ball joint stud in the spindle bore, and torque the retaining nut to 35 ft-lbs. Install a new cotter pin, tighten the nut if necessary to line up the cotter pin hole.

10. Lubricate the ball joint, and install the wheel and tire.

11. Remove the safety stands, and lower the car.

12. Remove the support from between the upper arm and frame.

13. Check and, if necessary, adjust caster, camber, and toe-in.

FRONT WHEEL SPINDLE REPLACEMENT

1. Position a support between the upper arm and frame as shown in Fig. 2, then raise the car and position safety stands.

2. Remove the wheel and drum.

3. Remove the brake carrier plate from the spindle. Support the plate to prevent damage to the brake hose.

4. Disconnect the spindle connecting rod end from the spindle arm.

5. Remove the cotter pins from both ball joint stud nuts, and loosen the nuts one or two turns. **Do not remove the nuts from the studs at this time.**

6. Position the ball joint remover tool between the upper and lower ball joint studs (Fig. 3). **The tool should seat firmly against the ends of both studs and not against the stud nuts.**

7. Turn the tool with a wrench until the tool places the studs under tension, and, with a hammer, tap the spindle near the studs to loosen them in the spindle. **Do not loosen the studs in the spindle with tool pressure alone.**

8. Remove the stud nuts and the spindle from both studs, using a floor jack under the lower suspension arm.

9. Position the spindle on the lower ball joint stud and install the stud nut.

10. Using a floor jack raise the lower suspension arm, and guide the upper ball joint stud into the spindle. Install the stud nut.

11. Torque the upper stud nut to 35-65 ft-lbs and the lower stud nut to 35-65 ft-lbs. Continue to tighten both nuts until the cotter pin holes and slots line up. Install new cotter pins.

12. Connect the spindle connecting rod end to the spindle arm.

13. Install the brake carrier plate on the spindle, and torque the bolts to 25-35 ft-lbs.

14. Install the wheel and drum, adjust the wheel bearing, and adjust the brakes.

15. Remove the safety stands, and lower the car.

16. Remove the support from between the upper arm and frame.

17. Check and, if necessary, adjust caster, camber, and toe-in.

FRONT SPRING REPLACEMENT

REMOVAL

1. Position a support between the upper arm and frame as shown in Fig. 2.

2. Raise the car and remove the wheel and tire as an assembly.

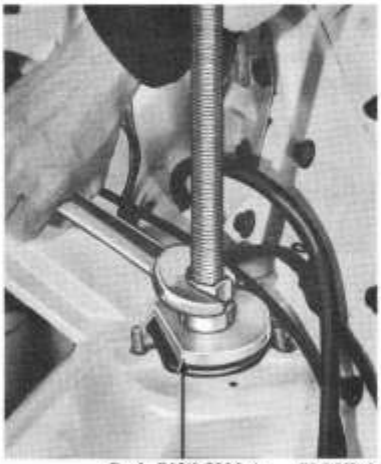
3. Remove the shock absorber lower retaining nuts.

4. Remove the shock absorber upper mounting bracket retaining bolts and remove the bracket and shock absorber (Fig. 8).

5. Install a safety stand at the front end of the underbody.

6. Install tool T60K 5310-A through the top of the spring housing so that the tool lower studs fit into the shock absorber lower mounting holes, and secure the tool to the spring seat with two nuts.

7. Fit the tool pilot into the spring upper seat, then compress the spring by tightening the nut on the threaded shaft of the tool (Fig. 4). Tighten the nut until the spring is loose in its housing.



Tool—T60K-5310-A F1087-A

FIG. 4—Coil Spring Removal

8. Remove the spring lower seat retaining nuts, then lift the assembly to disengage the spring seat from the suspension arm.

9. Guide the spring and tool down and out the forward end of the wheelhousing.

INSTALLATION

1. If the spring is to be replaced, measure the spring height compressed in the tool. Place the tool nut in a vise and rotate the assembly by hand until the spring is decompressed (Fig. 5).

F1089-A

FIG. 5—Spring Replacement

2. Transfer the tool to the new spring. Be sure that the pilot of the tool fits into the spring upper seat and that the spring coil is firmly seated in **both** grooves of the spring lower seat.

3. Place the tool nut in a vise, and rotate the spring until the previously measured spring height is attained.

4. Lift the spring and tool into place and position the assembly so that the spring seat groove containing the lower end of the spring coil is to the outboard side.

5. Install the spring lower seat to suspension arm retaining nuts.

6. Loosen the spring removal tool nut until the spring is properly seated, and then remove the tool (Fig. 4).

7. Install the shock absorber.

8. Install the wheel and tire assembly, remove the safety stand, and lower the car.

9. Remove the support from between the upper arm and frame.

UPPER ARM REPLACEMENT

REMOVAL

1. Remove the front spring as outlined under "Removal" in the foregoing section.

2. Position a safety stand under the lower arm.

3. Remove the cotter pin from the nut on the upper ball joint stud, and loosen the nut one or two turns. **Do not remove the nut from the stud at this time.**

4. Position the ball joint remover tool, and install the tool (T60K 3006-A with T57P 3006-A) between the upper and lower ball joint studs. **The tool should seat firmly against the ends of both studs and not against the stud nuts (Fig. 3).**

5. Turn the tool with a wrench until the tool places the studs under tension, and then tap the spindle near the upper stud with a hammer to loosen the stud in the spindle. **Do not loosen the stud in the spindle with tool pressure only.** If both arms are being removed, loosen the lower stud in the same manner as the upper stud.

6. Remove the nut from the upper stud and lift the stud out of the spindle.

7. Remove the upper arm inner shaft retaining nuts from the engine compartment, and remove the upper arm. Measure and note the total shim thickness at each inner shaft bolt.

8. Wipe off all loose dirt from the upper arm parts. **Do not wash the ball joint with a solvent.**

INSTALLATION

1. Position the upper arm on the underbody mounting bracket, and install but do not tighten the nuts and lockwashers on the two inner shaft retaining bolts. **The specified keystone-type lockwashers must be used.**

2. Install the adjusting shims on both bolts between the inner shaft and the underbody. **Install the same shim thicknesses that were removed from both bolts during disassembly.** Torque the nuts to 65-90 foot-pounds.

3. Position the upper ball joint stud in the top of the wheel spindle, and install the stud nut. Torque the nut to 35-65 ft-lbs, and continue to tighten it until the cotter pin hole and slots line up. Install a new cotter pin.

4. Lubricate the upper ball joint.

5. Position the support between the upper arm and frame and install the coil spring. Follow steps 4 through 9 under "Installation" in the foregoing procedure.

6. **Check and, if necessary, adjust caster, camber, and toe-in.**

UPPER ARM PARTS INSPECTION

Inspect the upper arm and the inner shaft for cracks, bends, or other damage. Replace the parts as required.

Check the condition of the bushings and the rubber seal on the ball joint stud. If any of these parts are cracked, torn, distorted, or worn, replace them.

Install the nut on the ball joint stud, and turn the stud in the ball joint with a torque wrench. If the turning effort is not within 20-30 inch-pounds torque, replace the ball joint.

Replacement arms come with the bushings, inner shaft, and ball joint installed. If the original arm is to be used, these components should be installed on the bench.

UPPER ARM OVERHAUL—ARM REMOVED

BUSHING AND INNER SHAFT REPLACEMENT

Always replace both upper arm bushings if either bushing is worn or damaged. Install only new bushings when replacing the inner shaft.

1. Unscrew the bushings from the inner shaft and suspension arm, then remove the shaft from the arm.

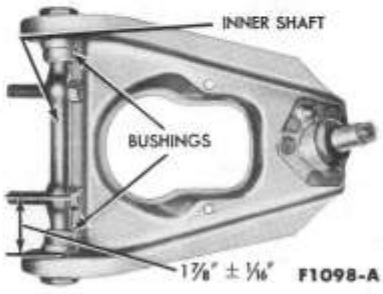


FIG. 6—Upper Arm Bushing Removal and Installation

2. Position the shaft in the arm, and install the new bushings on the shaft and the arm. **Turn the bushings so that the shaft is exactly centered in the arm.** The shaft will be properly centered when located at the dimension shown in Fig. 6. **Position the bushings carefully to avoid damaging the "O" rings inside the bushings.**

3. Torque the bushings to 160-190 ft-lbs.

UPPER BALL JOINT REPLACEMENT

The upper ball joint cannot be repaired and must be replaced if it is worn or damaged. The existence of "slop" or free-play is normal when the upper ball joint is unloaded.

1. Remove the ball joint from the arm. If the ball joint is riveted to the arm, drill a 1/8-inch pilot hole completely through each rivet, and then drill off the rivet head through the pilot hole with a 3/8-inch drill. Drive all rivets out of the holes.

2. Clean the end of the arm, and remove all burrs from the hole edges. Check for cracks in the metal at the holes, and replace the arm if it is cracked.

3. Install a new ball joint on the arm. **Use only the specified bolts, nuts, and washers. Do not attempt to rivet the new ball joint to the arm.**

4. Torque the ball joint retaining nuts and bolts to 12-17 ft-lbs.

5. Lubricate the ball joint.

LOWER ARM REPLACEMENT

REMOVAL

1. Position the tool shown in Fig. 2 under the upper arm for support.

2. Raise the car, position safety stands, and remove the wheel and tire.

3. Remove the stabilizer bar and link retaining nut, disconnect the bar from the link, and remove the link bolt.

4. Remove the strut to lower arm retaining nuts and bolts, and remove the steering arm stop.

5. Remove the cotter pin from the nut on the lower ball joint stud, and loosen the nut one or two turns. **Do not remove the nut from the stud at this time.**

6. Straighten the cotter pin on the upper ball joint stud nut. Position ball joint remover tool (T60K 3006-A with T57P 3006-A) between the upper and lower ball joint studs in the reverse position from that shown in Fig. 3. **The tool should seat firmly against the ends of both studs and not against the stud nuts.**

7. Turn the tool with a wrench until the tool places the studs under tension, and tap the spindle near the lower stud with a hammer to loosen the stud in the spindle. **Do not loosen the stud in the spindle with tool pressure only.** If both arms are being removed, loosen the upper stud in the same manner as the lower stud.

8. Remove the nut from the lower ball joint stud, and lower the arm.

9. Remove the lower arm to underbody pivot bolt, nut and washer. Remove the lower arm.

INSTALLATION

1. Position the lower arm to the underbody and install the pivot bolt, washer, and nut. Torque to 60-75 ft-lbs.

2. Install the stabilizer link bolt, washers, bushings and spacer. Connect the stabilizer bar to the link. Install the retaining nut and torque to 12-17 ft-lbs (Fig. 1).

3. Using a floor jack, raise the lower suspension arm, and guide the lower ball joint stud into the spindle. Install the stud nut and torque to 35-65 ft-lbs.

4. Position the strut and steering arm stop to the lower control arm. The stop goes between the arm and strut. Install the retaining bolts and nuts and torque to 40-55 ft-lbs.

5. Install the lower ball joint retaining nut cotter pin, and bend the upper ball joint retaining nut cotter pin.

6. Lubricate the lower ball joint. **Do not lubricate the lower arm bushings.**

7. Remove the safety stands and lower the car. Remove the tool supporting the upper arm.

8. **Check and, if necessary, adjust caster, camber, and toe-in.**

LOWER ARM PARTS INSPECTION

Inspect the lower arm for cracks, bends, or other damage, and replace the arm if necessary.

Check the condition of the ball joint and socket, the bushings, and the rubber seal on the ball joint stud. If any of these parts are cracked, torn, distorted, or worn, replace them.

The replacement arm comes with ball joint and components installed. If the original arm is to be used the ball joint should be installed on the bench.

LOWER BALL JOINT REPLACEMENT

The lower ball joint cannot be repaired and must be replaced if it is worn or damaged.

1. Remove the lower arm as outlined under "Lower Arm Replacement."

2. Remove the ball joint from the arm. If the ball joint is riveted to the arm, drill a ⅛-inch pilot hole completely through each rivet, and then drill off the rivet head through the pilot hole with a ⅜-inch drill. Drive all rivets out of the holes.

3. Clean the end of the arm, and remove all burrs from the hole edges. Check for cracks in the metal at the holes, and replace the arm if it is cracked.

4. Install a new ball joint on the arm. **Use only the specified bolts, nuts and washers. Do not attempt to rivet the new ball joint to the arm.**

5. Torque the ball joint retaining nuts and bolts to 28-45 ft-lbs.

6. In cases where the lower ball joint flange must be drilled for the strut retaining bolts, use the lower arm holes as a guide. **Do not elongate the lower arm holes.**

7. Install the lower arm as outlined under "Lower Arm Replacement", and lubricate the ball joint.

STABILIZER REPLACEMENT

1. Raise the car high enough to provide working space, and place supports under both front wheels.

2. Disconnect the stabilizer from the link at each lower arm. Disconnect both stabilizer retaining brackets, and remove the stabilizer.

3. Coat the necessary parts of the stabilizer with RuGLYDE or a comparable lubricant, and slide new insulators onto the stabilizer.

4. Connect the stabilizer retaining brackets, and connect the stabilizer to both suspension arms. Torque the cap screws to 12-17 ft-lbs, and the nut for the special 9/16-inch bolt to 12-17 ft-lbs.

5. Remove the supports and lower the car.

3 REAR SUSPENSION REPAIR

For necessary hoisting and jacking procedures, see Part 8-4.

REAR SPRING REMOVAL

1. Raise the car until the rear wheels clear the floor, and place supports beneath the underbody and beneath the axle.

2. Disconnect the parking brake cable spring (Fig. 7) from the outer spring clip.

3. Disconnect the lower end of the shock absorber from the spring plate.

4. Remove the spring plate nuts, the U-bolts, and the spring plate.

5. Remove the front hanger stud from the forward end of the spring (Fig. 7).

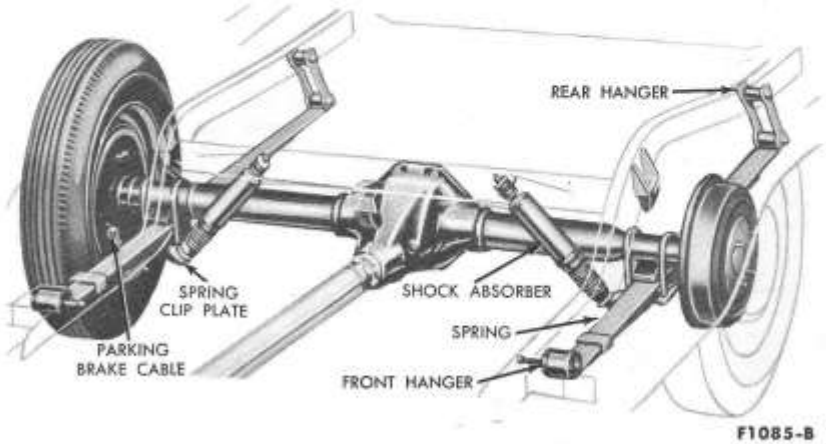


FIG. 7—Rear Suspension Assembly

6. Remove the shackle from the shackle hanger and spring, and remove the spring from the car.

REAR SPRING INSPECTION AND REPAIR

Inspect the rubber bushings, shackle and studs, and hanger and stud, for wear or damage. Replace parts where necessary.

Check for broken spring leaves.

Inspect the spring plate U-bolts for worn or damaged threads. Check the spring plate for distortion.

Check the underbody rail for secure welds at the point where the front hanger is installed.

REAR SPRING INSTALLATION

1. Position the spring under the rear axle. **The shorter end of the spring between the center tie bolt and the spring eye should be toward the front of the car.**
2. Install the shackle and shackle hanger, leaving the locknuts finger tight.
3. Install the front hanger stud finger tight in the spring and hanger.
4. Torque the shackle locknuts to 13-20 ft-lbs.
5. Install the spring plate and clip nuts. **Be sure that all parts are properly seated on the spring and rear axle.**
6. Torque the U-bolt nuts to 13-20 ft-lbs.
7. Connect the lower end of the shock absorber to the rear spring plate.
8. Place safety stands under the rear axle, lower the car until the spring is in the approximate curb load position, and then torque the front hanger stud locknut to 30-40 ft-lbs.
9. Remove the safety stands and lower the car.

4 SHOCK ABSORBER REPLACEMENT

FRONT SHOCK ABSORBER REMOVAL

1. Raise the front end of the car and place supports under both suspension lower arms. **Be sure that the lower end of the shock absorber remains accessible for servicing.**
2. Disconnect the shock absorber lower retaining nuts from the spring lower seat.
3. Remove the shock absorber upper mounting bracket retaining nuts. Lift the bracket and shock absorber from the car (Fig. 8).
4. Remove the shock absorber from the mounting bracket.
5. Remove the bushing and washers from the shock absorber stud.

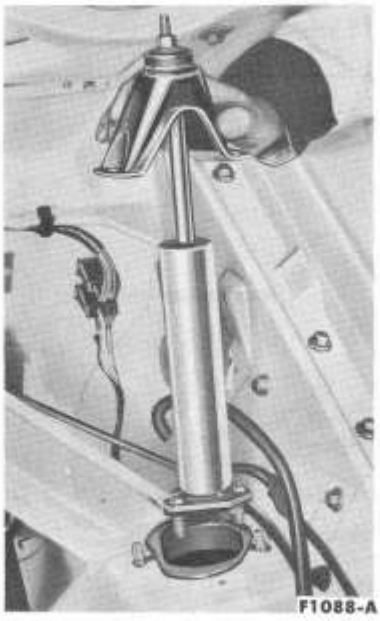


FIG. 8—Front Shock Absorber Removal

FRONT SHOCK ABSORBER INSTALLATION

1. Assemble the bushings to the shock absorber lower attaching studs.
2. Install the washer and upper bushing to the shock absorber. Install the upper mounting bracket, bushing, washer and retaining nut to the shock absorber.
3. Extend the shock absorber and install to the spring lower seat. Install the lower bushings, washers, and torque the nuts to 12-17 ft-lbs.
4. Install the upper mounting bracket to the body. Torque the retaining nuts to 8-13 ft-lbs.
5. Torque the shock absorber to mounting bracket nut to 15-25 ft-lbs.

REAR SHOCK ABSORBER REMOVAL

1. Disconnect the shock absorber from the spring clip plate (Fig. 7).
2. On the passenger car, remove the shock absorber access cover from the luggage compartment (Fig. 9).

On the Ranchero, remove the retaining screws, and lift the forward half of the floor panel from the body; then remove the access cover from the opening in the floor pan over the shock absorber.

On station wagons, remove the access cover from the opening in the seat riser over the shock absorber.

3. Remove the shock absorber upper retaining nut.
4. Compress the shock absorber and remove it from the car. Remove the bushings and washers from the shock absorber studs.

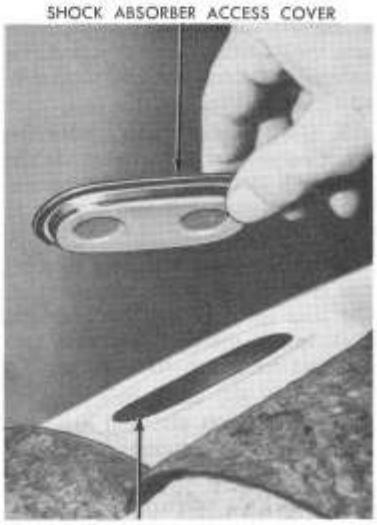


FIG. 9—Rear Shock Absorber Access Cover

REAR SHOCK ABSORBER INSTALLATION

1. Place the bushings and washers on the shock absorber studs.
2. Connect the upper stud to the bracket, and install the bushing, washer, and nut on the stud. Torque the nut to specification, and install the cover (on a station wagon or car).

On the Ranchero, after installing the access cover in the floor pan, install the forward half of the floor panel.

3. Connect the lower stud to the spring clip plate, and install the bushing, washer, and nut on the stud. **Be sure the spring clip plate is free of burrs.** Tighten the nut to specification.

PART 8-4 UNDERBODY

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The unitized body-frame construction of the 1961 Falcon requires special precautions and procedures when the car is jacked up or hoisted. In some cases, special hoist adapters must be used as recommended by specific hoist manufacturers.

1 HOISTING

DRIVE-ON TYPE HOIST

To prevent possible damage to the underbody, do not drive the car onto the drive-on type hoist without first checking for possible interference between the upright flanges of the hoist rails and the underbody. Should there be interference, the hoist flanges should be modified as necessary and/or the approach ramps built up to provide the needed clearance.

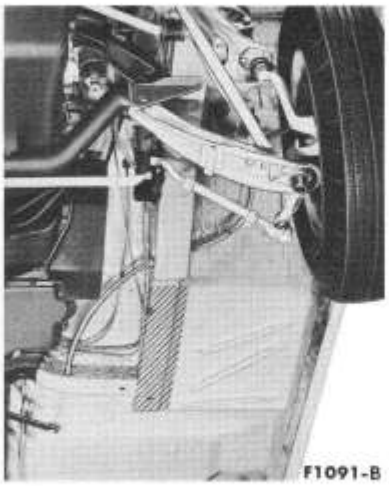

FIG. 1—Hoist Contact Area—Front

RAIL TYPE—FREE WHEELING HOIST

FRONT

The front adapters or hoist plates must be carefully positioned in contact with the lower suspension arms to assure safe, secure lifting.

REAR

The hoist adapters must be positioned carefully under the rear axle to prevent damage to the shock absorbers when the car is raised. The hoist rails should be raised slowly and the position of the adapters checked.

FORK LIFT—TWIN POST HOIST

FRONT

To assure safe hoisting, the front post adapters must be positioned carefully to contact the center of the lower suspension arms.

REAR

To prevent damage to the shock absorbers, the rear forks must contact the axle at points not farther outboard than 1 inch from the circumference welds near the differential housing. Carefully raise the rear post and check the position of the fork.

FRAME CONTACT HOIST

Frame contact hoist adapters are necessary to lift the car. The hoist adapter pads should each cover at least 12 square inches of underbody area. Figures 1 and 2 show recommended contact points.

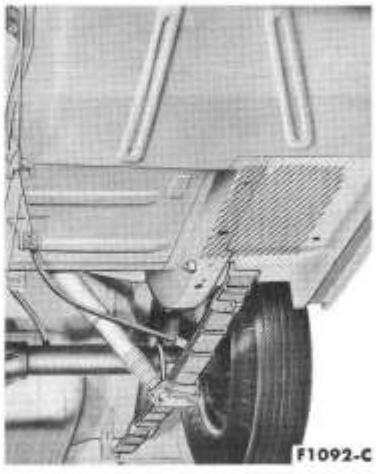

FIG. 2—Hoist Contact Area—Rear

2 JACKING

When a stationary floor jack or a roll jack is to be used, there are several specific recommended points of contact. Either side of the car may be raised at the front by jack contact at the lower arm strut connection. Either side of the front end of the car may also be raised by jack pressure on the front crossmember, or on the crossmember to which the stabilizer is connected.

Either side of the rear end of the car may be raised by jack pressure on the rear crossmember. Do not put pressure on the fuel tank.

To raise the front of the car with a bumper jack, position the jack directly in front of the parking light. At the rear, the bumper jack should be placed under the tail light midway between the bumper attaching bolts.

1961 FORD FALCON SHOP MANUAL

GROUP 9

STEERING

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PART 9-1 STEERING GEAR

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1 TROUBLE CHECKS

Table 1 lists various steering gear and linkage trouble symptoms and possible causes. Several of these symptoms are also common to suspension, frame, and wheel and tire troubles. For this reason, be sure that the cause of the trouble is in the steering gear or linkage before adjusting, repairing, or replacing any of the steering parts.

TABLE 1—Steering Gear and Linkage Trouble Symptoms and Possible Causes

Possible Causes of Trouble Symptoms	Trouble Symptoms									
	Jerky Steering	Loose Steering	Hard Steering	Hard Turning When Stationary	Rattles	Shimmy	Pull To One Side	Side-To-Side Wander	Body Sway Or Roll	Tire Squeal on Turns
Incorrect Tire Pressure			x	x		x	x	x	x	x
Incorrect Front Wheel Alignment	x		x			x	x	x		x
Incorrect Front Wheel Bearing Adjustment	x	x				x	x		x	
Tire Size Not Uniform			x	x		x	x	x		
Wheel Out of Balance	x					x				
Loose Steering Linkage Connections	x	x			x	x		x		
Loose Steering Gear Mountings		x		x	x	x		x	x	
Incorrect Steering Gear Adjustment	x	x	x	x		x		x	x	
Binding Front Suspension Ball Joints	x		x	x						
Bent Spindle Arm							x	x		x
Unequal Brake Adjustment							x			
Sagging or Broken Spring					x		x	x	x	
Lack of Lubrication			x	x	x					

2 STEERING GEAR ADJUSTMENTS

STEERING WORM AND SECTOR GEAR ADJUSTMENTS

The ball nut assembly and the sector gear must be adjusted properly to maintain minimum steering shaft end play (a factor of preload adjustment) and minimum backlash between sector gear and ball nut. There are only two possible adjustments within the recirculating ball-type steering gear, and **these should be made in the following order to avoid damage or gear failure.**

1. Disconnect the sector shaft arm (Pitman-arm) from the sector shaft (Fig. 5).

2. Loosen the steering gear housing attaching bolts at the underbody side rail to relieve possible binding between the steering column and the worm shaft.

3. Loosen the steering column bracket screws at the instrument panel.

4. Partially tighten the steering column bracket screws.

5. Torque the steering gear housing attaching bolts to specification.

6. Loosen the nut which locks the sector adjusting screw (Fig. 1), and turn the adjusting screw counterclockwise.

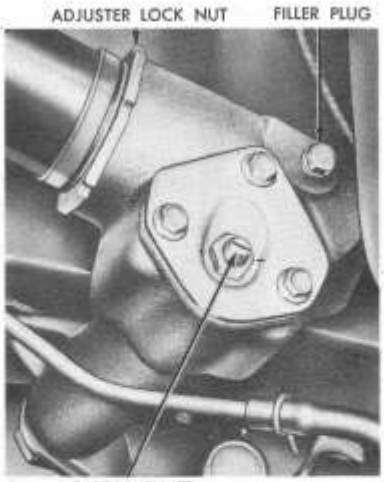

FIG. 1—Steering Gear Adjustment

7. Measure the worm bearing preload by attaching an inch-pound torque wrench to the steering wheel nut (Fig. 2). Read the pull required to keep the wheel moving for at least one complete turn. If the torque or preload is not within specifications (Group 17), adjust as explained in the next step.

8. Loosen the steering shaft bearing adjuster lock nut, and tighten

FIG. 2—Steering Gear Load Check

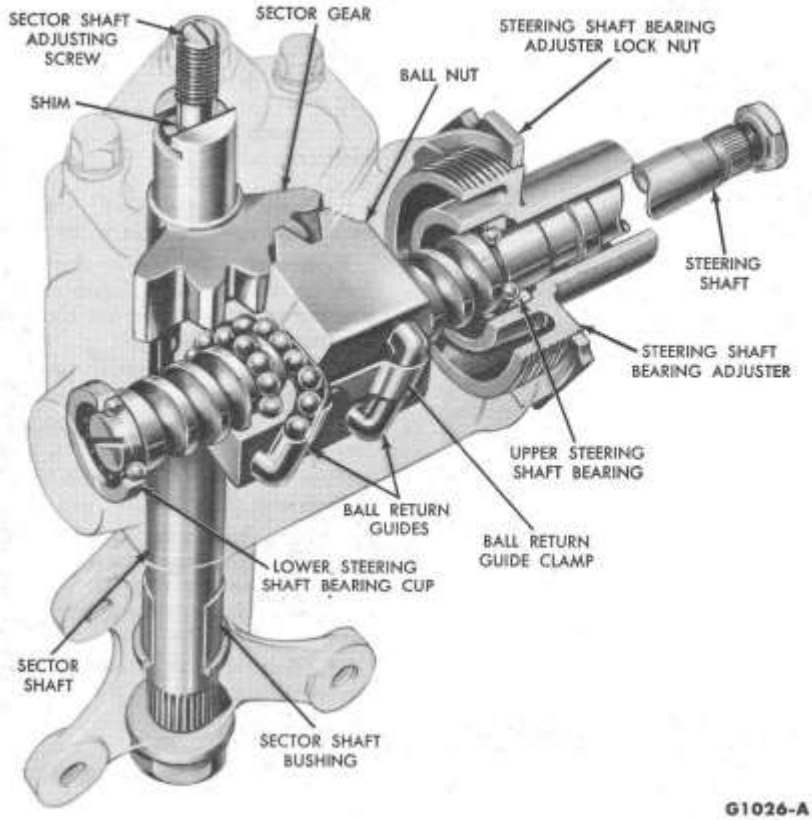

FIG. 3—Steering Gear

or back off the bearing adjuster (Fig. 3) to bring the preload within the specified limits.

9. Tighten the steering shaft bearing adjuster locknut, and recheck the preload.

10. Turn the steering wheel slowly to either stop. **Turn gently against the stop to avoid possible damage to the ball return guides.** Then rotate the wheel 2 5/16 turns to center the ball nut.

11. Turn the sector adjusting screw clockwise until the specified pull (Group 17) is necessary to rotate the worm past its center (Fig. 2). **No perceptible backlash is permissible at 30° on either side of center.**

12. Tighten the sector adjusting screw locknut, and recheck the backlash adjustment.

13. Tighten the steering column bracket bolts. Connect the sector shaft arm to the sector shaft, and torque the nut to specification.

STEERING WHEEL SPOKE POSITION ADJUSTMENT

When the steering gear is on the high point, the front wheels should be in the straight-ahead position and the steering wheel spokes should be in their normal position with the sector shaft arm pointing directly forward. If the spokes are not in their normal position, they can be adjusted without disturbing the toe-in adjustment (Part 8-1).

3 STEERING GEAR REPAIR

STEERING WHEEL REPLACEMENT

1. Remove the horn ring (or button) assembly and related parts.

2. Remove the nut from the end of the steering shaft, and remove the steering wheel from the shaft with the tool shown in Fig. 4.

3. Apply Lubriplate to the horn switch brush plate and to the upper surface of the steering shaft upper bushing.

4. With the front wheels straight forward, position the steering wheel on the steering shaft so that the spokes are properly centered and the splines on both parts are properly aligned.

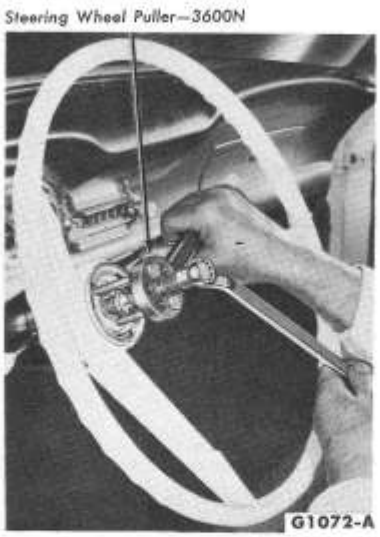

FIG. 4—Steering Wheel Removal

5. Install the steering wheel nut on the shaft, torque to specification and stake the nut.

6. Install the horn ring (or button) assembly and related parts.

STEERING GEAR REMOVAL

For hoisting and jacking instructions, see Part 8-4.

1. Raise the front of the car onto safety stands. Remove the sector shaft arm (Fig. 5).

2. Remove the steering gear attaching bolts and disconnect the transmission shift rod(s) at the gear shift lever(s).

3. Pull the rubber seal up on the steering column, fold the floor mat aside, and move the dash panel insulation out of the way.

4. Remove the retaining screws from the steering column weather seal on the dash panel. Remove the steering column cover plates and gasket.

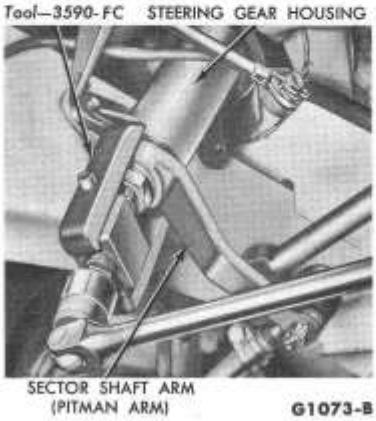

FIG. 5—Sector Shaft Arm Removal

5. Disconnect the horn and turn indicator wires under the instrument panel. Also on a car with a Fordomatic transmission, disconnect the neutral switch wires.

6. Remove the horn ring (or button) and spring. Remove the steering wheel retaining nut and the steering wheel (Fig. 4).

7. Remove the upper bearing sleeve and spring.

8. Remove the steering column clamp to instrument panel bolts and remove the clamp (upper and lower halves) and the insulator.

9. Slide the steering column tube assembly from the steering gear shaft, guiding the shift lever(s) up through the rubber seal at the dash panel.

10. Remove the steering gear and shaft assembly out through the engine compartment.

STEERING GEAR DISASSEMBLY

1. Rotate the steering shaft approximately 2¼ turns from either stop.

2. After removing the sector adjusting screw locknut and the housing cover bolts, remove the sector shaft with the cover. Remove the cover from the shaft by turning the screw clockwise. **Keep the shim with the screw.**

3. Loosen the adjuster nut, and remove the adjuster assembly and the steering shaft upper bearing.

4. Carefully pull the steering shaft and ball nut from the housing, and remove the steering shaft lower bearing. **To avoid possible damage to the ball return guides, keep the ball nut from running down to either end of the worm.**

Disassemble the ball nut only if there is indication of binding or tightness.

5. Remove the ball return guide clamp and the ball return guides from the ball nut. **Keep the ball nut clamp-side up until ready to remove the balls.**

6. Turn the ball nut over, and rotate the worm shaft from side to side until all 62 balls have dropped out of the nut into a clean pan. With the balls removed, the ball nut will slide off the worm.

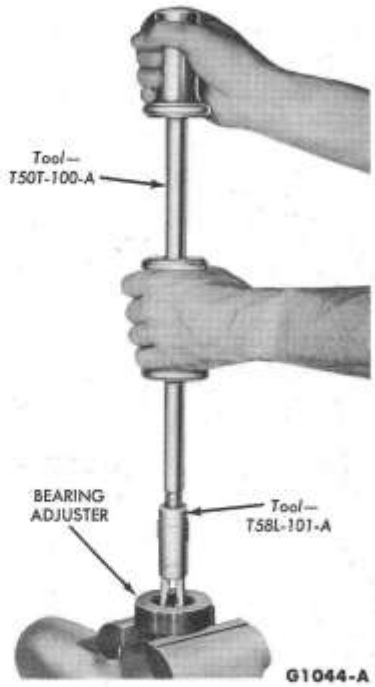

FIG. 6—Steering Shaft Upper Bearing Cup Removal

Remove bearing cups, seals, or bushings only if preliminary inspection shows damage.

7. Place the bearing adjuster in a vise, and remove the upper bearing cup (Fig. 6). Remove the lower bearing cup, using the same tool.

8. Press out both sector shaft bushings from the housing (Fig. 7).

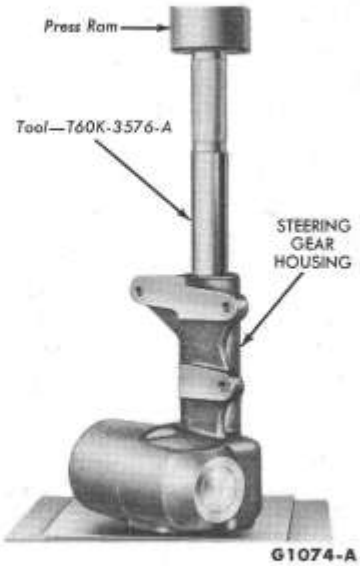

FIG. 7—Sector Shaft Bushing Removal

STEERING GEAR CLEANING AND INSPECTION

Wash all parts in a cleaning solvent, and dry with a lint-free cloth. **The bearings should not be spun dry with compressed air.** Inspect the shaft and worm for scoring, cracks, or checks, and for straightness of the shaft. Check the splines and the threads on the sector shaft for wear and burrs. Inspect the gear teeth for scoring, pitting, and other wear. Inspect the bearings for free movement, and the cups for wear or irregular surfaces. Check the housing for cracks and the bushings for scoring, pitting, or other wear.

STEERING GEAR ASSEMBLY

1. If the sector shaft bushings have been removed, press new bushings into the housing (Fig. 8).

2. If the steering shaft upper and/or lower bearing cup has been removed, press a new bearing cup into the housing (Figs. 9 or 10).

3. If the sector shaft oil seal has been removed, install a new oil seal.

4. Lay the steering shaft on a bench, and position the ball nut on the shaft with the guide holes up and the shallow end of the teeth to the left of the steering wheel position. Align the grooves in the worm and in the ball nut by sighting through the ball guide holes.

5. Count 31 balls, and drop as many of them as possible into one of the guide holes, slowly turning the worm away from the hole, until that circuit is full or until rotation is stopped by the end of the worm. If the balls are stopped by the end of the worm, hold in those already positioned, and turn the worm in the opposite direction. The filling of the circuit can then be continued until most of the balls are in place.

6. Lay one half of the ball return guide on the bench, and place the remainder of the 31 balls in it. Position the second half of the guide and, holding the two halves together, plug each open end with multi-purpose lubricant so the balls will stay in the guide when it is installed.

7. Push the guide into the guide holes of the ball nut, tapping lightly with the wooden handle of a screwdriver if necessary.

8. Assemble the second ball return circuit in the same way as the first.

9. Install the ball return guide clamp, and check the ball nut to see that it rotates freely.

10. Coat the threads of the steering shaft bearing adjuster, the housing cover bolts, and the sector adjusting screw with a suitable oil-resistant sealing compound. **Do not apply sealer to female threads, and especially avoid getting any sealer on the steering shaft bearings.**

11. Coat the bearings, bushings, and gear teeth with light engine oil.

12. Clamp the housing in a vise, with the sector shaft axis horizontal, and position the steering shaft lower bearing in its cup.

13. Position the steering shaft and ball nut assemblies in the housing.

14. Position the steering shaft upper bearing on the top of the worm, and install the steering shaft bearing adjuster and the adjuster nut. Leave the nut loose.

15. After installing the steering wheel nut on the steering shaft, adjust the worm bearing preload, using an inch-pound torque wrench. See Group 17 for specified preload.

16. Position the sector adjusting screw and adjuster shim, and check the end clearance which should not exceed 0.002 inch between the screw head and the end of the sector shaft. If clearance is greater than 0.002 inch, replace the shim.

17. Start the sector shaft pilot into the housing cover and then, using a screwdriver through the hole in the cover, turn the adjusting screw counterclockwise to pull the pilot into the cover.

18. Install a new gasket on the housing cover.

19. Rotate the steering shaft until the ball nut teeth are in position to mesh with the sector gear, tilting the housing so that the ball nut will tip toward the housing cover opening.

20. Push the housing cover and sector shaft assemblies into place, and install the two top housing cover bolts. The third bolt should be installed when lubricant is put into the gear housing. **Do not tighten the cover bolts until it is certain that there is some lash between ball nut and sector gear teeth.**

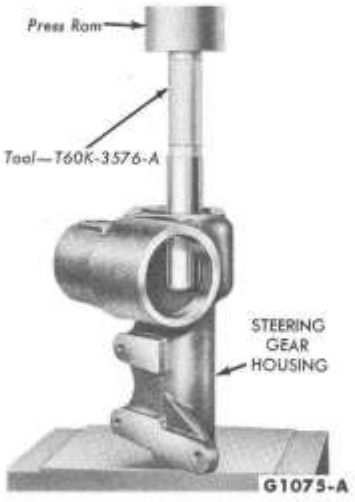

FIG. 8—Sector Shaft Bushing Installation

FIG. 9—Steering Shaft Lower Bearing Cup Installation

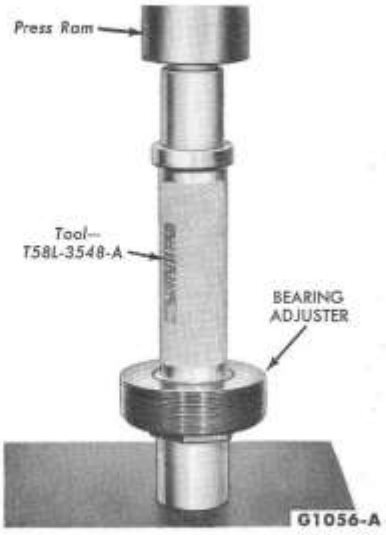

FIG. 10—Steering Shaft Upper Bearing Cup Installation

21. After loosely installing the sector shaft adjusting screw locknut, adjust the sector shaft mesh (backlash). See Group 17 for the specified mesh load. Remove the steering wheel nut.

STEERING GEAR INSTALLATION

1. Position the steering gear and shaft assembly through the engine compartment, resting the gear assembly on the underbody side rail.

2. Slide the steering column tube assembly over the steering shaft, guiding the shifting arms through the rubber seal at the dash panel.

3. Position the steering column assembly and retaining clamp and insulator, and loosely install the retaining bolts and nuts.

4. Position the upper bearing sleeve and spring. After applying Lubriplate to the upper surface of the steering shaft upper bearing and the horn switch brush plate, position the steering wheel. Install and stake the retaining nut. Install the turn indicator lever.

5. Install the horn ring (or button) and spring, and align the steering wheel to the center point.

6. Install the steering gear retaining bolts at the underbody. Torque the bolts to specification.

7. Position the sector shaft arm, and torque the retaining nut to specification.

8. Lower the car from the safety stands. Connect the horn, turn indicator wires, and (on a car with an automatic transmission) the neutral switch wires.

9. Connect the transmission shift rod(s). Position the steering column cover plates and gasket on the dash panel and install the retaining screws.

10. Position the dash panel insulation just above the steering column. Position the floor mat and push the rubber seal down to the floor mat.

11. Tighten the instrument panel clamp bolts.

12. If necessary, correct adjustment of the shift lever(s) and the neutral switch (Parts 5-2 and 6-2).

STEERING COLUMN UPPER BEARING REPLACEMENT

1. Disconnect the horn wire and the turn indicator wires below the instrument panel, and slide off the plastic insulator. Remove the horn ring (or button) and spring.

2. After removing the retaining nut, remove the steering wheel (Fig. 4). Unscrew the turn indicator lever.

3. Remove the turn indicator switch screws, and pull the switch to one side.

4. Remove the steering column tube flange retainer nuts allowing the bolts to drop into the gear shift lever socket assembly.

5. Remove the turn indicator switch, the steering column tube flange, the sleeve, and the turn indicator wiring assembly from the steering column tube.

6. Remove the steering column tube flange from the turn indicator switch and wiring assembly.

7. Remove the steering column upper bearing from the flange. Remove the bolts from the gear shift lever socket.

8. After applying Lubriplate, install the new upper bearing.

9. Feed the turn indicator switch wiring through the hole provided in the flange, through the steering column, and out through the routing hole under the instrument panel.

10. Position the flange retaining bolts and start the nuts flush with the end of the bolts. Position the flange and tighten the nuts. Install the turn indicator switch.

11. Install the turn indicator lever and position the bearing sleeve and spring. After applying Lubriplate to the horn switch brush plate, install the steering wheel, horn ring (or button) and spring.

12. Slide the plastic insulating tube over the wiring, starting the end into the steering column under the instrument panel. Connect the turn indicator and horn wires and test their operation.

PART 9-2 STEERING LINKAGE

The manual steering linkage (Figs. 1 and 2) consists of the sector shaft arm (Pitman arm), the steering arm to idler arm rod, the steering idler arm, and the spindle connecting rods (tie rods).

SPINDLE CONNECTING ROD END REPLACEMENT

The spindle connecting rod ends, which are threaded into the outer ends of the rod sleeves, have non-adjustable, spring-loaded ball studs. A rod end should be replaced when excessive looseness at the ball stud is noticed.

1. Remove the cotter pin and nut from the worn rod end ball stud (Figs. 1 and 2).

2. Disconnect the end from the spindle, using tool OTC 462.

3. Loosen the connecting rod sleeve clamp bolts, and count the number of turns needed to remove the rod end from the sleeve. Discard all rod end parts that were removed from the sleeve. **All new parts should be used when a spindle connecting rod end is replaced.**

4. Thread a new rod end into the sleeve, but do not tighten the sleeve clamp bolts at this time.

5. Install the seal on the rod end ball stud, insert the stud in the spindle arm hole, and install the stud nut. Torque the nut to specification and install the cotter pin.

6. Lubricate the rod end ball stud and, if necessary, the rest of the steering linkage.

7. Check and, if necessary, adjust toe-in (Part 8-1). **After toe-in is checked and adjusted, torque the old sleeve clamp bolts to specification. Add four pounds torque if new bolts are used.**

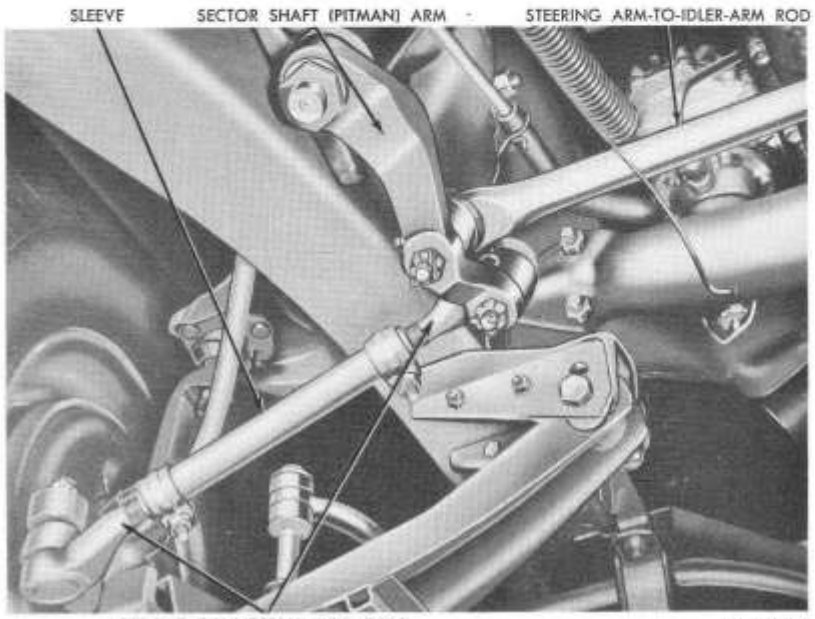

FIG. 1—Spindle Connecting Rod

SPINDLE SLEEVE REPLACEMENT

A spindle sleeve should be replaced if it becomes worn or damaged (Figs. 1 and 2). **Do not attempt to straighten the sleeve if bent or chase the threaded portion if damaged.**

1. Remove the spindle connecting rod ends as described in the previous sub-section.

2. Screw the spindle rod ends into the new sleeve the same number of turns as the worn ends that were removed. Do not tighten the clamp bolts at this time.

3. After installing the seal on the rod ends, position the sleeve assembly on the sector shaft arm (or the idler arm) and the spindle arm. Install the retaining nut, torque to specification, and install the cotter pin.

4. Lubricate the rod end ball stud and, if necessary, the rest of the linkage.

5. Check and, if necessary, adjust toe-in (Part 8-1). After toe-in is checked and adjusted, torque the sleeve clamp bolts to specification.

STEERING ARM TO IDLER ARM ROD REPLACEMENT

The rod connecting the steering sector shaft arm and the idler arm is non-adjustable and has non-adjustable ball studs. The rod should be replaced when damaged or when worn at the ball studs.

1. Remove the cotter pins and nuts from the ball studs at the sector shaft arm and the idler arm, and remove the steering arm to idler arm rod assembly (Figs. 1 and 2), using tool OTC 462.

2. After installing new seals on the ball studs, position the new steering arm to idler arm rod on

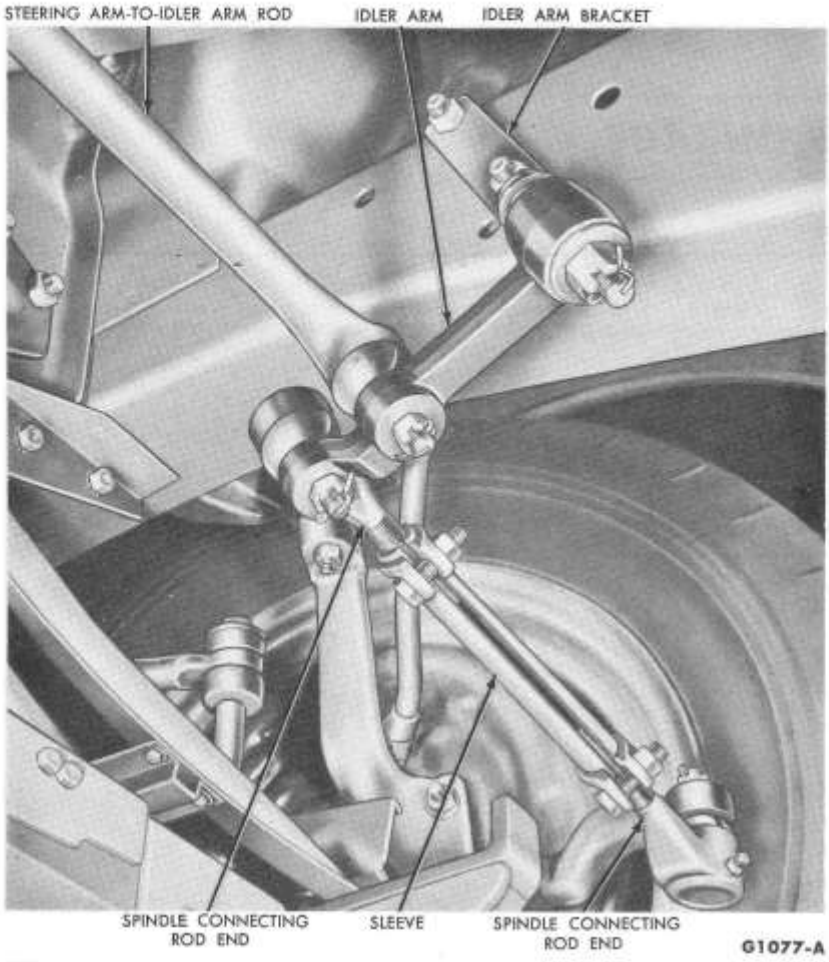

FIG. 2—Steering Idler Arm

the idler arm and the steering arm.

3. Install the ball stud retaining nuts and torque to specification.

4. Install cotter pins, lubricate the ball stud sockets, and if necessary, the rest of the steering linkage.

5. Check and, if necessary, adjust toe-in (Part 8-1).

STEERING IDLER ARM AND BUSHING REPLACEMENT

Replace the steering idler arm and bushing if the bushing is worn or the arm is damaged. Replace the idler arm bracket if the bushing is worn or the bracket is bent, or damaged. **Do not attempt to straighten a bent idler arm bracket.**

1. Disconnect the spindle rod and the steering arm to idler arm rod from the idler arm (Fig. 2).

2. After removing the idler arm retaining nut and special washer, remove the idler arm and bushing.

3. Position the new idler arm and bushing assembly.

4. With the idler arm pointed straight forward, position the special washer and torque the retaining nut to specification.

5. Connect the spindle rod and the steering arm to idler arm rod.

6. Check and, if necessary, adjust toe-in.

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GROUP 10

BRAKES

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PART 10-1 HYDRAULIC BRAKES

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1 TROUBLE SHOOTING

PRELIMINARY CHECKS

Always perform the following preliminary checks before attempting to check the causes of the trouble symptoms listed in Table 1.

Check the fluid level in the master cylinder reservoir. If necessary, add enough heavy-duty brake fluid to bring the level to within ½ inch of the top of the reservoir.

Push the brake pedal down as far as it will go while the car is standing still. If the pedal can be pushed down more than halfway between the released position and the floor, adjust the brakes.

Apply a steady pressure to the brake pedal. If it moves slowly toward the floor, check for leaks in the hydraulic system.

If the brake pedal movement feels spongy, bleed the hydraulic system to remove air from the lines and cylinders.

TABLE 1—Brake Trouble Symptoms and Possible Causes

Possible Causes of Trouble Symptoms	Trouble Symptoms												
	One Brake Drags	All Brakes Drag	Hard Pedal	Spongy Pedal	Car Pulls to One Side	One Wheel Locks	Brakes Chatter	Excessive Pedal Travel	Pedal Gradually Goes to Floor	Brakes Uneven	Low Pedal Reserve	Noisy or Grabbing Brakes	Brakes Do Not Apply
Pedal Improperly Adjusted		x											
Damaged Linkage			x					x					
Brake Line Restricted	x	x	x		x								
Leaks or Insufficient Fluid				x				x	x				x
Improper Tire Pressure					x					x			
Improperly Adjusted or Worn Wheel Bearing	x				x								
Distorted or Improperly Adjusted Brake Shoe	x	x	x			x		x			x	x	
Faulty Retracting Spring	x				x								
Drum out of Round	x				x		x						
Linings Glazed or Worn			x		x		x	x			x	x	x
Oil or Grease on Lining					x	x	x			x		x	x
Loose Carrier Plate						x	x						
Loose Lining							x						
Scored Drum										x		x	
Dirt on Drum-Lining Surface												x	
Faulty Brake Cylinder	x				x	x						x	
Dirty Brake Fluid	x	x								x			x
Faulty Master Cylinder		x							x				x
Air in Hydraulic System	x			x									x

Should one of the brakes be locked and the car must be moved, open the brake cylinder bleeder screw long enough to let out a few drops of brake fluid. **This bleeding operation will release the brakes, but it will not correct the cause of the trouble.**

ROAD TEST CHECKS

The car should be road tested only if the brakes will safely stop the car.

Apply the brakes at a speed of 25-30 mph to see if the car stops in a straight line. High-speed "panic" stops are not necessary to check for brake pull. If the brakes pull the car to one side, inspect and adjust them.

Apply the brakes hard without locking the wheels at a speed of about 50 mph, and check for brake pedal chatter or surge. This symptom is usually caused by an out-of-round brake drum.

2 BRAKE ADJUSTMENTS

The brakes should be adjusted when lining wear has reduced the brake pedal reserve to less than one-half of the total travel to the floor.

PRELIMINARY INSPECTION

1. Remove one of the front brake drums, and inspect the drum and the linings. **Do not let oil or grease touch the drum or the linings.** If the linings are worn to within 1/32 inch of the rivet heads, replace or reline both brake shoes. If the drum braking surface is excessively scored, refinish it. The condition of the remaining front drum and linings is usually about the same as that of the one inspected. The rear brake linings may also need replacing at the same time.

2. Check brake lines for damage or leakage.

3. Check the fluid level in the master cylinder reservoir. If necessary, add enough heavy duty brake fluid to bring the level to within ½ inch of the top of the reservoir.

4. Raise all four wheels. Then, with the parking brakes in the fully released position, check the brake cables. The cable adjustment should be just tight enough to remove the slack. **Excessive tightening may pull the brake shoes off their anchors.** See Part 10-2 for parking brake adjusting procedures.

BRAKE PEDAL ADJUSTMENT

When the brake pedal free-travel (which is the movement of the brake pedal before the push rod touches the master cylinder piston) is less than ¼ inch or more than 7/16 inch, the brake pedal should be adjusted.

1. Push the brake pedal down by hand pressure, and check the free travel.

2. Loosen the locknut on the eccentric bolt and rotate the bolt until the free-travel is within ¼-7/16 inch.

3. Hold the bolt securely, and torque the locknut to 25-30 foot-pounds.

4. Recheck the pedal free-travel to make sure that the adjustment did not change when the locknut was tightened.

BRAKE SHOE ADJUSTMENT

The brakes should be adjusted when the drums are at normal room temperature. If the shoes are adjusted when the drums are hot, dragging brakes may result when the drums cool.

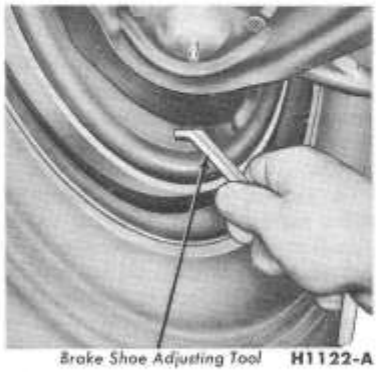
1. Raise the car until the wheels clear the floor. If the car is on a frame contact hoist, disconnect the parking brake cables to prevent their tightening when the rear axle and springs sag.

2. Remove the adjusting hole cover from the bottom of the brake carrier plate, and turn the adjusting screw (Fig. 1) until a slight drag on the wheel is noted.

3. Back off the adjustment just enough to allow the wheel to rotate freely. If it fails to rotate freely, the wheel and drum should be removed and the dust blown off the brake shoes and carrier plate. Apply a light coating of Lubriplate to the brake shoe-to-plate contact points. Install the wheel and drum, and adjust the brake again. Install the adjusting hole cover.

4. Adjust the remaining brakes.

5. If necessary, connect and adjust the parking brake cables (see Part 10-2).



Brake Shoe Adjusting Tool H1122-A

FIG. 1—Typical Brake Shoe Adjustment

6. When all brake shoes have been adjusted, check the operation of the brakes.

HYDRAULIC SYSTEM BLEEDING

When any part of the hydraulic system has been disconnected for repair or replacement, air may get into the lines and cause spongy pedal action. Bleed the hydraulic system after it has been properly connected to be sure that all air is expelled from the brake cylinders and lines.

The hydraulic system can be bled manually or with pressure bleeding equipment.

MANUAL BLEEDING

Bleed the longest lines first. Keep the master cylinder reservoir filled with new heavy-duty brake fluid during the bleeding operation.

Never use brake fluid which has been drained from the hydraulic system.

1. Attach a rubber drain tube to the bleeder screw at the brake cylinder that is located farthest from the master cylinder. **The end of the tube should fit snugly around the bleeder screw.**

2. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder screw.

3. Push the brake pedal down slowly by hand, allowing it to return slowly to the fully-released position. Repeat this operation until air bubbles cease to appear at the submerged end of the tube.

4. When the fluid is completely free of air bubbles, close the bleeder screw and remove the drain tube.

5. Repeat this procedure at each brake cylinder. Refill the master cylinder reservoir after each brake cylinder is bled and when the bleeding operation is completed. The fluid level should be within ½ inch of the top of the reservoir.

PRESSURE BLEEDING

Bleed the longest lines first. **Never use brake fluid which has been drained from the hydraulic system.**

The bleeder tank should contain enough new heavy-duty brake fluid to complete the bleeding operation, and it should be charged with 10-30 pounds of air pressure.

1. Clean all dirt from around the filler hole on the top of the master cylinder reservoir, and attach the bleeder tank hose to the filler hole.
2. Attach a rubber drain tube to the bleeder screw at the brake cylinder that is located farthest from the master cylinder. **The end of the tube should fit snugly around the bleeder screw.**
3. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder screw.
4. Open the valve on the bleeder tank to admit pressurized brake fluid to the master cylinder reservoir.
5. When air bubbles cease to appear in the fluid at the submerged end of the drain tube, close the bleeder screw and remove the tube.
6. Repeat this procedure at each brake cylinder.
7. When the bleeding operation is completed, close the bleeder tank valve and remove the tank hose from the filler hole. Refill the master cylinder reservoir to within ½ inch from the top of the reservoir.

3 MASTER CYLINDER, HYDRAULIC LINE, AND BRAKE PEDAL REPAIR

MASTER CYLINDER REMOVAL

1. Disconnect the rubber boot from the push rod end of the master cylinder.
2. Disconnect the brake lines from the brake fitting (Fig. 2) and disconnect the stop light wires.
3. Remove the master cylinder retaining bolts, and remove the cylinder from the push rod and engine compartment.

MASTER CYLINDER DISASSEMBLY

1. Clean the outside of the cylinder, and remove the filler cap and gasket. Pour out any remaining fluid.
2. Remove the stop light switch, brake fitting, and gaskets (Fig. 3).
3. Remove the snap ring from the push rod end of the cylinder, then remove the retainer and rubber bumper.

FIG. 2—Brake Master Cylinder—Installed

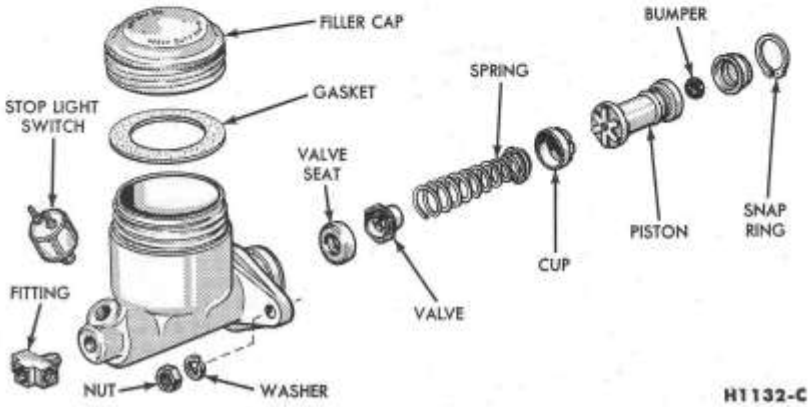


FIG. 3—Brake Master Cylinder—Disassembled

4. Remove the piston, cup, spring, valve assembly, and valve seat.

MASTER CYLINDER INSPECTION AND REPAIR

1. Clean all parts in clean denatured alcohol and inspect the parts for wear or damage, replacing them as required. When using a master cylinder repair kit, install all of the parts supplied.
2. Check all openings to be sure they are open and free from foreign matter.
3. Check the spring valve at the forward end of the piston. If the spring is loose or has moved so that the piston parts are open, replace the piston.
4. Inspect the cylinder bore for score marks or rust. If either condition is present, the cylinder should be honed. **When honing, do not remove more than 0.003 inch as oversize parts are not available.**
5. Remove any burrs or loose metal that may have resulted from honing. Then clean the cylinder with denatured alcohol.

MASTER CYLINDER ASSEMBLY

1. Dip all parts except the cylinder body in clean **heavy-duty** brake fluid.
2. Install the brake fitting (Fig. 3) on the forward end of the cylinder.
3. Thread the stop light switch into the cylinder and tighten it securely.
4. Insert the valve seat, valve and spring assembly, cup, and piston into the cylinder bore.
5. Compress the piston against the valve spring and install the rubber bumper, retainer and snap ring.

MASTER CYLINDER INSTALLATION

1. With the rubber boot on the push rod, insert the rod into the piston and position the cylinder against the dash panel.
2. Install and torque the mounting bolts to 12-18 foot-pounds.
3. Connect the brake lines into the master cylinder fitting, finger tight.
4. Fill the cylinder reservoir to within ½ inch of the top with heavy-duty brake fluid. Install and tighten the cap finger tight.

5. Bleed the master cylinder to force out any air that may be trapped within the reservoir. Tighten the brake lines at the master cylinder fitting.

6. Remove the filler cap and fill the reservoir to the level specified. Install the cap and wipe off any fluid from the cylinder.

7. Connect the wires to the stop light switch and the rubber boot to the master cylinder.

8. Adjust brake pedal free travel.

HYDRAULIC LINE REPLACEMENT

Steel tubing is used throughout the brake system with exception of the flexible hoses at the front wheels and at the rear axle housing brake connector. **Copper tubing should not be used in a hydraulic system.**

When connecting replacement hoses to the rear pipe connector or front brake cylinders, always use new gaskets. When connecting pipes to the rear connector hoses, or rear brake cylinders, tighten the pipe fitting nut with Milbar tool 1112-144 until the tool "clicks" at 12 ft. lbs.

If a section of the brake tubing becomes damaged, the entire section should be replaced with tubing of the same size, shape, and length.

The brake tubing should be double flared to provide a leak-proof connection, and it should be cleaned with denatured alcohol.

A flexible brake hose should be replaced if it shows any signs of deterioration.

When installing a new brake hose, position the hose so as to avoid contact with other chassis parts.

BRAKE PEDAL—FORDOMATIC TRANSMISSION

REMOVAL

1. Disconnect the brake pedal retracting spring (Fig. 4) at the brake pedal bracket.

2. Remove the master cylinder push rod to brake pedal arm retaining nut, eccentric bolt, and the two nylon washers.

3. Remove the retaining clip from the end of the brake pedal shaft, and remove the spring washer and nylon thrust washer.

4. Remove the brake pedal shaft. Remove the shaft bushing and remove the pedal.

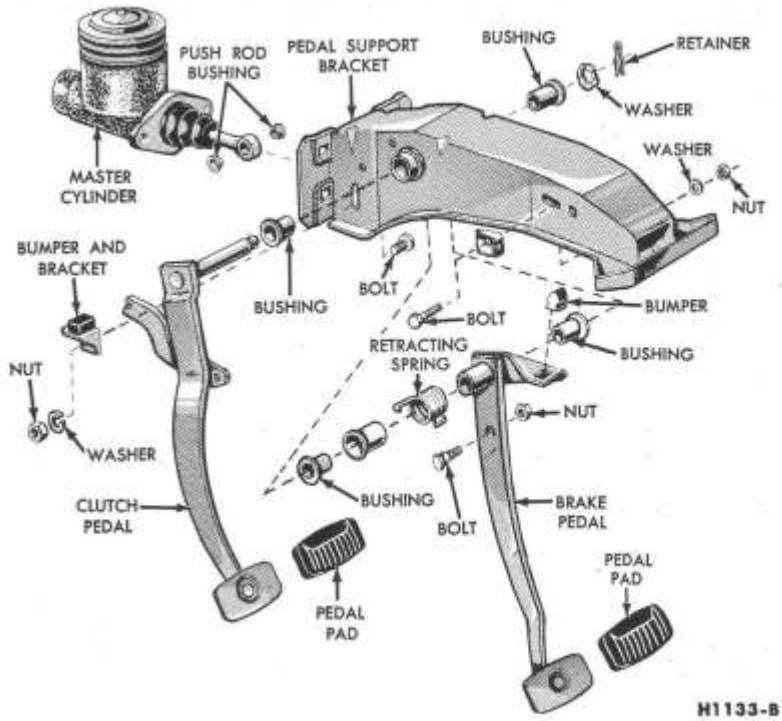


FIG. 4—Brake Pedal and Related Parts

5. Remove the brake pedal spring insulator and spring.

6. Remove the brake pedal pad and the pedal bumper.

INSTALLATION

1. Install the brake pedal pad and the bumper on the pedal assembly.

2. Install the brake pedal spring and spring insulator.

3. Apply a coating of Lubriplate to the two bushings and install in the brake pedal. Position the brake arm with spring and spring insulator to the support brace. Insert the spacer washer.

4. Install the brake pedal shaft nylon washer.

5. Install the nylon bushing, spring washer, and the retaining clip (Fig. 4) on the pedal shaft.

6. Connect the brake pedal return spring at the bracket.

7. Install the push rod eccentric bolt, washers, and the retaining nut.

8. Adjust the brake pedal free travel and tighten the retaining nut.

BRAKE PEDAL—MANUAL-SHIFT TRANSMISSION

REMOVAL

1. Back off the clutch pedal over-center spring adjusting nut and disconnect the equalizer rod. Remove the clutch pedal bumper, and the over-center spring bracket from the support bracket.

2. Remove the over-center adjusting nut and bolt. Remove the push rod eccentric bolt and washers.

3. Remove the clip (Fig. 4) from the clutch and brake pedal shaft and remove the clutch pedal, brake pedal, retracting spring, and bushings.

INSTALLATION

1. Apply a coating of Lubriplate to the bushings and install in the brake pedal. Position the brake pedal arm with spring and insulator to the support brace. Insert the spacer washer.

2. Insert the clutch pedal shaft through the brake pedal support bracket, brake pedal, and install the retaining clip (Fig. 4).

3. Connect the brake pedal retracting spring at the bracket. Connect the clutch pedal rod to the clutch pedal, and adjust the free travel.

4. Install the master cylinder push rod eccentric bolt, and adjust the free travel.

5. Connect the clutch link to the release lever. Adjust the over-center spring nut to the correct stud length specifications.

4 BRAKE DRUM AND BRAKE ASSEMBLY REPAIR

FRONT BRAKE DRUM REMOVAL AND INSTALLATION

REMOVAL

1. Raise the car so that the wheel is clear of the floor.

2. Back off the brake shoe adjustment.

3. Remove the hub cap, wheel, and bearing dust cap. Remove the cotter key, nut and washer.

4. Pull the brake drum approximately 2 inches forward and push back into position. Remove the wheel outer bearing and pull off the brake drum.

INSTALLATION

1. Make sure that the grease on the spindle is clean and is adequate.

2. Place the brake drum over the spindle and into position. With the larger diameter of the wheel bearing pointing out, place the bearing over the spindle and push into position, followed by the washer and retaining nut.

3. Adjust the wheel bearing, and install the dust cap, wheel and hub cap.

4. Adjust the brake.

REAR BRAKE DRUM REMOVAL AND INSTALLATION

REMOVAL

1. Raise the car so that the wheel is clear of the floor. Back off the brake shoe adjustment.

2. Remove the hub cap and wheel. Remove the two Tinnerman nuts and pull off the brake drum.

INSTALLATION

1. Place the drum over the brake assembly and into position. Install the two Tinnerman nuts and tighten securely.

2. Install the wheel and adjust the brake as outlined in this section.

BRAKE DRUM REFINISHING

Minor scores on a brake drum can be removed with a fine emery cloth. A drum that is excessively scored or shows a total indicator runout of over 0.005 inch should be turned down. Remove only enough stock to eliminate the scores and true up the drum. The refinished diameter must not exceed 0.060 inch oversize.

After a drum is turned down, wipe the refinished surface with a cloth soaked in clean denatured alcohol. If one drum is turned down, the opposite drum on the same axle should also be cut down to the same size.

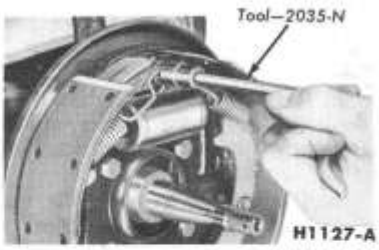


FIG. 5—Retracting Spring Removal

BRAKE SHOE AND ADJUSTING SCREW REMOVAL AND INSTALLATION

CLEANING AND INSPECTION

1. Remove the wheel and drum. Wash all the parts except the brake shoes in a cleaning fluid, and dry with compressed air.

2. Brush all dust from the carrier plates and interior of the brake drums.

3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn to within 1/32 inch of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that has been oil saturated. If any of the brake lining requires replacing, replacement must be made in sets of two—both front or both rear wheels.

4. Inspect remaining brake parts and replace any that are worn or damaged.

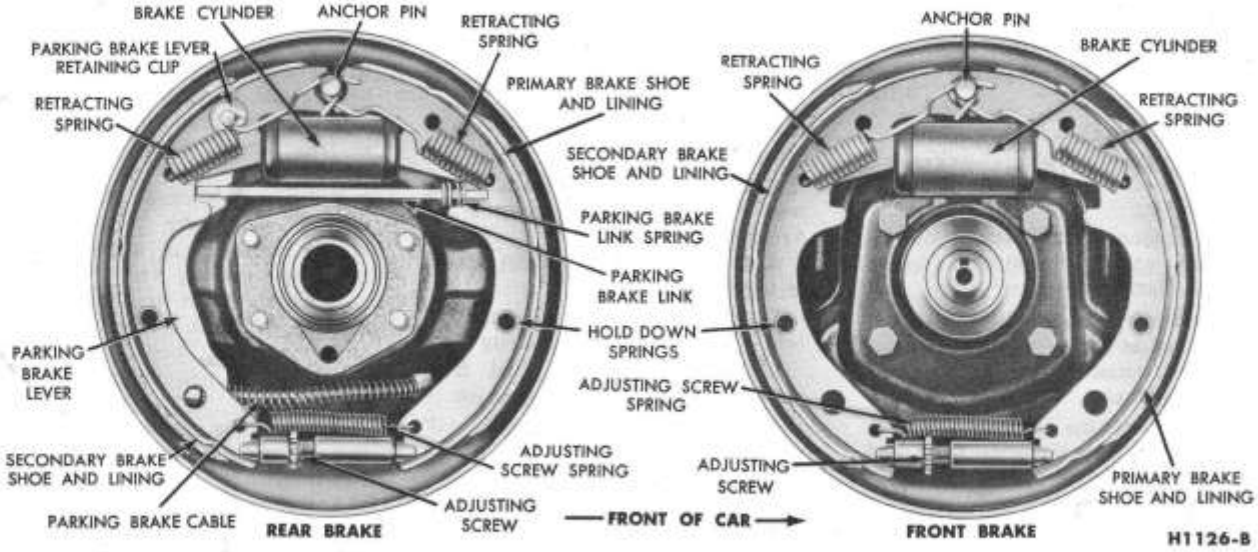


FIG. 6—Front and Rear Brakes

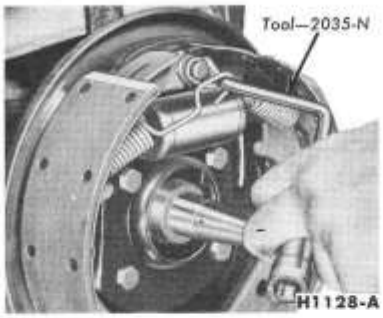


FIG. 7—Retracting Spring Installation

5. Inspect the brake drums and, if necessary, refinish as outlined in this section.

REMOVAL

1. With the wheel and drum removed, install a clamp over the ends of the brake cylinder.

2. Disconnect the brake shoe retracting springs (Fig. 5) and hold down springs (Fig. 6).

On the rear brakes, disconnect the secondary brake shoe from the parking brake lever by removing the retaining clip (Fig. 6). Remove the parking brake lever link and spring from between the lever and the primary shoe, then remove the brake shoes from the carrier plate.

Do not press the brake pedal down with the brake drums removed.

3. Remove the adjusting screw spring and the adjusting screw assembly, and separate the brake shoes.

INSTALLATION

1. Apply a light coating of Ford high-temperature grease to the brake shoe-to-carrier plate contact points and on the threaded portion of the adjusting screw. Thread the adjusting screw onto the nut.

2. Position the brake shoes so that the secondary shoe will be at the rear when placed in its proper position against the carrier plate.

3. Insert the brake adjusting screw (Fig. 6) between the lower ends of the brake shoes so that the star wheel will be directly opposite the carrier plate adjusting hole. Install the spring at the lower end of the shoes.

4. Place the shoe assembly in position against the carrier plate with the upper end of the shoes in line with the anchor pins, and the brake cylinder links in their appropriate slots in the shoes. Secure the assembly with the hold-down springs.

On rear brakes, engage the secondary shoe with the pin on the parking brake lever and secure with the retaining clip (Fig. 6). Install the parking brake link and spring between the lever and the primary shoe.

5. Place the anchor pin plate over the anchor pin. Install the primary shoe retracting spring followed by the secondary shoe retracting spring (Fig. 7).

6. Remove the brake cylinder clamps and wipe any dust off the front wheel spindle. Apply a coating of wheel bearing grease to the spindle.

7. Install the wheel and drum. Bleed and adjust the brakes as outlined in this section.

BRAKE SHOE RELINING

Brake linings that are worn to within $\frac{1}{32}$ inch of the rivet head or have been saturated with grease or oil should be replaced. Worn linings can score the brake drum. **When any lining requires replacement, it should be replaced in sets of two — both front or both rear wheels.**

Inspect brake shoes for distortion, cracks, or looseness. If this condition exists, the shoe should be discarded. **Do not repair a defective brake shoe.**

1. Wash the brake shoes thoroughly in a clean solvent. Remove all burrs or rough spots from the shoe.

2. Check the inside diameter of the brake drum. If the drum is less than 0.030 inch oversize, standard lining may be installed.

3. Position the new lining on the shoe. Insert and secure the rivets at the center holes. Install the remaining rivets. Install all parts supplied in the kit. **Ford replacement linings are ground, and no further grinding is required when the original brake drum diameter is maintained.**

4. Check the clearance between the lining and shoe. The lining must seat tightly against the shoe with not more than 0.005 inch clearance between any two rivets.

BRAKE CYLINDER REPLACEMENT

REMOVAL

1. With the wheel in a raised position, remove the wheel and drum.

2. Place a clamp over the ends of the brake cylinder.

3. Remove the brake shoe assembly following steps previously outlined in this section.

4. Disconnect the brake line from the brake cylinder. To disconnect the hose at a front cylinder, loosen the pipe fitting that connects the opposite end of the hose to the brake tube at a bracket on the frame. Remove the horseshoe-type retaining clip from the hose and bracket, disengage the hose from the bracket, then unscrew the entire hose assembly from the front brake cylinder.

At a rear cylinder, unscrew the pipe fitting that connects the tube to the cylinder.

5. Remove the two cylinder retaining screws at the back side of the carrier plate, and remove the cylinder.

INSTALLATION

1. Place the brake cylinder into position against the carrier plate and secure with two screws and lock washers.

2. On a front cylinder, install a new copper gasket over the hose fitting. Screw the hose assembly into the cylinder. Engage the opposite end of the hose to the bracket on the frame, install the horseshoe-type retaining clip, and connect the brake tube to the hose with the pipe fitting nut. Tighten the nut with Milbar tool 1112-144 until the tool "clicks" at 12 ft. lbs.

On a rear cylinder, connect the tube to the cylinder by tightening the pipe fitting to the cylinder. Tighten with Milbar tool 1112-144 until the tool "clicks" at 12 ft. lbs.

3. Install the links in the ends of the brake cylinder, and install the shoe and lining assemblies as outlined in this section.

4. Install the brake drum and wheel as outlined in this section.

5. Bleed and adjust the brakes as outlined in Section 2.

BRAKE CYLINDER OVERHAUL

The cylinder does not have to be removed from the carrier plate for disassembly, inspection, or overhaul. However, if the inspection reveals severe scoring or damage, the cylinder must be removed for replacement.

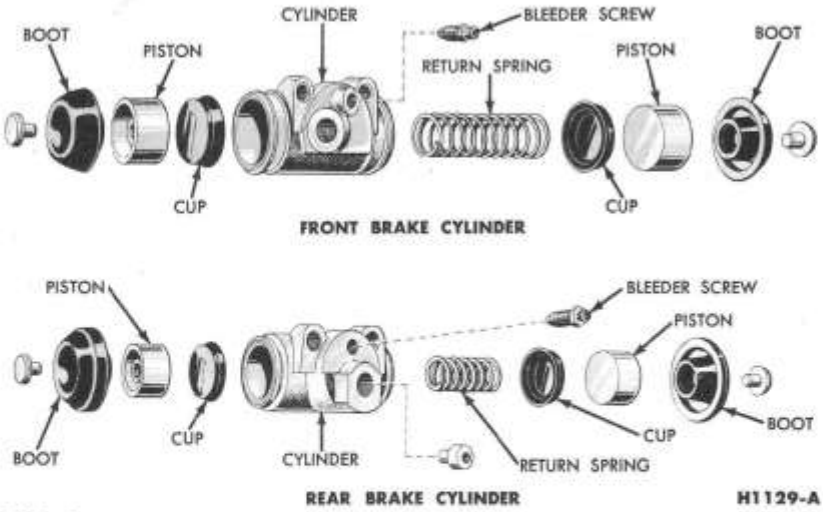


FIG. 8—Front and Rear Brake Cylinders

DISASSEMBLY

1. Remove the rubber boots (Fig. 8). Remove the pistons, cups, and return spring from the cylinder bore.

2. Remove the bleeder screw.

INSPECTION

1. Wash all parts in clean denatured alcohol and dry with compressed air.

2. Check all internal parts for excessive wear or damage. **If any internal part requires replacing, all should be replaced.**

3. Inspect the cylinder bore for score marks or rust. If either condition is present, the cylinder must be honed. **However, the cylinder should not be honed more than 0.003 inch beyond its original diameter.**

4. Check to be sure the bleeder hole is open.

ASSEMBLY

1. Apply a coating of heavy-duty brake fluid to all internal parts.

2. Thread the bleeder screw into the cylinder and tighten securely.

3. Insert the return spring, cups and pistons (Fig. 8) in their respective positions in the cylinder bore. Place a boot over each end of the cylinder.

BRAKE CARRIER PLATE REPLACEMENT

REMOVAL

1. Remove the wheel and brake drum. Disconnect the brake line from the brake cylinder.

2. Remove the brake shoe assemblies and the brake cylinder as outlined in this section. On the rear wheels, disconnect the parking brake lever.

3. If the rear carrier plate is being replaced, rotate the axle shaft so that the hole in the axle shaft flange lines up with the carrier plate retaining nuts, and remove the nuts. Pull the axle shaft assembly out of the housing with Tool T60K-4234-A and T50T-100-A, then remove the carrier plate.

If the front carrier plate is being replaced, remove the four bolts and nuts that secure the plate to the front wheel spindle and remove the plate.

INSTALLATION

1. Position a new **rear** carrier plate on the retaining bolts in the axle housing flange. Insert the axle shaft into the housing so that the splines engage the differential side gear with the bearing retainer sliding onto the retaining bolts and against the carrier plate. Install the retaining nuts through the access hole in the axle shaft flange.

Position a new **front** carrier plate to the wheel spindle and install the retaining bolts and nuts.

2. Install the brake shoes and the brake cylinder as outlined in this section.

3. Connect the brake line to the brake wheel cylinder, then install the wheel and brake drum.

4. Adjust the brake shoes as outlined in Section 2.

PART 10-2 PARKING BRAKES

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2 Parking Brake Repair ... 10-10

1 BRAKE ADJUSTMENTS

BRAKE SHOE ADJUSTMENT

The rear brake shoes should be adjusted before the parking brake linkage is adjusted. However, in most cases, the rear brake shoe adjustment (given in Part 10-1) will also provide satisfactory parking brake action.

PARKING BRAKE CABLE ADJUSTMENT

Check the parking brake cables when the brakes are fully released. If the cables are loose, adjust them as follows:

1. Pull up the handle until the third notch is engaged.

2. Loosen the locknut on the equalizer rod (Fig. 1), and then turn the nut in front of the equalizer several turns forward.

3. Turn the locknut forward against the equalizer until the cables are just tight enough to stop forward rotation of the wheels.

4. When the cables are properly adjusted, tighten both nuts against the equalizer.

5. Release the handle.

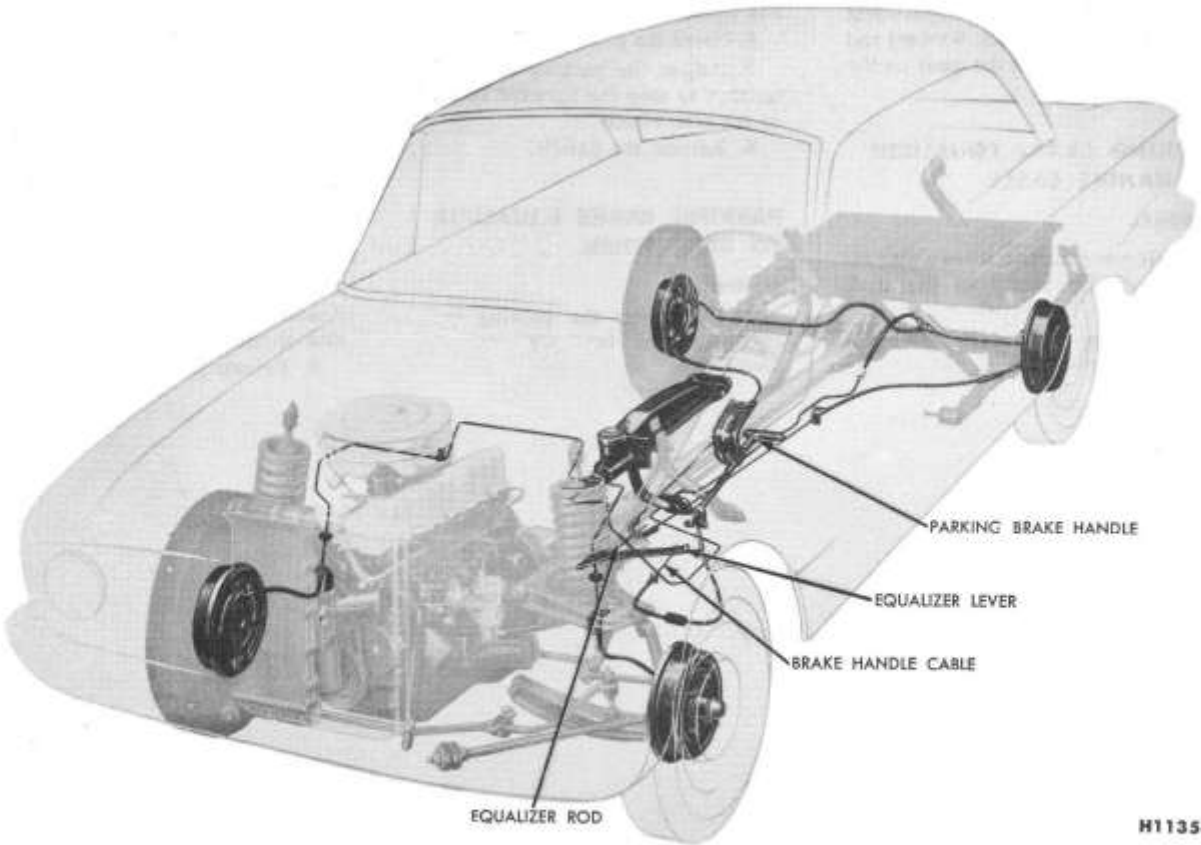

FIG. 1—Parking Brake Linkage

2 PARKING BRAKE REPAIR

PARKING BRAKE HANDLE ASSEMBLY

REMOVAL

1. Remove the two screws that hold the handle braeket on the instrument panel.
2. Remove the two nuts and lock washers that secure the control to the dash panel.
3. Remove the clevis pin that secures the pulley to the control handle assembly.
4. Disengage the locking rod and remove the ball on the cable from the slot in the control assembly.

INSTALLATION

1. Disengage the locking rod and connect the ball end of the cable to the slot on the control assembly.
2. Assemble the pulley to the control handle and the clevis pin.
3. Position the assembly against the dash panel and instrument panel. Secure the assembly to the instrument panel with the two screws.
4. From the engine compartment side, install the two lock washers and the retaining nuts on the studs on the control assembly.

PARKING BRAKE EQUALIZER TO HANDLE CABLE

REMOVAL

1. Remove the two screws that retain the cable clamp to the dash panel.
2. Remove the parking brake handle assembly.
3. Disengage the locking rod and remove the ball on the cable from the slot in the control assembly.
4. Push the cable down through the hole in the dash panel.
5. From the underside of the car, remove the cable and housing from the holes in the left front side member.
6. Remove the horseshoe-type clip and remove the cable from the hole in the frame crossmember.
7. Loosen the adjusting nut on the equalizer bar and remove the cable.

INSTALLATION

1. Attach the rear of the cable to the equalizer bar.
2. Thread the forward end of the cable and housing through the two holes in the left front side member.
3. Insert the cable and housing through the hole in the dash panel.
4. Disengage the locking rod and connect the ball end of the cable to the slot in the control assembly.
5. Install the two screws that retain the cable clamp to the dash panel and tighten.
6. Install the parking brake handle.
7. Adjust the parking brake at 3 notches to stop the forward rotation of the rear wheels.
8. Release the handle.

PARKING BRAKE EQUALIZER TO REAR WHEEL CABLE

REMOVAL

1. Disconnect the parking brake equalizer rod from the equalizer lever.
2. Remove the cotter pins from the cable guide brackets on the floor pan.
3. Remove the parking brake cable and housing from the clamp type brackets.
4. Back off the adjustments on the rear brake shoes.
5. Remove both rear hub caps, wheel and tire assemblies, and the rear brake drums.
6. Disconnect the parking brake housings from the carrier plates.
7. Disconnect the parking brake cable from the brake shoe lever, and remove the cable and housing from the car.
8. Remove the cable equalizer and the equalizer rod from the parking brake cable.

INSTALLATION

1. Install the cable equalizer and the equalizer rod on the cable.
2. Install the ends of the cable through the holes in the carrier plates and connect to the brake shoe levers.
3. Install the rear drums, wheel and tire assemblies, and hub caps.
4. Install the cable and housing in the clamp type brackets.
5. Install the cable in the guide brackets on the floor pan and insert the cotter pins.
6. Attach the parking brake equalizer rod to the equalizer lever.
7. Adjust the rear brake shoes, and then adjust the equalizer rod to 3 notches to stop the forward rotation of the rear wheels.
8. Release the handle.

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GROUP 11

GENERATING AND STARTING SYSTEMS

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PART 11-2 STARTING SYSTEM 11-11

PART 11-1 GENERATING SYSTEM AND BATTERY

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2	Generator Tests	11-3
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A schematic wiring diagram (Fig. 1) of the generating circuit shows the internal connections and windings of the various units. Color codes are shown to aid in tracing the circuit. Wire sizes are given as a guide for replacing any of the wires in the circuit.

Since the generator and generator regulator are precision built units, they must be checked with accurately calibrated instruments. Correct regulator setting requires that voltmeters be accurate to 0.05 (½ of one tenth) volt within the ranges of 13 to 16 volts, and that ammeters be accurate to 1 ampere between 30 and 40 amperes and between 50 and 60 amperes. All meters should be calibrated once a year and the date of calibration should be stamped on the meter face.

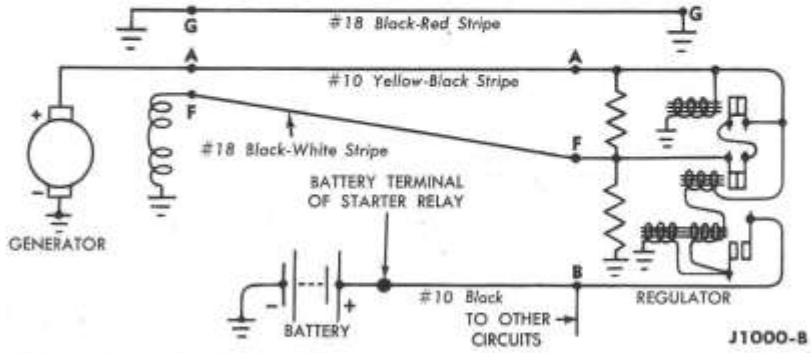

FIG. 1—Generating System Schematic

1 GENERATING SYSTEM TROUBLE DIAGNOSIS

If a battery has failed, is low in charge, or requires water frequently, good service demands that the reason for the condition be found.

Possible causes of these conditions are listed in the diagnosis guide. Follow through the complete procedure in order to make certain that all possible causes have been checked.

GENERATING SYSTEM TROUBLE DIAGNOSIS GUIDE

BATTERY LOW IN CHARGE	Indications of a battery low in charge are slow cranking, hard starting, and headlights dim at engine idle speed. Causes are: **1.** Generator belt worn, or loose and slipping over the generator pulley. **2.** Battery in such poor condition that it will not hold or take a charge. **3.** Generator not producing its rated output. **4.** Regulator units out of adjustment, and excessive resistance in the generator-to-battery circuit or in the battery-to-ground circuit. First, check the generator belt adjustment and condition.	**RECHARGE OR REPLACE BATTERY** Perform a battery Before Charge Test (page 11-9). Replace the battery if the test indicates it is worn out or under capacity. If the battery capacity is normal, proceed as follows: **TEST GENERATOR OUTPUT** Test the generator output to determine if the generator is at fault. If the output is normal or greater than the rating of the generator, proceed with a generator regulator test under the heading Test Generator Regulator. If the output is low, proceed as follows:

CONTINUED ON NEXT PAGE

GENERATING SYSTEM TROUBLE DIAGNOSIS GUIDE (Continued)

BATTERY LOW IN CHARGE (Continued)	**GENERATOR OUTPUT LOW** Connect a heavy jumper wire from the battery ground post to the generator ground terminal. Repeat the generator output test. If the output now reaches or exceeds rated output, either the generator or the battery is not properly grounded to the engine frame. Replace the battery-to-ground cable if it is corroded or partially broken. Clean the cable connections at the battery and engine, and tighten the connections. Tighten the generator and generator mounting bracket bolts. If the generator output is still less than normal, the generator output could be low due to an open or short circuit in the field, armature, brushes, or brush holders, or the brushes can be worn too short or may be sticking in the brush holder and not making good contact on the commutator. Remove the generator for repair. **TEST GENERATOR REGULATOR** If the generator output is normal, test the regulator to determine if it is properly adjusted.	After checking all three regulator units, adjust or replace the regulator as necessary. If the regulator is not at fault, test the circuit resistance. **TEST CIRCUIT RESISTANCE** Check the external circuit to determine the circuit resistance. **RESISTANCE EXCESSIVE** If the resistance (voltage drop) is greater than that specified for the car, locate the trouble by performing complete external circuit resistance test (Page 11-9). Repair or replace the defective part. **RESISTANCE NORMAL** If the resistance (voltage drop) is equal or less than that specified for the car, the battery is low in charge due to improper operation such as: **1.** Excessive night driving. **2.** Excessive use of accessories. **3.** Short trips. **4.** Accidental discharge of battery. **5.** Incorrect engine lubricant for ambient temperature encountered.
HIGH CHARGING RATE	Indications of this symptom are: **1.** Generator, lights, fuses, or radio tubes burn out repeatedly. **2.** Battery requires too frequent refilling. **3.** The ignition contacts are burned. To determine the possible cause of the high charging rate, check the following items: **1.** Make certain that all connections, including the regulator ground, are tight.	**2.** Check the voltage regulation. If the voltage regulation is high, check the contacts and replace the regulator if the contacts are burned. **3.** If the contacts are in good condition, adjust the regulator to the specified limits (Group 17). In cases where the generator itself burns out, in addition to the high voltage, a high setting of the current limiter could account for the failure.

2 GENERATOR TESTS

The generating system is a negative (−) ground system. Output is controlled by a regulator which is connected between the armature and field. The field is grounded internally (Fig. 1).

The armature shaft is supported by permanently-lubricated ball bearings which fit into the end plates. The shaft is keyed to an integral pulley and cooling-fan assembly. The pulley is connected to the engine crankshaft pulley with a belt. The generator mounting is shown in Fig. 2.

To obtain the most accurate generator test readings, the ammeters and voltmeters should register the expected readings in the middle range of the meter scale.

If the generator and regulator testing meters are combined into one unit, follow the manufacturer's operating instructions.

GENERATOR OUTPUT TEST

When a generator output test is conducted off the car, a generator-regulator test bench must be

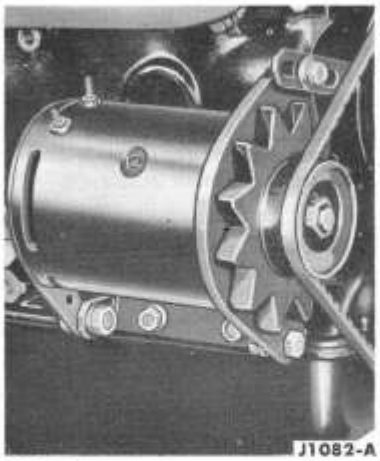

FIG. 2—Generator Mounting

used. In this case, the generator is placed on the test bench and driven by a motor. Follow the procedure given by the manufacturer.

To test the output of the generator on the car, proceed as follows (Fig. 3).

Disconnect the regulator armature and field wires at the generator. Connect a jumper wire from the generator armature terminal to the generator field terminal and the positive lead of a 0-50 ammeter to the generator armature terminal. Start the engine and while it is idling, connect the ammeter negative lead to the positive terminal of the battery. Run the engine at 1500 rpm, and read the current output on the ammeter. The generator output should reach or exceed 25 amperes.

Disconnect the test leads as soon as the test is completed to prevent overheating the generator, and then stop the engine.

ARMATURE TESTS

Checking the armature for open, short, or grounded circuit must be done off the car.

OPEN CIRCUIT TEST

An open circuit in the armature can sometimes be detected by examining the commutator for evidence of burning. The spot burned on the commutator is caused by an arc formed every time the commutator segment connected to the open circuit passes under a brush.

SHORT CIRCUIT TEST

To test the armature for a short circuit in the windings, a "growler" must be used as shown in Fig. 4. Rotate the armature slowly. When the shorted winding is under the steel strip, it will cause the strip to vibrate.

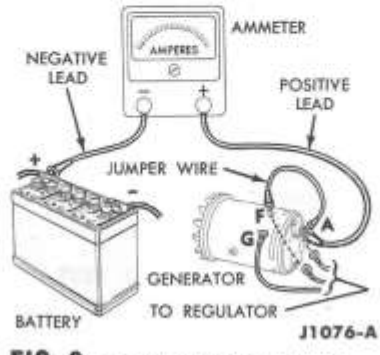

FIG. 3—Generator Output Test

FIG. 4—Growler Test for Shorted Armature

GROUNDED CIRCUIT TEST

To determine if the armature windings are grounded, make the connections as shown in Fig. 5. If the voltmeter indicates any voltage, the armature windings are grounded to the frame.

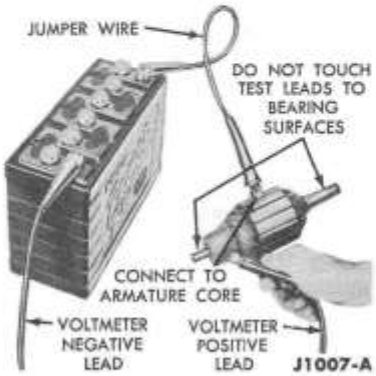

FIG. 5—Armature Grounded Circuit Test

FIELD TESTS

Only two tests are necessary for checking the field. Both open and short circuits can be tested in one operation. The second test is for a grounded circuit.

OPEN OR SHORT CIRCUIT TEST

Disconnect the field lead from the generator terminal. Connect a 0-5 ammeter from the battery to the field terminal as shown in Fig. 6. The normal current draw, as indicated by the ammeter should be 1.5 to 1.6 amperes. If there is little or no current flow, the field has a high resistance or is open. A current flow, considerably higher than that specified above, indicates shorted or grounded turns.

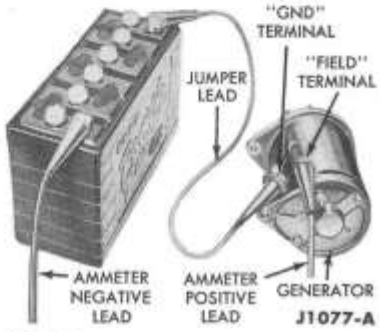

FIG. 6—Field Open Circuit Test

GROUNDED CIRCUIT TEST

Remove the ground terminal stud from the generator frame. Make the voltmeter and battery connections as shown in Fig. 7. If the voltmeter indicates any voltage, the field coils are grounded. **Be sure that the ground terminal stud is not touching the housing.**

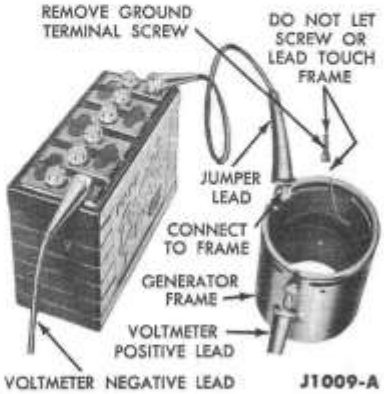

FIG. 7—Field Grounded Circuit Test

3 GENERATOR REPAIR

The complete disassembly procedure is given in "Generator Overhaul." However, armature replacement, commutator turning and undercutting, bearing replacement, and brush replacement can be accomplished after removal without completely disassembling the generator. A disassembled view of the generator is shown in Fig. 8.

GENERATOR REMOVAL AND INSTALLATION

1. Disconnect the armature, field, and ground wires at the generator terminals.

2. Remove the adjustment arm to generator bolt, the generator belt, and the two pivot bolts from the mounting bracket. Then remove the generator (Fig. 2).

3. To install the generator, clean the mating surfaces of the generator frame and mounting bracket.

4. Install the generator in the bracket with the two pivot bolts and lockwashers (Fig. 2).

5. Install the generator belt, and the adjustment arm to generator bolt. Adjust the belt tension and tighten all bolts securely.

6. Connect the armature, field, and ground leads on the generator terminals. Start the engine and check the generator operation.

OVERHAUL

Use the following procedures for generator overhaul.

DISASSEMBLY

1. Remove the two generator through bolts and the brush end plate. Slide the armature assembly out the other end of the frame. Do not lose the locating dowel if it drops out of the front end plate. Remove the brushes from the brush end plate.

2. Clamp the armature in a vise equipped with soft jaws, and remove the retaining nut, lockwasher, pulley, and woodruff key from the armature shaft.

3. Slide the front end plate off the armature shaft. **Be sure to remove any burrs from the keyway before removing the front end plate.** Remove the bearing stop ring and remove the bearing from the front end plate.

4. Remove the dust shield. Remove the field and ground terminal screws from the generator frame, and unscrew the field pole shoe screws as shown in Fig. 9.

5. Slide the pole shoes and field windings out of the frame, and separate the windings and shoes.

CLEANING AND INSPECTION

1. Wash all parts except the armature, field coils, and ball bearings in solvent and dry the parts thoroughly.

2. Wipe off the armature and field windings, the commutator, and the armature shaft.

3. Check the condition of the bearings. If the ball bearings are worn or have lost their lubricant, they must be replaced.

4. Check the armature windings for worn insulation, overheating, and unsoldered connections.

FIG. 9—Pole Shoe Screw Removal

5. Check the armature for shorts, opens or grounds.

6. Check the field windings for worn insulation and unsoldered connections at the terminal screws. Check the current draw with a 12 volt supply, if the current draw is not within specifications, replace the field winding. Resolder any connections as required.

7. Replace the armature or the field coils if the insulation is worn, or if an open, short, or grounded circuit is indicated.

8. Check the commutator for runout and uneven or scored surfaces. Turn down the commutator and undercut the mica if necessary.

9. Inspect the brush end plate for cracks, poor insulation or loose rivets. Replace the end plate if it is cracked or if the positive brush insulation is broken or cracked. Tighten any loose brush holder rivets.

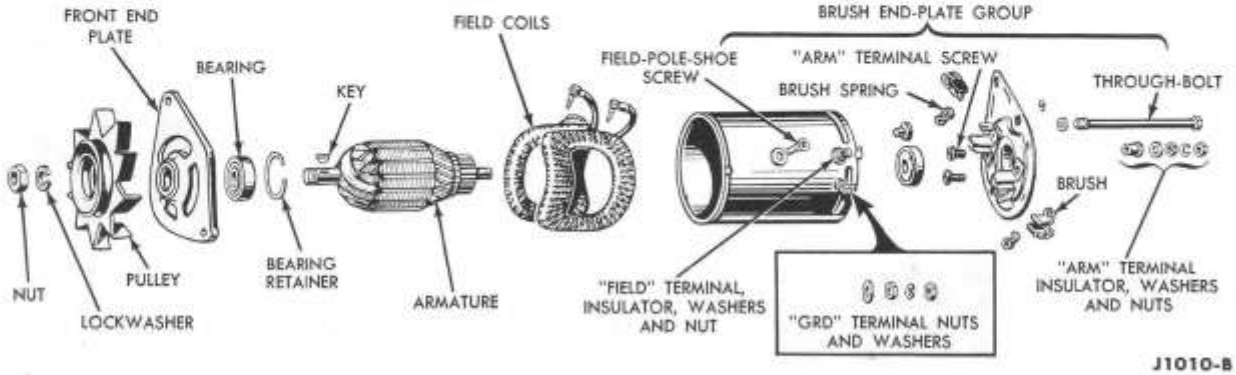

FIG. 8—Disassembled Generator

10. Check the brush spring tension. If the tension is not within specifications, replace the springs.

ASSEMBLY

1. Install the field coils on the pole shoes, and mount the shoe and coil assemblies in the frame.

2. Tighten the field pole shoe screws (Fig. 9). **As the screws are tightened, strike the frame several sharp blows with a soft faced hammer to seat and align the pole shoes.**

3. Install the ground terminal screw, washer, and nut in the frame.

4. Install the field terminal screw, insulators, washer, and nut in the frame.

5. Insert new brushes in the brush holders and seat them (Fig. 11). Install the armature terminal screw and insulators, and install the ground brush screw.

6. Move the brushes back in the holders until the brush springs ride against the side of the brushes to retain them in the retracted position.

7. Install the bearing in the front end plate and insert the bearing stop ring.

8. Slide the plate on the armature shaft (with the snap ring toward the armature windings), and install the woodruff key, pulley, lockwasher, and retaining nut.

9. Install the armature and front end plate assembly in the frame, locating the dowel in the frame groove.

10. Install the brush end plate (aligning the locating boss and frame groove), and install the through bolts with lockwashers.

11. Use a piece of stiff wire with a hooked end to reach through the ventilating slots, and position the brush springs on top of the brushes. Install the dust shield.

POLARIZING GENERATORS

Normally, it is only necessary to polarize a generator when a generator has been rebuilt and if new pole shoes have been installed. Generators are polarized during manufacture, and normally, there is enough residual magnetism left to allow the generator to start charging.

To polarize a rebuilt generator mounted on the vehicle, disconnect the field wire and the battery wire from the regulator. With the engine turned off, momentarily connect the two wires together.

Do not polarize a generator by any method that applies battery voltage to the field terminal of the regulator, such as shorting from the battery terminal to the field terminal of the regulator, or by connecting a jumper wire directly from the battery to the generator field terminal. This action causes excessive current to flow from the battery through the regulator contacts to ground, thus burning the points.

ARMATURE REPLACEMENT

1. Remove the two through bolts and the brush end plate. Slide the armature and front end plate assembly out of the frame.

2. Clamp the armature in a vise equipped with soft jaws, and remove the retaining nut, lockwasher, pulley, and woodruff key.

3. Remove any burrs or scratches from the keyway or shaft, and slide the front end plate off the shaft.

4. Install the front end plate on the new armature.

5. Install the woodruff key, pulley, lockwasher, and retaining nut.

6. Slide the armature and front end plate assembly into the frame, aligning the dowel with the frame slot.

7. Install new brushes in the brush end plate, retract the brushes until the brush springs ride against the side of the brushes, to retain them in the retracted position.

8. Install the end plate (aligning the dowel and the frame slot). Install the through bolts with lockwashers.

9. Use a piece of stiff wire with a hooked end to reach through the ventilating slots, and position the brush springs on top of the brushes.

COMMUTATOR TURNING

Check the commutator runout as shown in Fig. 10. If the surface of the commutator is rough or more than 0.002 inch out-of-round, turn it down, and undercut it.

BRUSH REPLACEMENT

Replace the generator brushes when they are worn to 5/8 inch. Always change both brushes when replacement is required. If the brush wear has been excessive, check the condition of the commutator, and turn it down if necessary.

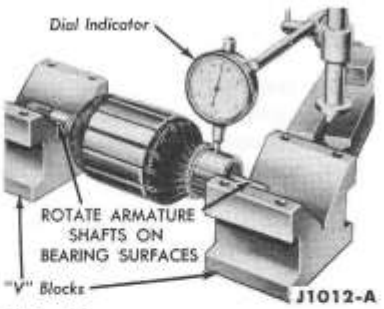

FIG. 10—Commutator Runout Check

1. Remove the two through bolts from the generator frame.

2. Remove the brush end plate and the armature and front end plate assembly from the generator frame.

3. Disconnect the brush terminals and remove the brushes.

4. Clean the carbon and dirt from the brush end plate. Repair or replace the insulation between the brush holders and end plate and the armature terminal and end plate if it is worn or cracked. Clean the commutator with sand paper.

5. Make sure that the new brushes slide freely in the brush holders. Seat the new brushes by sanding as shown in Fig. 11.

6. Retract the brushes until the brush springs ride against the side of the brushes, to retain them in the retracted position.

7. Install the armature and front end plate assembly and the brush end plate (aligning the dowel and locating boss and the frame slots).

8. Install the through bolts with lockwashers.

9. Use a piece of stiff wire with a hooked end to reach through the ventilating slots and position the brush springs on top of the brushes.

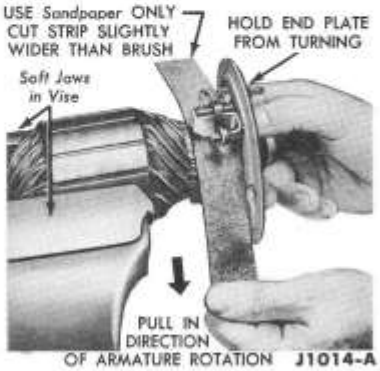

FIG. 11—Generator Brush Seating

4 GENERATOR REGULATOR

OPERATION

The generator regulator is composed of three control units mounted as an assembly (Fig. 12). Each unit has a set of contact points and an energizing coil for operating the points, and each of the units performs a separate function to maintain control of the generator.

CUTOUT RELAY

When the engine is not operating, the contact points on the cutout relay (Fig. 12), are held open by spring tension. At approximately 12 volts, the coils are energized sufficiently to overcome the spring tension and close the cutout points connecting the generator to the external load.

VOLTAGE LIMITER RELAY

The voltage limiter holds the generator voltage below a predetermined setting by controlling the amount of voltage applied to the field coils. The voltage limiter thus protects the battery, lights, ignition system etc. from high voltage when the system load demand is low.

CURRENT LIMITER RELAY

The current limiter relay protects the generator armature windings by limiting the maximum amount of current supplied by the generator. Like the voltage limiter, the current limiter performs its function by controlling the amount of current that is supplied to the generator field coils. The current limiter thus protects the generator when the system load demand is high.

TEMPERATURE COMPENSATION

The generator regulator has been designed to exercise automatic control over the generating system, and also to compensate for seasonal temperature changes. In cold weather a higher voltage output is required to handle the load. In warm weather, the voltage must be reduced to avoid over charging the battery. The temperature compensation is built into the regulator unit by making the armature hinge of bi-metal. The temperature sensitivity of the bi-metal causes the regulator voltage setting to change according to temperature. Therefore, it is necessary to establish a "normal" or stabilized regulator operating temperature to coincide with the specified voltage setting of 14.6 to 15.4 volts. The standard ambient air temperature established for this setting is 70° to 80° Fahrenheit. The regulator temperature for this or any setting, is defined as the temperature of the regulator after ½ hour of operation in the car or, after the regulator has been heated until it becomes stabilized.

For correct voltage regulation adjustment, first be sure that the regulator has reached "Normal" operating temperature as defined above; then make the voltage adjustment setting to coincide with the prevailing, ambient air temperature. The specifications section shows the proper voltage limits for various ambient air temperatures.

ON THE CAR

On the car, ambient air temperature will be the temperature of the engine compartment air. To measure the air temperature, first clip the voltage regulator setting thermometer onto the regulator cover (Fig. 13).

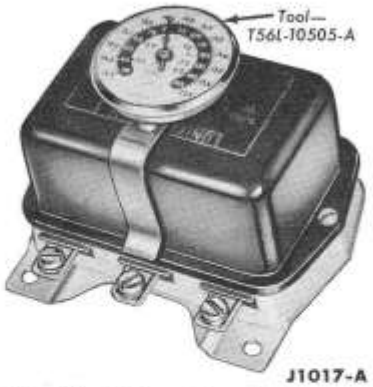

FIG. 13—Voltage Regulator Setting Thermometer

Run the engine to stabilize the regulator. The engine fan will cause the air in the engine compartment to circulate past the regulator until the regulator has stabilized at the ambient air temperature. After the regulator and thermometer have stabilized, the thermometer will show the voltage setting at which the regulator should be operating.

ON THE TEST BENCH

When the regulator is mounted on a regulator test bench, the ambient air temperature will be the room temperature. Clip the voltage regulator setting thermometer onto the regulator cover (Fig. 13). Mount a small fan on the regulator test bench about 12 to 15 inches from the regulator. Operate the fan and the regulator to stabilize the regulator. The fan will provide sufficient air flow to ensure stabilization of the regulator at the temperature indicated by the

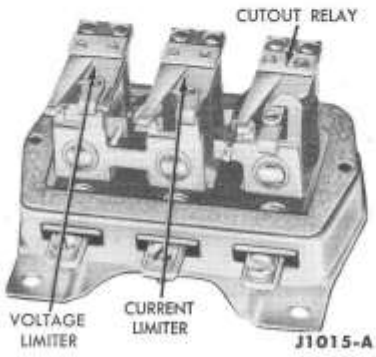

FIG. 12—Generator Regulator

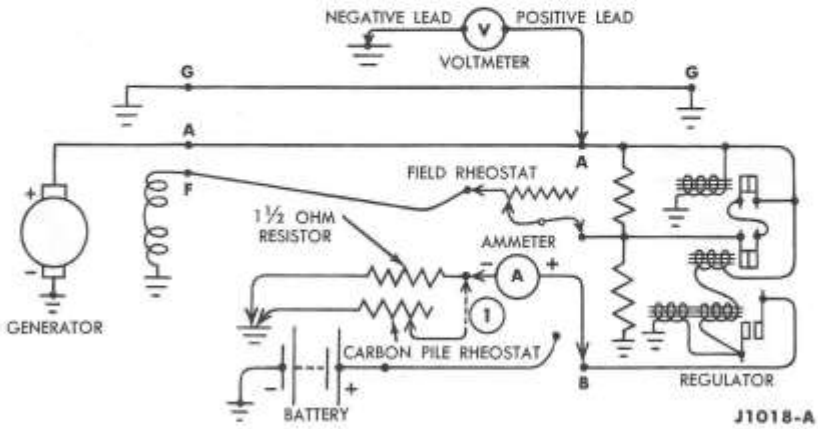

FIG. 14—Regulator Test Schematic

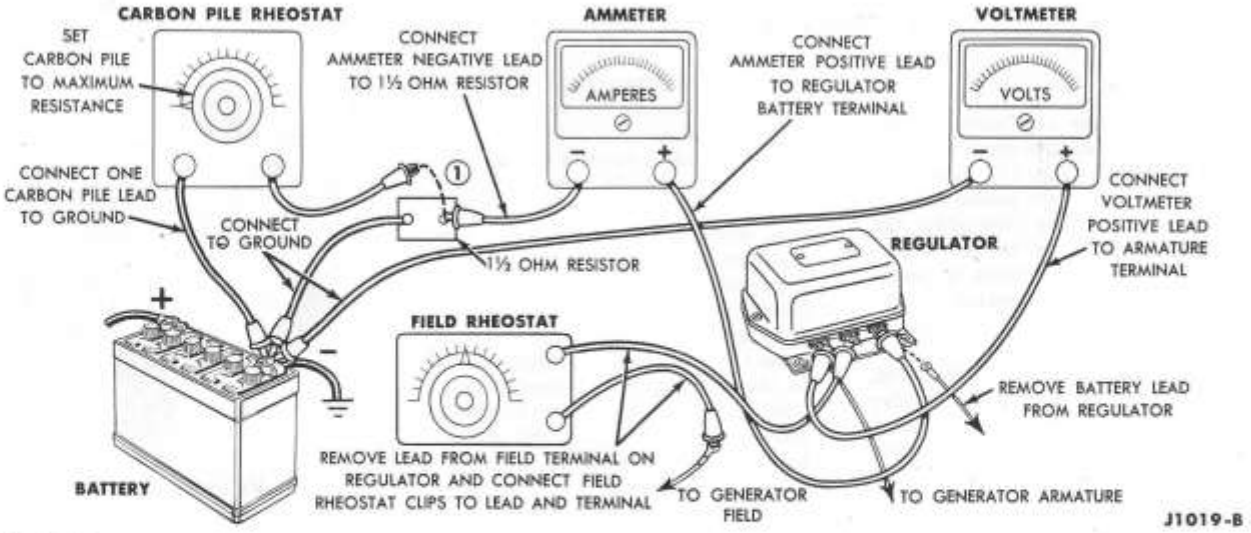

FIG. 15—Regulator Test Connections

thermometer. After stabilization, the thermometer will show the voltage setting at which the regulator should be operating.

REGULATOR AND CIRCUIT TESTS

The four tests presented here are outlined for on-the-car operation and should be conducted in the sequence indicated. Be sure that the regulator is at "normal" operating temperature (equivalent to the temperature after 30 minutes of operation on the vehicle with 10 ampere load). Connect the test equipment as shown in Fig. 14 or 15.

Always be careful when making any test connections to the regulator, so as not to short the battery lead or terminal to the regulator field terminal. To do so will burn the regulator contacts. Disconnect a battery cable while making these connections.

CUTOUT TEST

Start the engine and run it at approximately 1500 rpm. Decrease the resistance in the field circuit, and the voltage output of the generator, indicated by the voltmeter, will increase until the cutout closes. The cutout closing will be indicated by a rise of the ammeter needle and a "dip" of the voltmeter needle. The maximum voltage at the time the voltmeter needle dips or drops back will be the closing voltage of the cutout relay. This operation should be repeated to accurately determine the closing voltage of the cutout.

VOLTAGE LIMITER TEST

Reduce the resistance in the field circuit to zero. The ammeter should show an approximate 10 ampere load. Read the voltage regulation on the voltmeter scale. Speed the engine momentarily to see if the voltage remains regulated.

CURRENT LIMITER TEST

Connect the carbon pile rheostat across the 1½-ohm resistor, Fig. 14 or 15. With the engine speed at 1500 rpm, slowly decrease the resistance of the rheostat until the voltmeter reading drops to 13 volts. The ammeter will indicate the setting of the current limiter.

Remove all test leads except the

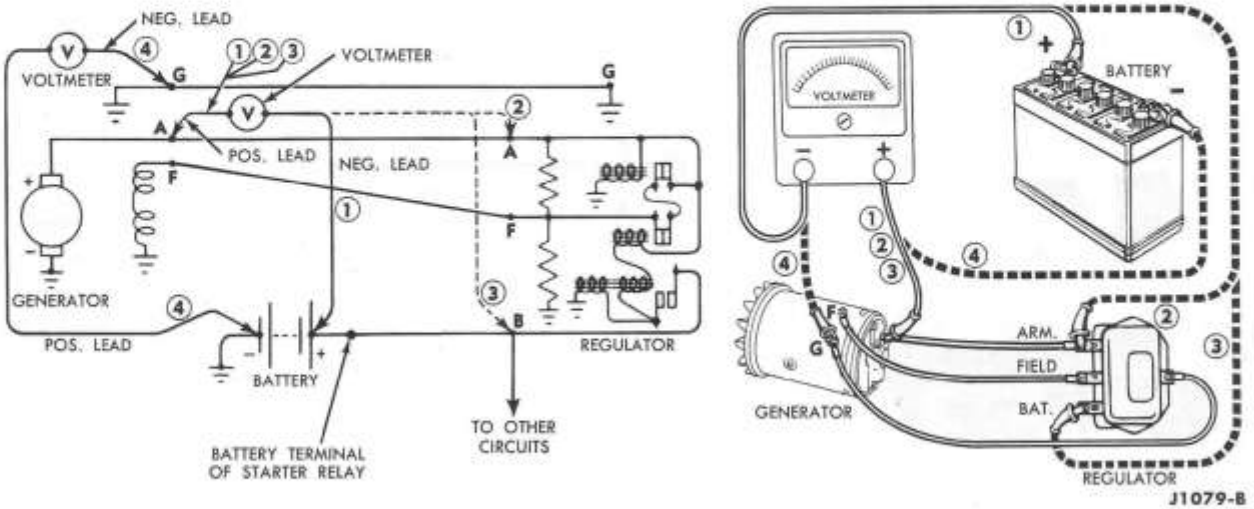

FIG. 16—Regulator External Circuit Test

voltmeter leads. Install the battery and field leads on the regulator terminals. Run the engine at 1500 rpm, and read the voltage regulation (under battery load) on the voltmeter. **The voltage reading will usually be low when the engine is first started because the battery is partially discharged. After a few moments of operation, the voltage will rise to the original value.**

EXTERNAL CIRCUIT RESISTANCE TEST

For the purpose of this test, the resistance values of the circuit have been converted to voltage drop readings for a current flow of 25 amperes. Connect the test equipment as shown in Fig. 16 to measure voltage drop around the circuit.

Crank the engine for 30 seconds with the ignition switch OFF to partially discharge the battery. Then start the engine and run it at approximately 1500 rpm.

Touch the voltmeter negative lead to the center of the battery positive post (Fig. 16, connections marked ①) to check the generator to battery circuit. The voltage drop should be less than 0.7 volt.

If the voltage drop in the generator to battery circuit exceeds 0.7 volt, locate the exact part of the circuit wiring causing the trouble, by contacting the negative lead to other points of the circuit. Connect the lead to the armature terminal of the regulator (connections marked ②). The voltage drop should be less than 0.2 volt. Connect the lead to the battery terminal of the regulator (connections marked ③). The voltage reading should be less than 0.4 volt. If both these readings are within

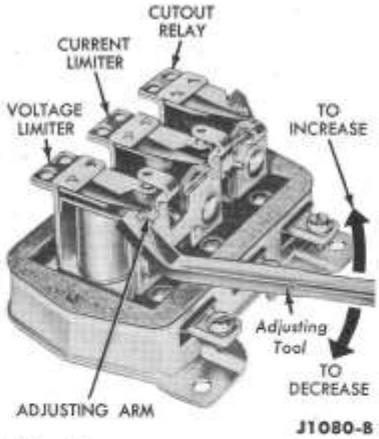

FIG. 17—Regulator Adjustment

limits, the excessive resistance is in the regulator to battery wires or their connections.

Check the battery to generator ground circuit by connecting the voltmeter as shown in Fig. 16 (connections marked ④). The voltage reading should be less than 0.1 volt.

REGULATOR ELECTRICAL ADJUSTMENT

The adjustment of the regulator must be checked with the regulator at normal operating temperature.

ADJUST CUT-IN VOLTAGE

The cut-in voltage is increased by bending the adjusting arm upward, or decreased by bending it downward (Fig. 17).

ADJUST VOLTAGE LIMITER

Make a regulator voltage setting test with the cover on. If the regulator voltage is not within the limits as shown in Group 17, for the ambient temperature involved, compute the difference as a positive or negative correction. Remove the regulator cover and make a new regulator voltage limit test. Adjust the new setting either up or down by the amount of the correction just computed. If the voltage is less than that specified, increase the spring tension by bending the adjusting arm upward (Fig. 17). To decrease the voltage, bend the adjusting arm downward. Check the voltage setting with the regulator cover replaced.

ADJUST CURRENT LIMITER

If the current limit on the regulator is less than that specified, increase the spring tension by bending the adjusting arm upward (Fig. 17). To decrease the current limit, bend the adjusting arm downward. Install the cover and check the setting.

REGULATOR REPLACEMENT

Disconnect the battery ground cable at the battery. Disconnect the armature, field, and battery leads at the regulator terminals. Remove the mounting screws and the regulator. **Always disconnect a battery cable when working on the regulator to prevent an accidental short circuit of the battery lead to ground.**

To install the regulator, replace it in position and install the mounting screws. Mount the ground wire terminal under the mounting screw at the back of the regulator. Connect the armature, field, battery, and radio suppression condenser wires to the regulator terminals. Connect the battery ground cable.

5 BATTERY

BATTERY TESTS AND CONCLUSIONS

If a battery has failed, is low in charge or requires water frequently, good service demands that the reason for this condition be found.

Some battery test equipment combines the necessary instruments and controls in a single unit. Be sure to follow the directions of the manufacturer when using such combined equipment.

Hydrogen and oxygen gases are produced in the course of normal battery operation. Flames or sparks may cause this gas mixture to explode if they are brought near the vent openings of the battery. The sulphuric acid in the battery electrolyte can cause a serious burn if spilled on the skin or spattered in the eyes. It should be flushed away immediately with large quantities of clear water.

BEFORE CHARGE TESTS

BATTERY CAPACITY TEST

A high-rate discharge tester in conjunction with a voltmeter is used for this test. **If the battery solution is not within 60°F. to 100°F., let it stand until warm before making this test.** Add water if necessary to bring the battery solution to the proper level. **Fill only to the narrow ring near the bottom of each vent well.** Figure 18 shows the entire Battery Capacity Test in outline form.

1. Connect the high-rate discharge tester and the appropriate voltmeter to the battery terminals.

2. Adjust the discharge tester to draw three times the ampere hour rating of the battery. After 15 seconds and with the battery still under load, read the battery terminal volt-

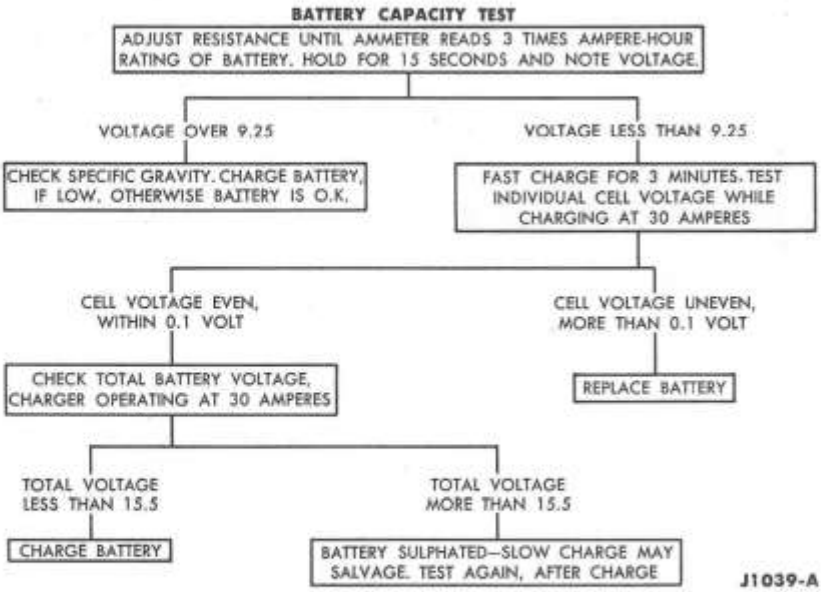

FIG. 18—Battery Capacity Test Outline

age. **The voltmeter clips must contact the battery posts and not the high rate discharge tester clips. Unless this is done the actual battery terminal voltage will not be indicated.**

3. If the terminal voltage is 9.25 volts or more, the battery has good output capacity and will accept a normal charge. Test the specific gravity if water has not been recently added, and recharge if necessary.

4. If the terminal voltage is below 9.25 volts, make a test charge on the battery. **When making a capacity test in areas where consistent zero temperatures occur, the terminal test limit voltage should be increased from 9.25 volts to 9.65 volts.**

Battery Test Charge. The condition of a discharged battery may be tested by passing current through it.

1. Connect a fast charger to the battery and charge the battery for 3 minutes at a rate of 30 amperes.

2. After 3 minutes of fast charge, and with the fast charger still operating, test the individual cell voltages of the battery.

3. If the cell voltages vary more than 0.1 volt, replace the battery. If the cell voltages are even within 0.1 volt, test the total battery voltage (charger still operating).

4. If the total battery voltage is now under 15.5 volts, the battery is satisfactory and may be safely fast charged (see Specifications Group 17). **Always follow the fast charge with sufficient slow charge to bring the battery to a full charge.**

5. If the total battery voltage was over 15.5 volts, the battery is probably sulphated. Place the battery on continued slow charge.

When the battery is fully charged (check with a hydrometer or battery charge tester) make a capacity test. If the terminal voltage is 9.25 volts or above, place the battery back in service. If the terminal voltage is below 9.25 volts, replace the battery.

BATTERY CHARGE TESTS

Battery charge may be tested by measuring the battery electrolyte solution specific gravity (hydrometer) or by measuring the voltage of the battery cells on open circuit (no current flow) with a battery charge tester (open circuit voltage tester).

A discharged 12-volt battery can freeze during cold weather. The specifications section (Group 17), shows the temperatures at which batteries of various specific gravities will begin to freeze.

BATTERY CHARGING

A battery that is not sulphated may be charged by either a fast charging or slow charging method. Most fast charge units may be adjusted for making a slow charge.

FAST CHARGING

Follow the instructions of the fast charger manufacturer, as fast chargers vary slightly with different manufacturers.

Test the battery cells for specific gravity. Then, fast charge the battery at 30 to 40 amperes maximum for the length of time shown in the specification section (Group 17), corresponding to the specific gravity condition of the battery.

SLOW CHARGING

Always follow a fast charge with a slow charge at 3 amperes for 12-volt batteries of less than 70 ampere-hour capacity. Batteries of 10 ampere-hour capacity or higher require a 4 ampere slow charge. Continue the slow charge until the battery is fully charged. A battery is considered fully charged when the specific gravity readings of all cells, taken at hourly intervals, do not increase over a 3-hour period.

PART 11-2 STARTING SYSTEM

Section		Page
1	Starter Trouble Diagnosis	11-11
2	Starter and Starter Circuit Tests	11-14
3	Starter Repair	11-16

The function of the starting system is to crank the engine at a high enough speed to permit it to start. The system includes the starter motor and drive, the battery, a remote control starter switch, and heavy circuit wiring.

A schematic diagram of the starting circuit, shown in Fig. 1, illustrates the internal connections of the starting system units.

Cars equipped with an automatic transmission have a starter neutral switch in the starter control circuit, which prevents operation of the starter if the selector lever is not in the N (neutral) or P (park) position.

The automatic transmission starter neutral switch adjustment procedure is covered in Part 6-2, Section 2.

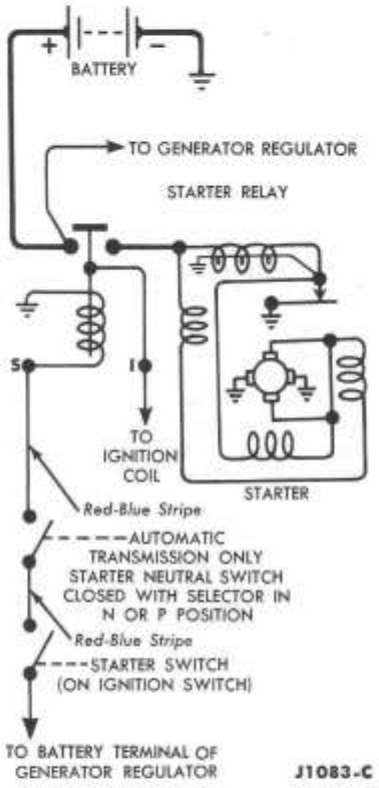

FIG. 1—Starting Circuit Schematic

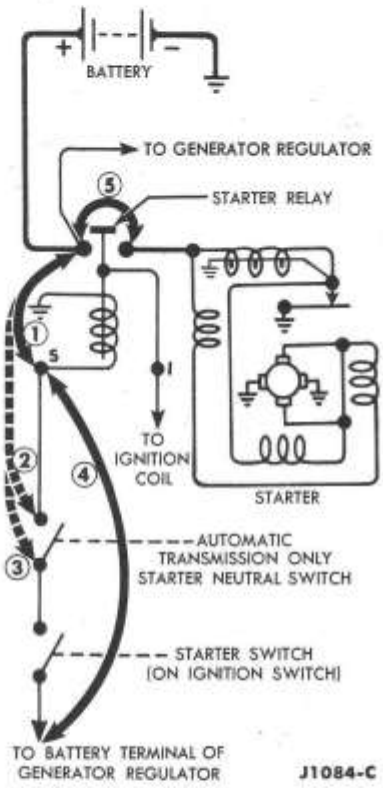

FIG. 2—Starting Circuit Test

1 STARTER TROUBLE DIAGNOSIS

If the engine cranks but will not start, the trouble is in the engine (fuel or ignition system) and not in the starting system. If the engine will not crank even with a booster battery connected, engine parts may be seized or the starter may be faulty. If the engine cranks but cannot be started with a booster battery connected, attempt to start it by pushing the car. If it still will not start, push or tow the car to the shop for a complete diagnosis.

Do not push or tow a car equipped with an automatic transmission for more than 12 miles, without raising the rear wheels off the ground, or disconnecting the driveshaft.

STARTER TROUBLE DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK AND STARTER RELAY DOES NOT CLICK	This symptom may be caused by any one of the following: **1.** The battery may be discharged. **2.** The ignition switch, starter neutral switch, or starter may be inoperative. **3.** The circuit may be open or contain high resistance.

CONTINUED ON NEXT PAGE

STARTER TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE WILL NOT CRANK AND STARTER RELAY DOES NOT CLICK (Continued)	**CHECK BATTERY** Perform a Battery Capacity Test. If the battery does not test as having good capacity, make a Battery Test Charge. Replace the battery if the test indicates that it is worn out or under capacity. **CHECK STARTER RELAY** **1.** Disconnect and ground the high tension lead from the spark coil so that the engine cannot start. **2.** With a fully charged battery, operate the starter to crank the engine. If the engine will not crank and the relay does not click, connect a jumper lead from the battery terminal of the relay to the starter switch terminal of the relay (Fig. 2, connection ①). If the engine does not crank, the starter relay is probably defective. **3.** On cars with an automatic transmission, if the engine cranks in Step 2, connect a jumper lead from the battery terminal of the relay to the relay side of the neutral switch (Fig. 2, connection ②). If the engine does not crank, the wire or a connection between the neutral switch and the relay is loose or broken.	**4.** On cars with an automatic transmission, if the engine cranks in Step 3, connect the jumper lead from the battery terminal of the relay to the ignition switch side of the neutral switch (Fig. 2, connection ③). If the engine does not crank, the neutral switch is out of adjustment or defective. **5.** If the engine cranks in the preceding steps, connect the jumper lead from the starter switch terminal of the relay to the battery terminal (yellow wire) on the generator regulator (Fig. 2, connection ④). Turn the ignition switch to the start position. If the engine does not crank, the wire from the battery terminal of the relay to the generator regulator is loose or broken. If the engine does crank, there are three possible defects: The wire from the battery terminal of the regulator to the ignition switch is loose or broken. The ignition switch starter terminal is defective. The wire from the starter switch to the automatic transmission neutral switch or to the starter relay is loose or broken.
ENGINE WILL NOT CRANK BUT STARTER RELAY CLICKS	If the relay clicks when the ignition switch is operated, connect a heavy jumper from the relay battery terminal to the relay starter motor terminal (Fig. 2, connection ⑤). If the engine cranks, replace the relay. If the engine does not crank, observe the spark when connecting and disconnecting the jumper. If there is a heavy spark, see Check Engine and Starter Drive below. If the spark is weak or if there is no spark at all, proceed as follows: **CHECK CABLES AND CONNECTIONS** If the spark at the relay is weak when the jumper is connected, inspect the battery starter cables for corrosion and broken conductors. Check the ground cable to see if it is broken or badly corroded. Inspect all cable connections. Clean and tighten them if necessary. Replace any broken or frayed cables. If the engine still will not crank, the trouble is in the starter motor, and it must be repaired or replaced. **CHECK ENGINE AND STARTER DRIVE** If a heavy spark is obtained when	the jumper wire is connected, remove all the spark plugs, and attempt to crank the engine with the starting motor. If the engine cranks with the spark plugs removed, water has probably leaked into the cylinders causing a hydrostatic lock. The cylinder heads must be removed, and the cause of internal coolant leakage eliminated. If the engine will not crank, rock the car back and forth with the transmission in high gear, or in case of an automatic transmission or if the car cannot be rocked, loosen the starter mounting bolts to free the starter pinion. If the starter drive mechanism is locked, remove the starter from the engine, and examine the starter drive pinion for burred or worn teeth. Examine the teeth on the flywheel ring gear for burrs and wear. Replace the pinion or the flywheel ring gear if they are worn or damaged. If the starter drive mechanism is not locked, remove the starter from the engine, and perform the no-load current test. The starter should run freely. Compare the reading

CONTINUED ON NEXT PAGE

STARTER TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE WILL NOT CRANK BUT STARTER RELAY CLICKS (Continued)	obtained from the ammeter with the no-load current draw specification for the starter. If the current reading and no-load speed are below specifications, the starter has high resistance and should be repaired. If the current reading is above normal, and the starter is running slower than it should at no load, it is probably due to tight or defective bearings, a bent shaft, or the armature rubbing the field poles. A shorted coil in the starter also causes the current reading to be high. Disassemble the starter and determine the cause. Repair if possible, or replace the starter. If the no-load current reading of the starter is normal, the engine is seized and cannot be turned by the starter. Disassemble the engine and repair or replace the defective parts.
STARTER SPINS BUT DOES NOT CRANK THE ENGINE	If the starter spins but will not crank the engine, the starter drive mechanism is worn or broken, or the drive engagement contacts have failed. Repair or replace the starter mechanism parts as required.
ENGINE CRANKS SLOWLY	Several causes may result in this symptom: **1.** The battery may be low in charge. **2.** There may be excessive resistance in the starter circuit. **3.** The starter may be faulty. **4.** The engine may have excessive friction. **CHECK BATTERY** Test the state of charge of the battery. If the battery is discharged, recharge the battery, and check the starter relay for possible internal shorts to ground that may have caused the battery to discharge. Perform a Battery Capacity Test (page 11-9). If the battery does not test as having good capacity, make a Battery Test Charge (page 11-10). Replace the battery if the test indicates it to be worn out or under capacity. **CHECK EXTERNAL CIRCUIT VOLTAGE DROP** If the battery was fully charged in the previous test, test the starter external circuit voltage drop. The voltage drop will be either normal or excessive. **VOLTAGE DROP (RESISTANCE) EXCESSIVE** If the voltage drop (resistance) is greater than that specified, locate the exact part of the circuit with the excessive resistance. **1.** To correct excessive resistance in the battery-to-starter-relay-cable, clean and tighten the cable connections. Recheck the voltage drop. If it is still excessive, replace the cable. **2.** To correct excessive resistance of the starter relay contacts, replace the starter relay. **3.** To correct excessive resistance in the starter relay-to-starter motor cable, clean and tighten the cable connections. Recheck the voltage drop. If it is excessive, replace the cable. **4.** To correct excessive resistance in the battery-to-ground cable, clean and tighten the cable connections. Recheck the voltage drop. If it is still excessive, replace the cable. **VOLTAGE DROP NORMAL** If the voltage drop (resistance) is normal, test the starter current draw while the starter is cranking the engine. If the starter current is low (normal 100-150 amperes), proceed as follows: **Cranking Current Low.** Remove the starter from the engine, and repair or replace. **Cranking Current Normal or High.** Test the starter current draw at no-load. If the current draw is above or below specifications, remove the starter from the engine and repair or replace. If the current draw at no-load is normal, the starter is not at fault. The engine has excessive friction, and the cause must be determined. Repair or replace faulty parts.

2 STARTER AND STARTER CIRCUIT TESTS

DESCRIPTION

Heavy cables, connectors, and switches are used in the starting system because of the high current required by the starter while it is cranking the engine. The amount of resistance in the starting circuit must be kept to an absolute minimum to provide maximum current for starter operation. Loose connections, corroded relay contacts, and partially broken or undersize cables will result in slower than normal cranking speed, and may even prevent the starter from cranking the engine.

The starter is a four-brush, series-parallel wound unit. The circuit to the starter is completed by means of a relay controlled by a switch which is part of the ignition switch.

The starter utilizes an integral positive-engagement drive. When the starter is not in use, one of the field coils is connected directly to ground through a set of contacts (Fig. 1). When the starter is first connected to the battery a large current flows through the grounded field coil, actuating a moveable pole shoe. The pole shoe is attached to the starter drive actuating lever and thus the drive is forced into engagement with the flywheel.

When the moveable pole shoe is fully seated, it opens the field coil grounding contacts and the starter is then in normal operation. A holding coil is used to maintain the moveable pole shoe in the fully seated position, during the time that the starter is turning the engine.

Figure 3 shows the starter mounted on an engine.

Five different tests of the starter and its circuit are described. Arrangement of these tests is not intended to indicate an order of procedure. The selection of the test to be made is controlled by the circumstances encountered.

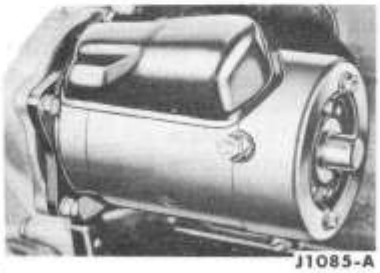

FIG. 3—Starter Mounting

STARTER LOAD TEST

Connect the test equipment as shown in Fig. 4. Be sure that no current is flowing through the ammeter and heavy-duty carbon pile rheostat portion of the circuit (rheostat at maximum resistance). Crank the engine with the ignition OFF, and determine the exact reading on the voltmeter. This test is accomplished by disconnecting and grounding the high tension lead from the spark coil, and by connecting a jumper from the battery terminal of the starter relay to the ignition switch terminal of the relay.

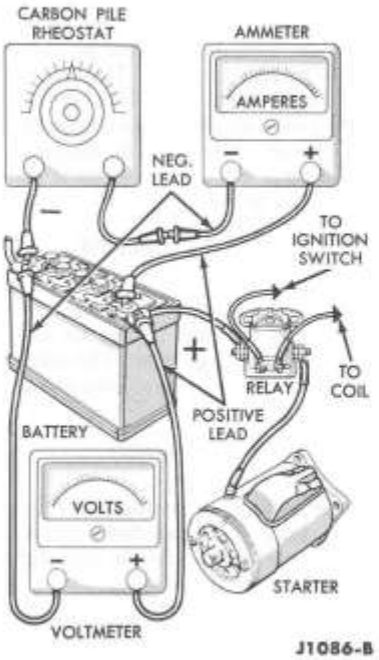

FIG. 4—Starter Load Test

Stop cranking the engine, and reduce the resistance of the carbon pile until the voltmeter indicates the same reading as that obtained while the starter cranked the engine. The ammeter will indicate the starter current draw under load. This reading should be a maximum of 150 amperes with the engine at normal operating temperature.

STARTER NO-LOAD TEST

The starter no-load test will uncover such faults as open or shorted windings, rubbing armature, and bent armature shaft. The starter can be tested, at no-load, either on the engine or test bench.

ON ENGINE

With the engine idling, make the ammeter connections as shown in Fig. 5. The no-load current draw on the ammeter should be 70 amperes maximum.

ON TEST BENCH

Connect the ammeter positive lead to the battery positive terminal and the ammeter negative lead to the starter terminal. Connect a lead from the battery negative terminal to the starter ground. The starter will run at no-load, and the current draw indicated on the ammeter should be 70 amperes maximum at 12 volts.

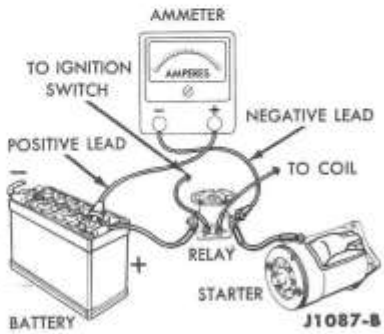

FIG. 5—Starter No-Load Test

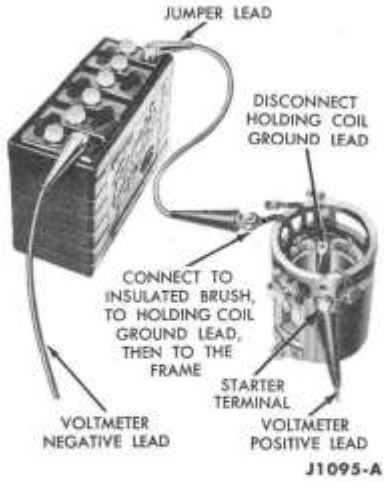

FIG. 6—Field Open Circuit Test

ARMATURE AND FIELD OPEN CIRCUIT TEST—ON TEST BENCH

An open circuit armature may sometimes be detected by examining the commutator for evidence of burning. The spot burned on the commutator is caused by an arc formed every time the commutator segment connected to the open-circuit winding passes under a brush.

An open circuit test of the field can be made on the test bench by connecting a voltmeter and battery as shown in Fig. 6. If no voltmeter reading is obtained, a coil is open.

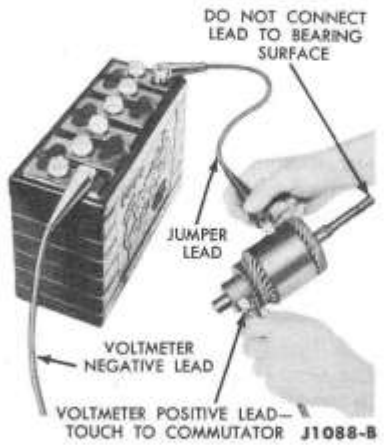

FIG. 7—Armature Grounded Circuit Test

ARMATURE AND FIELD GROUNDED CIRCUIT TEST—ON TEST BENCH

This test will determine if the winding insulation has failed, permitting a conductor to touch the frame or armature core.

To determine if the armature windings are grounded, make the connections as shown in Fig. 7. If the voltmeter indicates any voltage, the windings are grounded.

Grounded field windings can be detected by making the connections as shown in Fig. 8. If the voltmeter indicates any voltage, the field windings are grounded.

STARTER CIRCUIT TEST

Excessive resistance in the starter circuit can be determined from the results of this test. Make the test connections as shown in Fig. 9. Crank the engine with the ignition OFF. This test is accomplished by disconnecting and grounding the high tension lead from the spark coil and by connecting a jumper from the battery terminal of the starter relay to the ignition switch terminal of the relay.

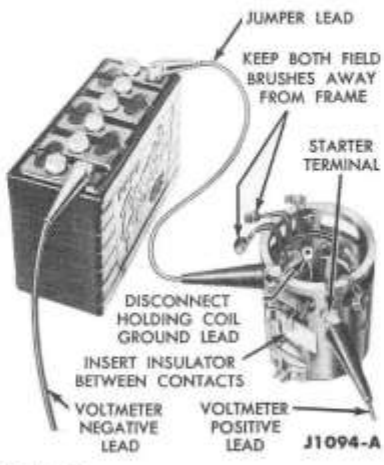

FIG. 8—Field Grounded Circuit Test

The voltage drop in the circuit will be indicated by the voltmeter (0 to 1 volt range). Maximum allowable voltage drop should be:

1. With the voltmeter negative lead connected to the starter terminal and the positive lead connected to the battery positive terminal (Fig. 9, connection ①) . . . . . .0.5 volt.

2. With the voltmeter negative lead connected to the battery terminal of the starter relay and the positive lead connected to the positive terminal of the battery (Fig. 9, connection ②) . . . . . .0.1 volt.

3. With the voltmeter negative lead connected to the starter terminal of the starter relay and the positive lead connected to the positive terminal of the battery (Fig. 9, connection ③) . . . . . .0.3 volt.

4. With the voltmeter negative lead connected to the negative terminal of the battery and the positive lead connected to the engine ground (Fig. 9, connection ④ . . .0.1 volt.

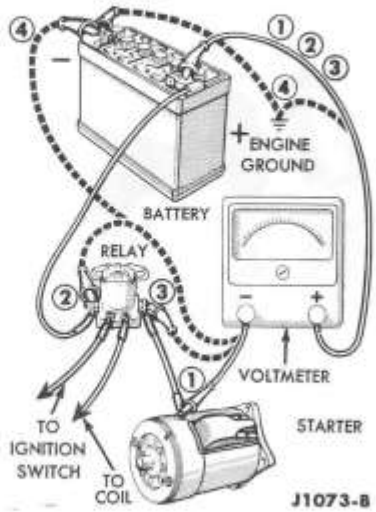

FIG. 9—Starter Circuit Test

3 STARTER REPAIR

In many cases it will not be necessary to completely disassemble the starter to accomplish repair or replacement of certain parts. The armature replacement, commutator turning, and brush replacement are procedures which eliminate the steps in disassembly that do not apply to these particular operations.

STARTER REPLACEMENT

1. Disconnect the starter cable at the starter terminal, remove the flywheel housing to starter retaining screws. Remove the starter assembly and the rubber dust ring.

2. Position the rubber dust ring on the flywheel housing.

3. Position the starter assembly to the flywheel housing, and start the starter retaining screws. On a car with an automatic transmission, the transmission dipstick tube bracket is mounted under the starter side mounting bolt. Snug all bolts, then tighten to specifications, tightening the middle bolt first. Connect the starter cable.

STARTER OVERHAUL

Use the following procedure when it becomes necessary to completely overhaul the starter. Figure 10 illustrates the starter completely disassembled.

DISASSEMBLY

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive actuating lever cover.

2. Remove the through bolts, starter drive gear housing, and the starter drive actuating lever return spring.

3. Remove the pivot pin retaining the starter gear actuating lever and remove the lever.

4. Remove the armature.

5. Remove and discard the spring clip retaining the starter drive gear to the end of the armature shaft, and remove the starter drive gear assembly.

6. Remove the commutator brushes from the brush holders and remove the brush end plate.

7. Remove the two screws retaining the ground brushes to the frame.

8. On the field coil that operates the starter drive gear actuating lever, bend the tab up on the field retainer and remove the field coil retainer.

9. Remove the three coil retaining screws, using tool 10044-A and an arbor press (Fig. 11). The arbor press prevents the wrench from slipping out of the screw. Unsolder the field coil leads from the terminal screw, and remove the pole shoes and coils from the frame.

10. Remove the starter terminal nut, washer, insulator, and terminal from the starter frame. Remove any excess solder from the terminal slot.

CLEANING AND INSPECTION

1. Wipe the field coils, armature, armature shaft, and drive with a clean cloth. Wash all other parts in solvent and dry the parts.

2. Check the field coils for continuity. Check the armature for grounds and open circuits.

3. Check the commutator runout (Fig. 12) and, if necessary, turn down the commutator.

4. Inspect the armature shaft and bearings for scoring and excessive wear.

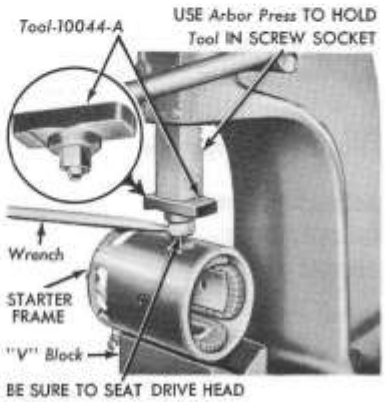

FIG. 11—Pole Shoe Screw Removal

5. Check the brush holders for broken springs and the insulated brush holders for shorts to ground.

6. Check the brush spring tension. It should be 48-56 ounces. Replace the springs if the tension is not within limits.

ASSEMBLY

1. Install the starter terminal, insulator, washers, and retaining nut in the frame (Fig. 13). Be sure to position the slot in the screw perpendicular to the frame end surface.

2. Position the coils and pole pieces, with the coil leads in the terminal screw slot, and then install the retaining screws. As the pole shoe screws are tightened, strike the frame several sharp blows with a soft-faced hammer to seat and align the pole shoes, then stake the screws.

3. Install the solenoid coil retainer and bend the tabs to retain the coil to the frame.

4. Solder the field coil to the starter terminal. Use a 300 watt iron.

5. Check for continuity and grounds in the assembled coils.

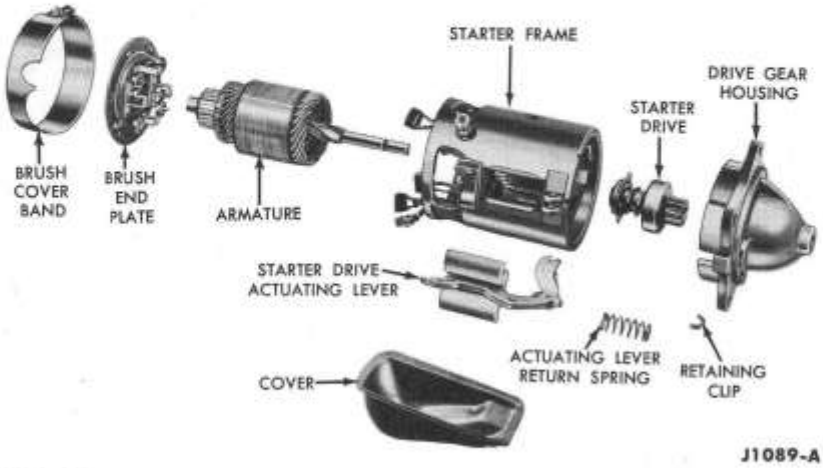

FIG. 10—Starter Disassembled

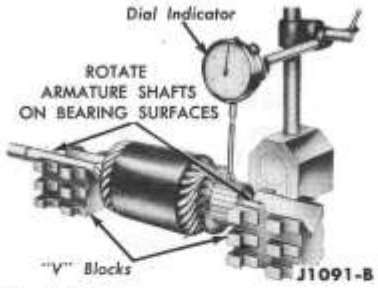

FIG. 12—Commutator Runout Check

6. Solder the two brushes to the field coils.

7. Position the ground brushes to the starter frame and install the retaining screws.

8. Position the starter brush end plate to the frame, with the end plate boss in the frame slot.

9. Install the starter motor drive gear assembly to the armature shaft and install a new retaining spring clip.

10. Position the fiber thrust washer on the commutator end of the armature shaft and position in the starter frame.

11. Position the drive gear actuacting lever to the frame and install the pivot pin.

12. Position the starter drive actuating lever return spring and the drive gear housing to the frame and install the through bolts. **Do not pinch the brush leads between the brush plate and the frame.**

13. Install the brushes in the brush holders. **Be sure to center the brush springs on the brushes.**

14. Position the drive gear actuating lever cover on the starter and install the brush cover band. Tighten the band retaining screw.

15. Check the starter no-load amperage draw.

ARMATURE REPLACEMENT

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive actuating lever cover (Fig. 10).

2. Remove the through bolts, starter drive gear housing, and the starter drive actuating lever return spring.

3. Remove the pivot pin retaining the starter gear actuating lever and remove the lever.

4. Remove the armature. If it is necessary to remove the starter drive gear assembly, remove the spring clip from the end of the armature shaft and remove the assembly.

5. Replace the starter drive gear assembly and retaining clip, if removed.

6. Before installing the armature, remove the brushes from their holders.

7. Install the washer on the commutator end of the armature shaft and install the armature.

8. Position the starter gear actuating lever to the frame and drive gear assembly and install the retaining pivot pin.

9. Position the starter drive actuating lever return spring, starter drive gear housing, and brush plate to the starter frame, and then install the through bolts.

10. Place the brushes in their holders, and center the brush springs on the brushes.

11. Position the actuating lever cover and brush cover band, and then tighten the retaining screw.

COMMUTATOR TURNING

Check the commutator run-out as shown in Fig. 12. If the surface of the commutator is rough or more than 0.002 inch out-of-round, turn it down.

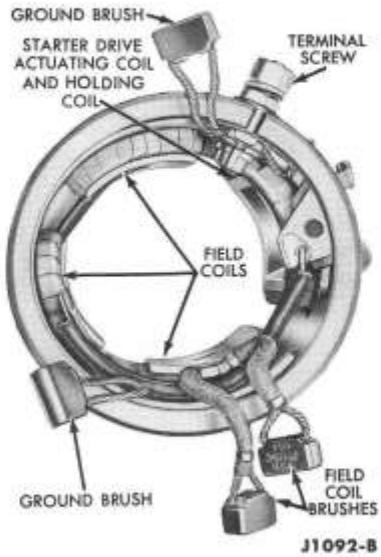

FIG. 13—Field Coil Assembly

BRUSH REPLACEMENT

Replace the starter brushes when they are worn to half size. Always install a complete set of new brushes.

1. Loosen and remove the brush cover band and starter drive actuating lever cover.

2. Remove the two through bolts from the starter frame.

3. Remove the drive gear housing, and the actuating lever return spring.

4. Remove the starter drive actuating lever pivot retaining pin and lever, and remove the armature.

5. Remove the brushes from the brush holders and remove the brush end plate.

6. Remove the ground brush retaining screws from the frame and remove the brushes (cut the ground brush nearest the starter terminal) from the terminal block.

7. Unsolder the brush leads from the field coils.

8. Clean and inspect the starter motor.

9. Replace the brush end plate if the insulation between the field holder brush and the end plate is cracked or broken.

10. Solder the new field brushes to the field coils. Use a 300 watt iron.

11. Install the ground brush leads to the frame with the retaining screws.

12. Clean the commutator with #00 or #000 sandpaper.

13. Position the brush end plate to the starter frame, with the end plate boss in the frame slot.

14. Position the fiber washer on the commutator end of the armature shaft and install the armature in the starter frame.

15. Install the drive gear actuating lever to the starter with the pivot pin.

16. Position the return spring on the actuating lever and the drive gear housing to the starter frame. Install the through bolts.

17. Install the commutator brushes in the brush holders. Center the brush springs on the brushes.

18. Position the actuating lever cover and install the brush cover band.

STARTER DRIVE

The starter drive is shown in Fig. 14.

REPLACEMENT

1. Loosen and remove the brush cover band and the starter drive actuating lever cover.
2. Loosen the through bolts enough to allow removal of the drive gear housing and the starter drive actuating lever return spring.
3. Remove the pivot pin retaining the starter drive actuating lever and remove the lever.

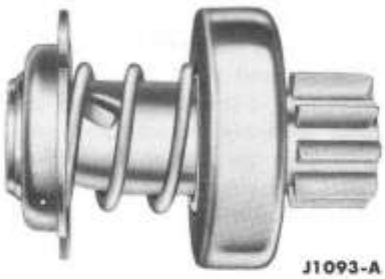

FIG. 14—Starter Drive

4. Remove the drive gear retaining spring clip from the end of the armature shaft and remove the drive gear assembly.
5. Install the drive gear assembly on the armature shaft and install the retaining clip.
6. Position the starter gear actuating lever on the starter frame and install the retaining pivot pin. **Be sure the actuating lever properly engages the starter drive assembly.**
7. Position the starter drive actuating return spring and drive gear housing to the starter frame, and then tighten the through bolts.
8. Position the starter drive actuating lever cover and brush cover band on the starter. Tighten the brush cover band retaining screw.

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GROUP 12

LIGHTS, INSTRUMENTS, AND ACCESSORIES

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PART 12-2 RADIO AND HEATER 12-12

PART 12-3 AIR CONDITIONING 12-19

PART 12-1 LIGHTING SYSTEM, HORN, AND INSTRUMENTS

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3	Horns, Windshield Wipers, and Turn Indicator	12-7
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1 TROUBLE DIAGNOSIS

Problems of the lighting, horn, turn indicator and instrument systems are covered in one of the following trouble diagnosis guides. These guides list many of the sources of trouble encountered in the electrical systems. The items listed are not in the order of probable occurrence. Individual circumstances and experience will dictate which items to check first.

LIGHT TROUBLE DIAGNOSIS GUIDE

ALL HEADLIGHTS DO NOT LIGHT	**1.** Loose battery cable. **2.** Loose or broken wire from the battery to the headlight switch (Fig. 1). **3.** Defective headlight switch. **4.** Disconnected or broken wire from the headlight switch to the beam selector switch.	**5.** Defective beam selector switch. **6.** All headlight bulbs burned out. This may be caused by a defective or improperly adjusted generator voltage regulator (Part 11-1).
INDIVIDUAL LIGHTS DO NOT LIGHT	**1.** Burned out bulb.	**2.** Loose or broken wires to the bulb.
LIGHTS BURN OUT REPEATEDLY	**1.** Loose or corroded electrical connections. **2.** Excessive vibration.	**3.** Improperly adjusted or defective generator voltage regulator (Part 11-1).

TURN INDICATOR TROUBLE DIAGNOSIS GUIDE

TURN INDICATOR LIGHTS INOPERATIVE	**1.** Burned out fuse. **2.** Loose or broken wire from ignition switch to flasher. **3.** Defective flasher. **4.** Loose or broken wire from flasher to turn indicator switch.	**5.** Defective turn indicator switch. **6.** Broken or loose wires from switch to lights. **7.** Burned out bulbs, or loose sockets.
TURN INDICATOR LIGHTS OPERATE INCORRECTLY	**1.** Burned out bulb. **2.** Loose or broken wires from switch to light.	**3.** Defective indicator switch. **4.** Defective flasher.
TURN INDICATOR CANCELS IMPROPERLY	**1.** Cam improperly positioned on steering wheel hub.	**2.** Coil spring on switch plate assembly loose or weak.

HORN TROUBLE DIAGNOSIS GUIDE

HORNS DO NOT SOUND	**1.** Loose connection at the horn button contact. **2.** Open wire (blue-yellow band) to the horn button.	**3.** Open wire (black-yellow band) to the horn relay. **4.** Inoperative relay. **5.** Horns defective or out of adjustment.
ONE HORN FAILS TO OPERATE	**1.** Broken or loose wire from the relay to the horn.	**2.** Horn defective or out of adjustment.
HORNS OPERATE CONTINUOUSLY	**1.** Shorted wire to the horn button. **2.** Shorted relay.	

INSTRUMENT TROUBLE DIAGNOSIS GUIDE

OIL PRESSURE INDICATOR LIGHT INOPERATIVE	**1.** Indicator bulb burned out. **2.** Loose or broken wire from the light to the indicator switch.	**3.** Defective oil pressure indicator switch (page 12-11).
CHARGE INDICATOR LIGHT INOPERATIVE	**1.** Burned out bulb. **2.** Loose or broken wires from the light to the armature terminal of the voltage regulator or to the ignition	terminal of the ignition switch. **3.** Wire from the regulator to the generator, or the generator brushes not making contact.
FUEL GAUGE ERRATIC OR INOPERATIVE	**1.** Loose or broken wire from the constant voltage regulator to the fuel gauge. **2.** Defective fuel gauge (page 12-9). **3.** Loose or broken wire from the	fuel gauge to the fuel tank sending unit. **4.** Defective fuel tank sending unit (page 12-9). **5.** Poor ground between the fuel tank and body.
TEMPERATURE GAUGE ERRATIC OR INOPERATIVE	**1.** Loose or broken wire from the constant voltage regulator to the temperature gauge. **2.** Defective temperature gauge (page 12-10).	**3.** Loose or broken wire from the temperature sending unit to the temperature gauge. **4.** Defective temperature sending unit (page 12-10).
BOTH FUEL AND TEMPERATURE GAUGES ERRATIC OR INOPERATIVE	**1.** Loose or corroded constant voltage regulator ground. **2.** Defective constant voltage regulator (page 12-9).	**3.** Broken or loose wire from or to the constant voltage regulator. **4.** Defective ignition switch.

2 LIGHTING SYSTEM

The lighting system uses two number "2" type headlights, one on each fender. Figure 1 shows the wiring diagram for the exterior lights. See Group 17 Specifications for a complete electrical wiring diagram.

HEADLIGHT ALIGNMENT

All headlight adjustments are to be made with a full fuel tank, an empty car and recommended pressure in all tires. Before each adjustment, bounce the car by pushing on the center of both the front and rear bumpers, to level the car.

The headlights are adjusted using the low beam.

To align the headlights by means of a wall screen, select a level portion

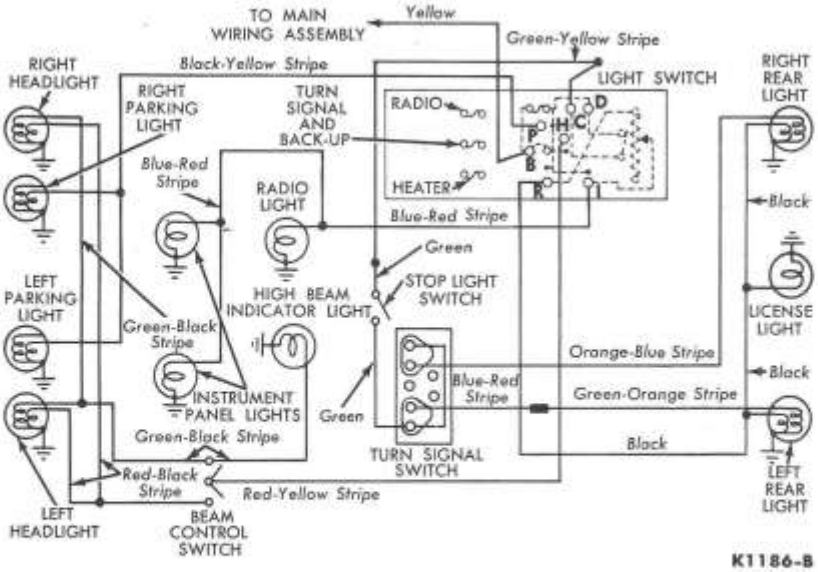

FIG. 1—Exterior and Instrument Panel Light Circuit

of the shop floor. Lay out the floor and wall as shown in Fig. 2.

Establish the headlight horizontal centerline by subtracting 20 inches from the actual measured height of the headlight lens center from the floor and adding this dimension (dimension "B," Fig. 3) to the 20-inch reference line obtained by sighting over the uprights. Then draw the headlight vertical centerlines on the screen (dimension "A," Fig. 3). Draw two lines 2 inches to the right of each vertical centerline. Place the car in position and turn the headlights on low beam.

Each headlight is adjusted by means of two screws located under the headlight trim ring as shown in Fig. 4. Adjust each headlight beam as shown in Fig. 3.

Always bring each beam into final position by turning the adjusting screws clockwise so that the headlight will be held against the tension springs when the operation is completed.

BULB REPLACEMENT

HEADLIGHTS

Remove the retaining screws and headlight trim ring. Loosen the retaining ring screws (Fig. 4), rotate the retaining ring counterclockwise, and remove the ring. The headlight bulb may now be pulled forward far enough to disconnect the wiring assembly plug.

Plug in the new bulb, and place it in position, making sure that the locating tabs are placed in the positioning slots. Install the retaining ring, rotating it clockwise under the screws, and tighten the screws. Place the trim ring into position, and replace the mounting screws.

PARKING LIGHT

To replace the bulb in the parking light, remove the retaining screws, lens, and gasket. The bulb is the double contact bayonet-type for use with the turn indicator. After the bulb is replaced, the gasket, lens, and retaining screws are then replaced.

TAIL AND STOP LIGHT AND LICENSE PLATE LIGHT

The tail and stop light is shown disassembled in Fig. 5.

The license plate light is shown disassembled in Fig. 6. The bulb and socket assembly snaps into the bezel and lens assembly which then mounts into the bumper.

INTERIOR LIGHTS

The dome light is a plastic unit, which is held to the roof by two screws. Remove the dome light lens retaining screws, lens, and then remove the bulb.

INSTRUMENT LIGHTS

The instrument panel light bulbs can be replaced by pulling out the individual light sockets from the rear of the panel.

SWITCHES

Before removing any switch, disconnect a battery cable from one of the battery terminals.

HEADLIGHT AND BEAM SELECTOR SWITCH TESTS

The following test may be made to determine whether a headlight switch or a beam selector switch is defective.

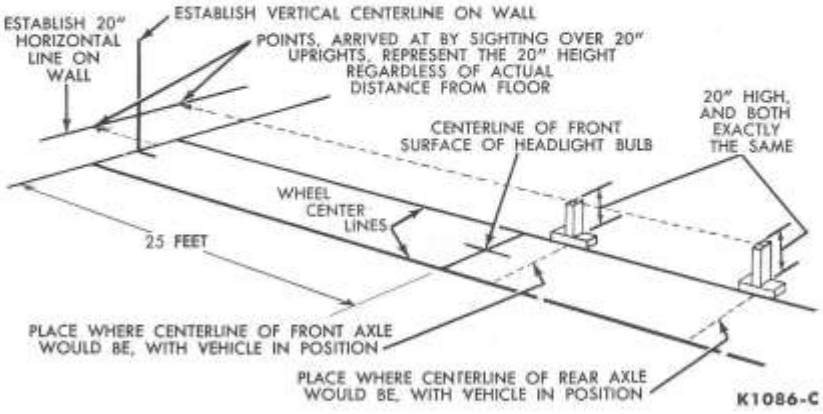

FIG. 2—Floor and Wall Layout

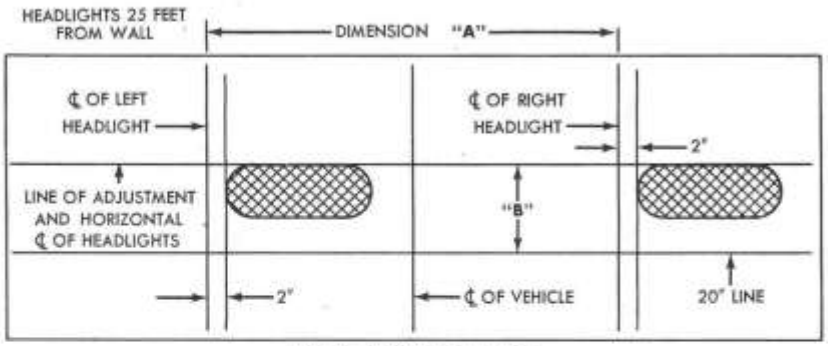

FIG. 3—Headlight Wall Screen

Set the headlight switch to the headlight position, and operate the beam selector switch. If none of the headlights turn on when the beam selector switch is operated, yet the instrument panel lights operate, the headlight switch or the red-yellow band wire from the headlight switch to the beam control switch is probably defective. Substitute a known good switch for the suspected switch to determine whether the switch or the wiring is at fault.

If the headlights operate only with the beam control switch in one position, the switch or the wiring from the switch to the headlight is defective. Substitute a known good switch for the suspected switch to determine whether the switch or the wiring is at fault.

HEADLIGHT SWITCH

1. Remove the light switch control knob and shaft by pressing the knob release button (Fig. 7), on the switch housing with the knob in the full ON position. Pull the knob out of the switch.

2. Remove the switch bezel nut, using tool 17470-N-51, and remove the switch from the rear of the instrument panel.

3. Disconnect the fuse panel from the switch (Fig. 7).

4. Plug the fuse panel to the light switch.

5. Position the light switch assembly to the instrument panel and install the switch retaining nut.

6. Install the light switch knob.

7. Check the operation of the switch.

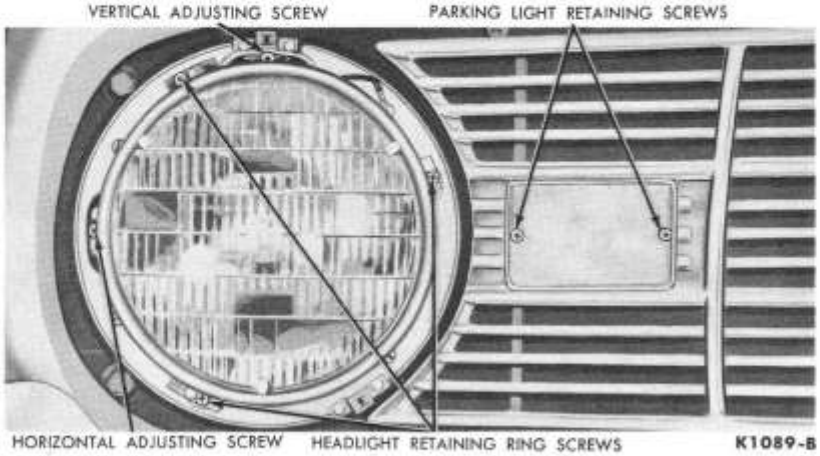

FIG. 4—Headlight Adjustment

FIG. 5—Taillight and Stop Light

HEADLIGHT BEAM CONTROL SWITCH

Lay the floor mat back from the area of the switch, and remove the mounting screws. Disconnect the wire terminal block from the switch.

To install the switch, connect the terminal block to the switch, and mount the switch to the floor. Replace the floor mat.

STOP LIGHT SWITCH

Disconnect the wires at the bullet connectors, and unscrew the switch from the master cylinder (Fig. 8).

DOME LIGHT SWITCH

The dome light switch is a part of the headlight switch. It is actuated by rotating the switch control knob to the maximum counterclockwise position. The dome light and headlight switch is replaced as a unit. The dome light circuit diagram is shown in Fig. 9.

IGNITION SWITCH AND LOCK CYLINDER

1. Disconnect the negative cable from the battery.

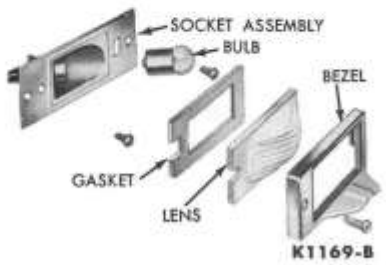

FIG. 6—License Plate Light

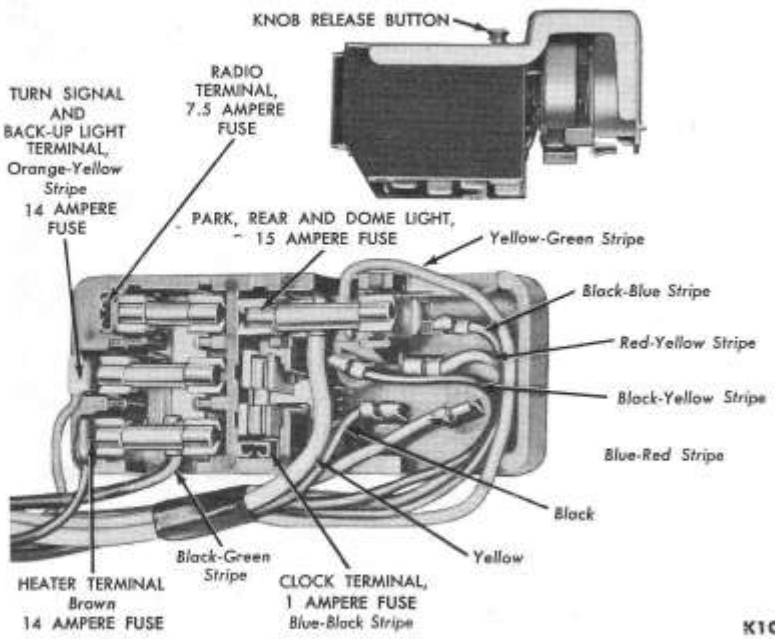

FIG. 7—Headlight Switch

2. Turn the ignition key to the accessory position. Slightly depress the pin shown in Fig. 10, turn the key counterclockwise, and pull the key and lock cylinder out of the switch assembly. If only the lock cylinder is to be replaced, proceed to step 9.

3. Press in on the rear of the switch and rotate the switch ⅛ turn counterclockwise (as viewed from the terminal end). Remove the bezel, switch and spacer.

4. Remove the nut from the back of the ignition switch. Remove the accessory and gauge feed wires from the accessory terminal of the switch. Pull off the insulated plug from the rear of the switch.

5. If a new ignition switch is to be installed, insert a screwdriver into the lock opening of the ignition switch and turn the slot in the switch to a full counterclockwise position.

6. Connect the insulated plug with wires to the back of the ignition switch. Position the accessory and gauge wires onto the ignition switch stud and install the retaining nut.

7. Position the retainer on the switch with the open face away from the switch.

8. Place the switch and spacer to the switch opening and press the switch toward the instrument panel and install the bezel.

9. If a new lock cylinder is to be installed, insert the key in the cylinder and turn the key to the accessory position. Place the lock and key in

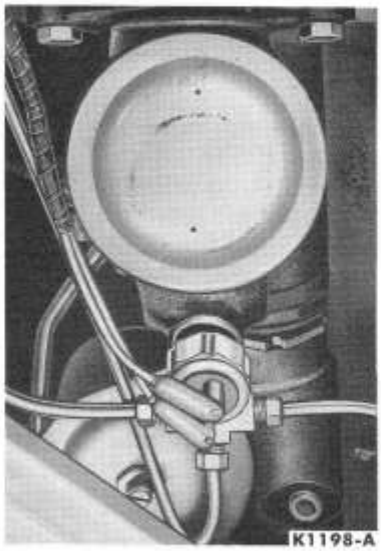

FIG. 8—Stop Light Switch

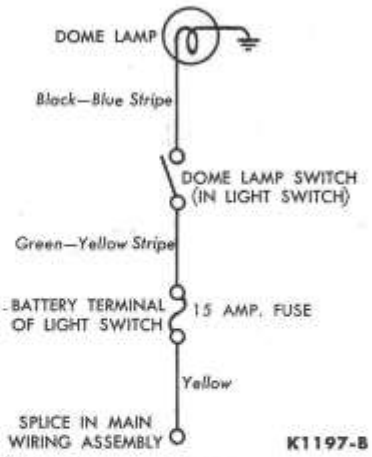

FIG. 9—Dome Light Diagram

the ignition switch, depress the pin slightly (Fig. 10), and turn the key counterclockwise. Push the lock cylinder into the switch. Turn the key to check the lock cylinder operation.

10. Connect the battery cable and check the ignition switch operation.

CIRCUIT BREAKER AND FUSES

A combination headlight switch, dome light switch, and circuit breaker is used (Fig. 7). The circuit breaker protects the headlight circuit.

The fuse panel, mounted under the headlight switch, contains the following fuses: parking, rear and dome light fuse, radio, turn indicator, and heater fuses.

FIG. 10—Ignition Switch Removal

3 HORNS, WINDSHIELD WIPERS, AND TURN INDICATOR

HORNS

A pair of tuned horns is controlled by means of a relay. The horn button closes the relay contacts, completing the circuit to the horns. One of the horns has a high-pitched tone; the other has a low-pitched tone.

TEST AND ADJUSTMENT

The only test necessary on the horns is for current draw. The current adjustment also adjusts the tone of the horn.

Current Draw Test. Connect a voltmeter and ammeter to the horn and to a voltage supply as shown in Fig. 11. The normal current draw for the horns at 12 volts is 10.0-11.0 amperes.

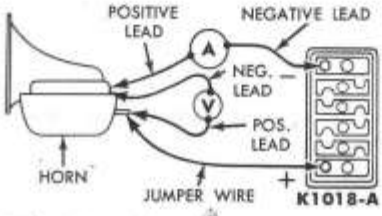

FIG. 11—Horn Current Draw Test

Adjustment. Tone and current are adjusted by changing the contact tension (Fig. 12). Connect the horn as shown in Fig. 11. Turn the self locking tone-adjusting nut until the current is within the limits for the horn being adjusted. Replace the cover and recheck the current draw.

REPLACEMENT

The horns are mounted on each side of the engine compartment directly behind the radiator deflectors. Disconnect the horn wire at the terminal. Remove the horn mounting bracket to horn retaining screws and remove the horn.

To install, mount the horn in position, then attach the horn wire to the horn terminal.

HORN RING

The horn ring is assembled to the steering wheel. The horn ring contact makes connection with the horn relay wire by means of a sliding contact mounted on the end of the steering column. When the horn ring is depressed, the horn ring contact makes connection with ground.

HORN BUTTON CONTACT

Removal

1. Disconnect the blue-yellow stripe band horn wire under the instrument panel, to the left of the steering column.

2. Press down evenly on the horn button or ring and turn counterclockwise until it lifts out from the steering wheel.

3. Remove the horn button and spring.

4. Mark the steering wheel position to the steering column. Remove the steering wheel retaining nut and remove the steering wheel.

5. Remove the turn indicator lever, remove the turn indicator mechanism retaining screws (Fig. 13), and lift the mechanism to one side.

6. Remove the screw retaining the horn button contact and pull the contact and wire from the steering column.

Installation

1. Install the horn contact wire through the steering column and install the retaining screw.

2. Position the turn indicator mechanism in place and install the retaining screws.

3. Install the turn indicator lever.

4. Install the steering wheel and retaining nut.

5. Install the horn button spring and button.

6. Connect the blue-yellow stripe band horn wire under the instrument panel.

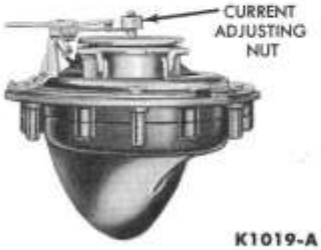

FIG. 12—Horn Adjustment

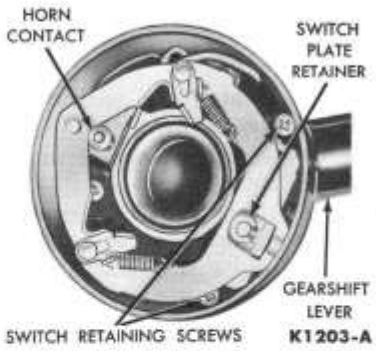

FIG. 13—Horn Button Contact

WINDSHIELD WIPERS

WIPER MOTOR REPLACEMENT

1. Disconnect the vacuum hose at the wiper motor.

2. Loosen the control cable retaining screw at the wiper motor, and remove the control cable from the motor.

3. Remove the wiper motor to mounting bracket retaining bolts and remove the motor from the car.

4. Install the wiper motor to the mounting bracket with the retaining bolts.

5. Connect, adjust, and tighten the wiper control cable at the wiper motor.

6. Connect the vacuum hose at the wiper motor. Start the engine and check the wiper operation.

WINDSHIELD WIPER CONTROL REPLACEMENT

1. Disconnect a battery cable at the battery.

2. Loosen the wiper control knob set screw and remove the knob.

3. Remove the wiper control to instrument panel retaining nut, using tool 17470-N51.

4. Loosen the control cable retaining screw at the wiper. Disconnect and remove the wiper control assembly.

5. Insert the control cable through the retaining bracket and connect to the wiper motor. Adjust the control cable and tighten the retaining screw.

6. Install the wiper control to the instrument panel with the retaining nut.

7. Install the wiper control knob and tighten the set screw.

8. Connect the battery. Start the engine and check the wiper control operation.

WIPER PIVOT SHAFT AND LINKAGE ASSEMBLY REPLACEMENT

1. Remove the windshield wiper blade and arm assembly.

2. Remove the pivot shaft assembly retaining nut, bezel, and gasket.

3. Remove the pivot shaft actuating link to the wiper motor retaining clip. Remove the link and pivot shaft assembly.

4. Position the link and pivot shaft assembly to the cowl and wiper motor. Install the link to the wiper with the retaining clip.

5. Install the pivot shaft assembly to the cowl and install the gasket, bezel, and retaining nut.

6. Install the wiper and arm assembly, then check the pivot shaft operation.

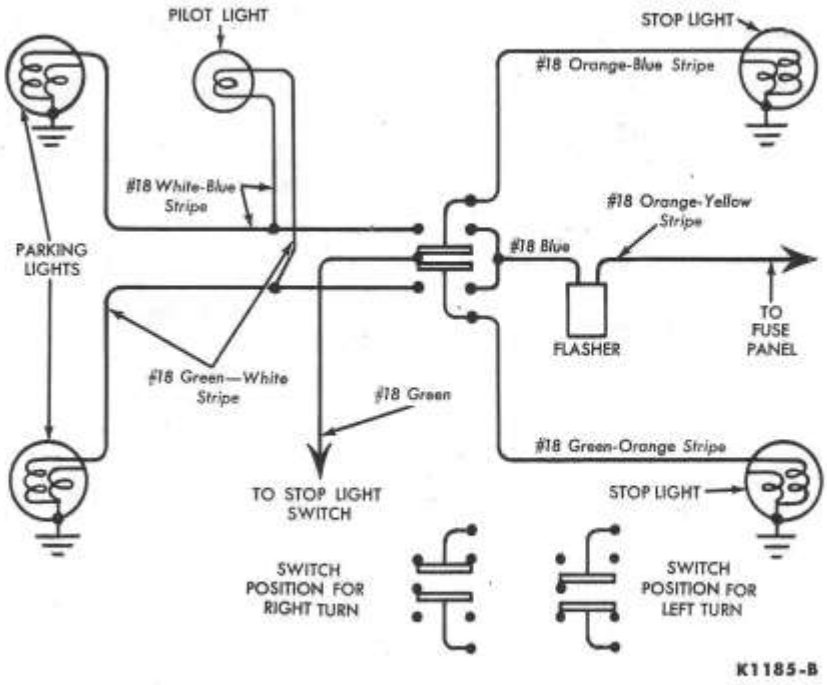

FIG. 14—Turn Indicator Diagram

TURN INDICATOR

The turn indicator wiring diagram is shown in Fig. 14.

TURN INDICATOR SWITCH AND WIRE

Removal

1. Disconnect the horn wire and the turn indicator switch wires under the instrument panel at the steering column. Slide the insulator tube from the steering column and wires.

2. Remove the horn button and spring.

3. Mark the steering wheel position on the steering column. Remove the steering wheel retaining nut and remove the steering wheel.

4. Unscrew and remove the turn indicator lever.

5. Remove the turn indicator switch to steering column retaining screws and pull the switch away from the steering column flange (Fig. 13).

6. Remove the steering column flange retaining nuts. The bolts will fall into the steering column upper hub.

7. Remove the turn indicator switch, steering column flange, sleeve, and wiring assembly from the steering column.

8. Remove the two bolts that fell into the steering column upper hub.

9. Remove the steering column flange from the turn indicator switch assembly.

Installation

1. Route the turn indicator switch wiring through the hole in the steering column flange, down the steering column, and out the hole in the steering column under the instrument panel.

2. Position the steering column flange retaining bolts to the underside of the flange and start the retaining nuts. Position the steering column flange to the steering column.

3. Tighten the steering column flange to steering column retaining nuts.

4. Position the turn indicator switch to the steering column flange and install the retaining screws.

5. Install the turn indicator lever.

6. Position the steering column flange sleeve and sleeve spring.

7. Install the steering wheel and retaining nut.

8. Install the horn button and spring.

9. Slide the insulator over the turn indicator and horn button wires and connect the wires.

10. Check the turn indicator and horn operation.

4 INSTRUMENTS

This section contains information on operating principles and tests of the various units in the instrument cluster assembly. A circuit diagram showing the connections of the gauges is shown in Fig. 15.

The instrument cluster (Fig. 16) includes a charge indicator light, fuel gauge, temperature gauge, oil pressure indicator light and speedometer. A gauge voltage regulator maintains a constant voltage supply to the fuel gauge and temperature gauge circuits. All of the instruments are electrically operated except the speedometer.

It is not necessary to remove the entire instrument cluster in order to remove the individual instruments, as the instruments are mounted on the outer surface of the cluster. To re-

move any instrument, remove the cluster lens retaining screws and remove the lens. Remove the instrument retaining screws, pull the instrument away from the panel and disconnect the wires or cables.

FUEL GAUGE AND TEMPERATURE GAUGE

The constant voltage regulator (Fig. 17) used with the fuel and temperature gauges maintains an average value of 5.0 volts at the gauge terminals. The regulator is temperature compensated for all expected ambient (surrounding air) temperatures.

If the fuel gauge indicates improperly and at the same time the temperature gauge indicates improperly and in the same direction, the constant voltage regulator could be defective, as it supplies both gauges.

CONSTANT VOLTAGE REGULATOR

Test. Turn the ignition switch ON. Check for voltage at the gauge feed wire (black with green band) at one of the gauges. The voltage should oscillate between zero and about 10 volts. If it does not, the constant voltage regulator is defective, or there is a short to ground between the voltage regulator and the gauges.

Replacement

1. Disconnect the speedometer cable from the speedometer. Remove the instrument cluster mounting screws and lay the cluster on the steering column. It may be necessary to remove the wiring harness from its left mounting clip in order to accomplish this.

2. Disconnect the plug-on type wire connectors at the constant voltage regulator.

3. Loosen the regulator retaining screw and remove the regulator.

4. Install the constant voltage regulator in place with the retaining screw.

5. Connect the wires to the regulator and check the operation of the gauges.

6. Install the cluster in the instrument panel, and install the speedometer cable.

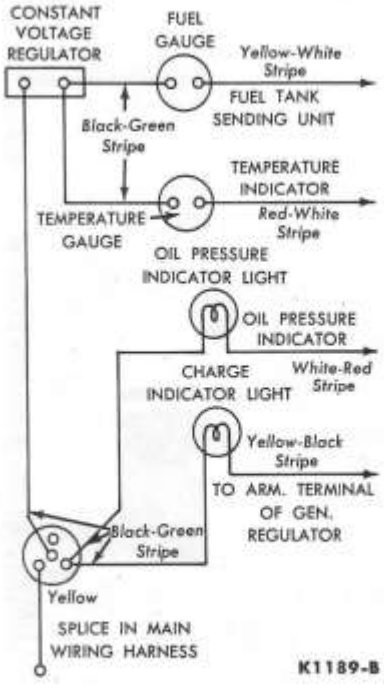

FIG. 15—Instrument Gauge Circuit

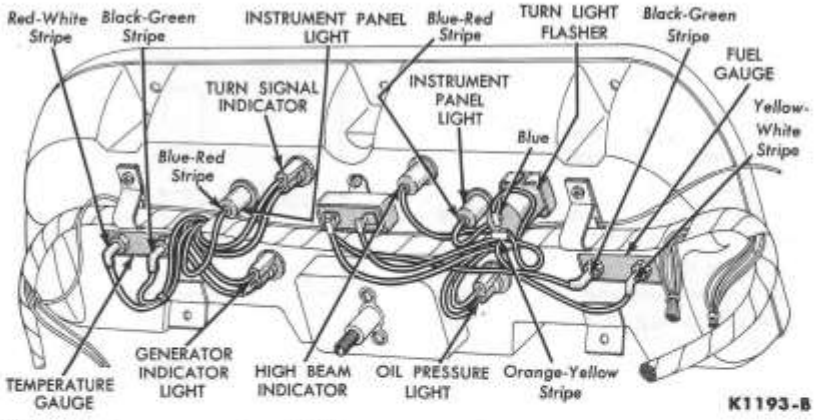

FIG. 16—Instrument Panel Wiring

FUEL GAUGE

The fuel gauge consists of a sending unit, located on the fuel tank, and a remote register unit (fuel gauge) mounted in the instrument cluster. The remote register unit pointer is controlled by a bimetallic arm and heating coil. The sending unit is a rheostat that varies its resistance depending on the amount of fuel in the tank. The fuel gauge circuit is shown in Fig. 18.

Fuel Gauge Unit Test. Place the ignition switch in the off position, and connect the terminals of two, series connected, flashlight cells to the gauge terminals. The 3 volts should cause the gauge to read approximately full scale.

If the gauge unit is inaccurate or does not indicate, replace it with a new unit.

Fuel Gauge Unit Replacement

1. Disconnect the battery cable. Remove the instrument cluster bezel, lens, and cluster mask from the instrument cluster housing (Fig. 19).

2. Disconnect the fuel gauge retaining screws and pull the fuel gauge away from the cluster. Disconnect the wires and remove the fuel gauge.

3. Position the fuel gauge to the instrument cluster and connect the wires.

4. Install the fuel gauge with the retaining screws.

5. Install the cluster mask, lens, and bezel with the retaining screws.

Fuel Sending Unit Test. The sending unit can be tested by first making a gauge unit test to determine the accuracy of the instrument panel gauge.

If the gauge unit is inaccurate or does not indicate, replace it with a new unit. If the gauge unit still indicates improperly or is erratic in its operation, the sending unit or wiring to the sending unit is faulty. Repair the wiring or replace the sending unit.

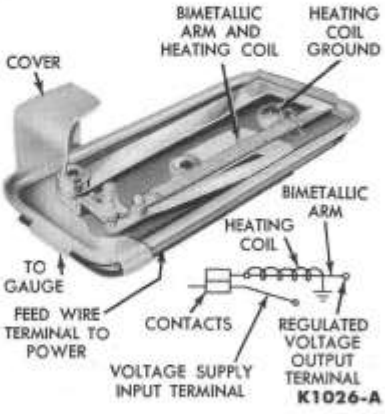

FIG. 17—Gauge Voltage Regulator and Circuit

Fuel Sending Unit Replacement

1. Remove the drain plug and drain the fuel into a suitable container.

2. Disconnect the fuel gauge sending unit wire at the sending unit.

3. Loosen the hose clamp and disconnect the tank line at the sending unit.

4. Turn the sending unit retaining ring counterclockwise and remove the unit, retaining ring, and mounting gasket.

5. Clean the fuel gauge sending unit mounting surface at the fuel tank.

6. Position the sending unit and mounting gasket to the fuel tank and secure with the retaining ring.

7. Connect the sending unit wire and fuel tank line.

8. Install the drain plug and fill the tank with the fuel removed.

9. Check the fuel gauge operation and check for leaks.

TEMPERATURE GAUGE

The temperature indicator consists of a sending unit (Fig. 20) mounted in the cylinder head, and a remote register unit, (temperature gauge) mounted on the instrument panel (Fig. 19). The principle of operation is similar to the fuel gauge except that the resistance of the sending unit is varied by engine temperature. The temperature gauge circuit is shown in Fig. 21.

Temperature Gauge Test. Perform the same test as that described for the fuel gauge. The temperature gauge pointer should read approximately full scale. This test will determine the accuracy of the instrument panel gauge unit.

Temperature Gauge Replacement

1. Disconnect the battery cable. Remove the instrument cluster bezel, lens, and cluster mask from the instrument panel (Fig. 19).

2. Remove the temperature gauge retaining screws, pull the temperature gauge from the cluster, disconnect the wires, and remove the temperature gauge.

3. Position the temperature gauge assembly to the instrument cluster and connect the wires.

4. Install the temperature gauge to the instrument cluster with the retaining screws.

5. Install the cluster mask, lens, and bezel with the retaining screws.

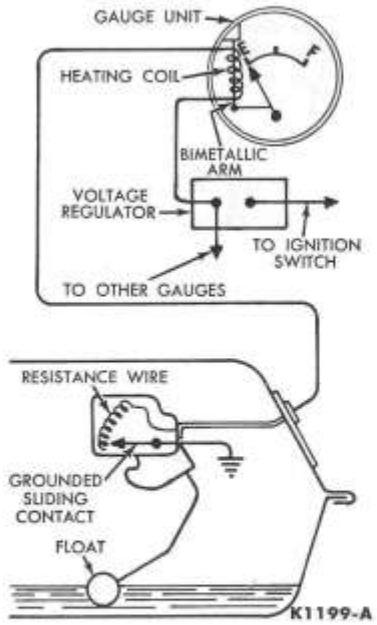

FIG. 18—Fuel Gauge Circuit

Connect the battery cable.

Temperature Sending Unit Test. The sending unit can be tested by first making a temperature gauge test to check the accuracy of the gauge. Start the engine and allow it to warm up to normal temperature. If no reading is indicated on the gauge, check the sending unit to gauge wire by removing the wire from the sending unit and momentarily grounding the wire. If the gauge still does not indicate, the wire is defective. Repair or replace the wire. If the gauge now indicates, the sending unit is faulty.

Temperature Sending Unit Replacement

1. Disconnect the temperature sending unit wire at the sending unit, and relieve any pressure in the cooling system by loosening the radiator cap.

2. Prepare the new temperature sending unit for installation by applying a small amount of water resistant sealer to the threads.

3. Remove the temperature sending unit from the cylinder head and immediately install the new temperature sending unit.

4. Connect the wire to the temperature sending unit.

5. Start the engine and check the sending unit operation.

SPEEDOMETER

The speedometer is connected to the output shaft of the transmission by means of a flexible shaft, and a drive gear located inside the transmission.

SPEEDOMETER TESTS

To test the odometer accuracy, drive the car over a "measured mile." Speedometer accuracy can be checked by comparing the speedometer in question against one known to be accurate, while two cars are moving at the same speed, or by timing the car on a "measured mile."

Most cases of speedometer inaccuracy are due to a change to non-standard tire sizes without changing the speedometer drive gear ratio.

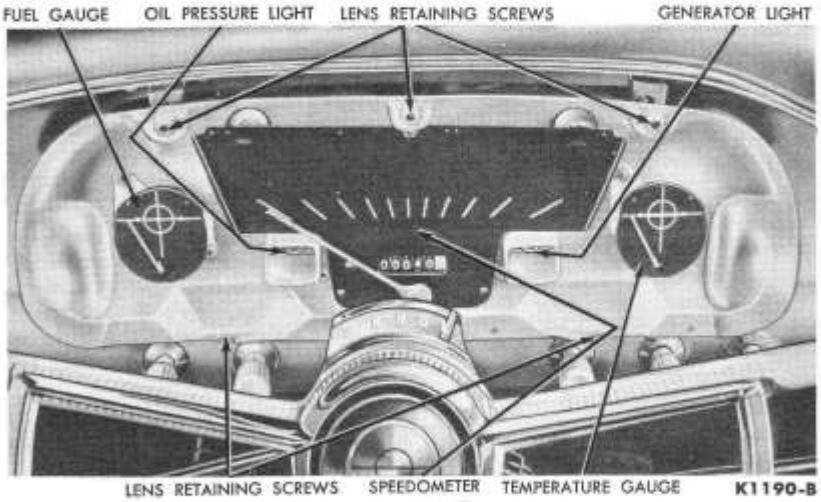

FIG. 19—Instrument Cluster

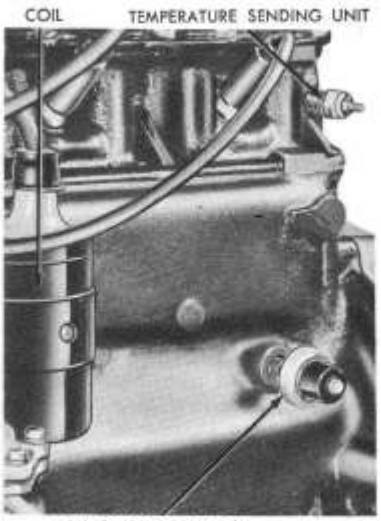

FIG. 20—Oil Pressure Switch and Temperature Sending Unit

Refer to the specifications section for the proper gears to use for various rear axle and tire size combinations.

SPEEDOMETER REPLACEMENT

1. Disconnect the cable housing at the speedometer head.

2. Remove the instrument cluster bezel retaining screws and lift the bezel, lens, and cluster mask plate from the cluster housing (Fig. 19).

3. Remove the speedometer assembly retaining screws and lift the speedometer from the cluster housing.

4. Position the speedometer assembly to the cluster housing and install the retaining screws.

5. Position the cluster mask plate to the cluster housing. Clean and position the instrument cluster lens in the bezel.

6. Install the instrument cluster bezel and lens to the cluster housing.

7. Connect the speedometer cable housing to the speedometer assembly.

SPEEDOMETER CABLE REPLACEMENT

1. Disconnect the speedometer cable housing at the speedometer.

2. Pull the speedometer cable out of the housing.

If the speedometer cable is broken, it will be necessary to disconnect the cable housing from the transmission to remove the lower broken section.

3. Lubricate the new cable with cable lubricant B5A-19581-A. (Do not over lubricate.) Insert the cable in the cable housing, and twist it slightly to make sure that the squared drive is engaged in the speedometer driven gear.

4. If the speedometer driven gear is to be replaced, make certain that the gear is in position before inserting the retainer clip through the gear slots.

5. Connect the cable housing at the speedometer assembly.

SPEEDOMETER CABLE LUBRICATION

Follow the procedure for speedometer cable replacement. Wipe off all of the old lubricant from the cable before applying new lubricant. Apply cable lubricant B5A-19581-A sparingly to the entire length of the cable.

CHARGE INDICATOR LIGHT

A red generator charge indicator light is used. This light flashes on if the battery is discharging and the generator is not supplying current. The indicator light is connected between the armature terminal of the generator regulator and the coil terminal of the ignition switch. This actually places the light in parallel with the regulator cut-out contacts. If the ignition switch is on, and the cut-out contacts are open, the charge indicator light will light up, indicating that the generator is not connected to the battery. The circuit for the light is from the battery, through the light, and through the generator armature to ground. As soon as the generator comes up to speed, the cut-out contacts close. This bypasses the warning light which then goes out and this indicates that the battery is connected to the generator.

To test the charge indicator light, turn the ignition switch on with the engine stopped. The light should come on. If it does not, the light is either burned out or the wiring to the light is defective.

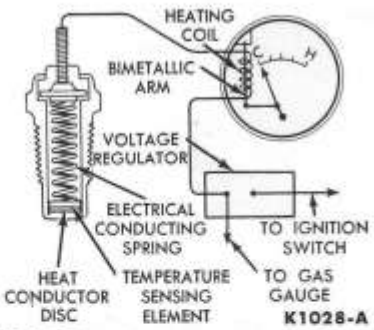

FIG. 21—Temperature Gauge Circuit

OIL PRESSURE INDICATOR LIGHT

All models are equipped with a red indicator light which flashes on when the oil pressure is below a safe value. The light should come on when the ignition switch is first turned on, and it should go out when the engine comes up to speed. The light is connected between the oil pressure switch unit and the coil or ignition terminal of the ignition switch (Fig. 15).

INDICATOR LIGHT TEST

To test the oil pressure switch on the engine (Fig. 20), turn the ignition switch on, engine not running. The indicator light should come on. If the indicator light does not come on, short the terminal of the oil pressure switch unit to ground. If the light now comes on, the oil pressure switch is defective. If the light still does not come on, the bulb is burned out or the wires from the bulb to the ignition switch and oil pressure switch are defective.

OIL PRESSURE SWITCH REPLACEMENT

1. Disconnect the oil pressure sending unit wire at the unit (Fig. 20).

2. Remove the oil pressure sending unit from the engine.

3. Apply the sealing compound to the threads of the unit to be installed, and install the new oil pressure sending unit.

4. Connect the wire to the oil pressure sending unit.

5. Check the operation of the unit.

PART 12-2 RADIO AND HEATER

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2	Radio	12-13
3	Heater	12-16

1 RADIO AND HEATER TROUBLE DIAGNOSIS

RADIO TROUBLE DIAGNOSIS

The procedures given cover only minor radio receiver troubles. Each procedure either locates the minor trouble or determines that the receiver should have a major repair.

The following parts will be required to make the radio trouble shooting tests:

Spare Fuses (7.5 ampere)

Antenna and Lead

Speaker

Radio Tubes (one each: 12AD6, 12AE6A, 12BL6)

Suppression Equipment (complete set)

Pretest and mark all of the test parts so that these known good parts will not be left in a tested receiver.

RADIO TROUBLE DIAGNOSIS GUIDE

NO RECEPTION	**1.** Burned out fuse. **2.** Defective antenna. **3.** Shorted speaker lead or defective speaker. **4.** Reversed battery polarity. **5.** Burned out tubes. If all tubes do not light up, make certain that voltage is available at the "A" lead (12 Volts). If some tubes light up, replace those that do not light.	If the radio still will not operate, substitute the known quality test tubes for those in the receiver, one at a time, allowing enough time for each tube to heat up before going on to the next tube. **Be sure to turn off the radio receiver before removing or installing the speaker or any radio tube.** If radio still will not play, remove the receiver for a major repair.
NOISY OR ERRATIC RECEPTION	**NOISY RECEPTION—ENGINE NOT RUNNING** **1.** Loose connections. **2.** Defective radio tubes. **NOISY RECEPTION—ENGINE RUNNING** **1.** Defective suppression equipment.	**2.** Suppression condensers not properly grounded. **3.** Receiver not properly grounded to instrument panel. **NOISY RECEPTION—CAR IN MOTION** **1.** Loose or broken lead-in cable. **2.** Loose or defective radio antenna. **3.** Defective wheel static collector.
DISTORTED OR GARBLED SOUND	**1.** Voice coil rubbing on center pole piece of speaker magnet. **2.** Torn speaker cone. **3.** Foreign material on cone.	**4.** Bent or twisted speaker mounting. **5.** Defective radio tube. **Be sure to turn off the radio receiver before removing or installing the speaker or any radio tube.**
WEAK RECEPTION	**1.** Poor adjustment of the antenna trimmer. **2.** Defective radio tube.	**Be sure to turn off the radio receiver before removing or installing a tube.**

HEATER TROUBLE DIAGNOSIS GUIDE

INSUFFICIENT OR NO HEAT	**1.** Burned out fuse or loose wires to the heater blower. **2.** Defective motor ground. **3.** Fan loose on motor shaft, or motor stalled. **4.** Defective heater blower switch. **5.** A kinked or collapsed water hose.	**6.** Improperly connected heater hoses. **7.** Plugged heater core, or air outlet. **8.** Improperly installed engine thermostat. **9.** Incorrectly installed and adjusted control cables. **10.** Air leaks in the body.
INSUFFICIENT OR NO DEFROSTING	**1.** Improperly adjusted defroster control cable. **2.** Disconnected defroster hose.	**3.** Binding defroster valve. **4.** Plugged or loose defroster nozzle. **5.** Obstructed defroster openings at windshield.
TOO MUCH HEAT	Incorrectly adjusted blend-air valve.	

2 RADIO

GENERAL INFORMATION

A pictorial diagram showing the radio connections is shown in Fig. 1.

One model of radio receiver is available. The radio receiver model number (14MD) identifies the manufacturer (Motorola) and is the prefix to the Serial Number stamped on the receiver (Fig. 2).

The antenna connector and trimmer condenser are located on the right side of the receiver as shown in Figure 2. The fuse is located in the fuse panel attached to the headlight switch. The speaker is connected to the receiver chassis with a polarized connector.

All receiver models can be tested (minor repair tests) and the tubes changed while the receiver is mounted in the car. Removal of the bottom cover permits access to all tubes as shown in Figure 3.

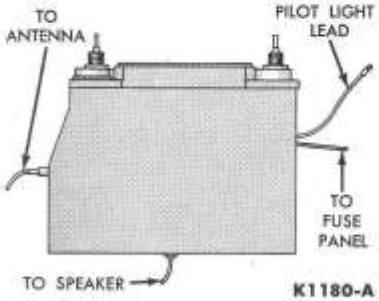

FIG. 1—Radio Wiring Connections

RADIO REPLACEMENT

To remove the radio receiver, proceed as follows:

1. Pull the radio control knobs off and remove the nuts and washers retaining the radio to the instrument panel.

2. Disconnect the antenna lead at the right side of the radio.

3. Disconnect the speaker lead.

4. Disconnect the radio lead wire at the fuse panel and the pilot light wire. Remove the lead wire from the retaining clips.

5. Remove the radio right support bracket to radio retaining bolt. Remove the radio left support bracket to radio retaining nut.

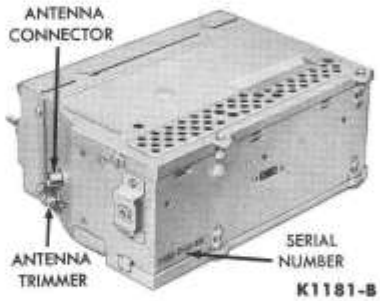

FIG. 2—Radio Identification

6. Remove the radio assembly from the instrument panel.

7. Position the radio to the instrument panel, and then install the

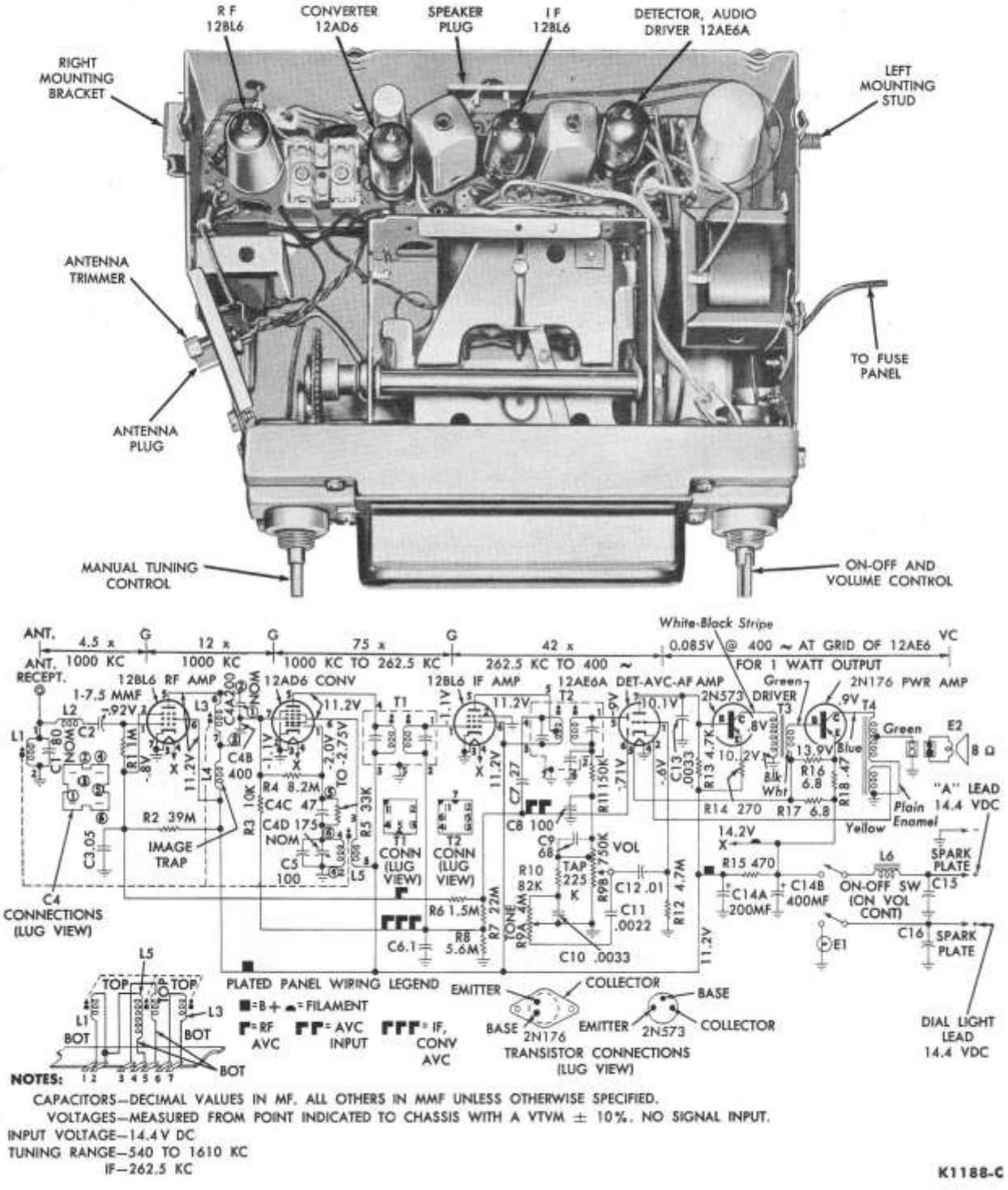

FIG. 3—Radio Circuit Diagram and Tube Arrangements

washers and retaining nuts at the knob shafts. Be sure the radio mounting stud enters the support bracket.

8. Install the radio support bracket retaining nut and bolt.

9. Connect the antenna lead to the radio.

10. Connect the radio speaker lead.

11. Connect the radio power lead and the pilot light lead.

12. Install the radio control knobs.

13. Check the radio operation and adjust the antenna trimmer.

ANTENNA REPLACEMENT

1. Disconnect the antenna lead from the side of the radio receiver.

2. Remove the antenna mounting nut, remove the spacer from the antenna, and remove the antenna assembly.

3. Tie a string to the antenna lead, and fish the string through the opening into the passenger compartment with a piece of wire.

4. Position the antenna assembly in the opening, put the spacer in position on the antenna and install the antenna retaining nut.

5. Pull the antenna lead through the opening and route the lead over the glove box and connect the lead to the radio.

ANTENNA TRIMMER ADJUSTMENT

Be sure to warm up the receiver for 15 minutes before making the following adjustments:

Extend the antenna to its maximum length. Tune in the weakest station between 12 and 16 on the dial and reduce the volume until the station is barely audible. Turn the antenna trimmer knob (Fig. 2) slowly in either direction until a peak of volume is reached.

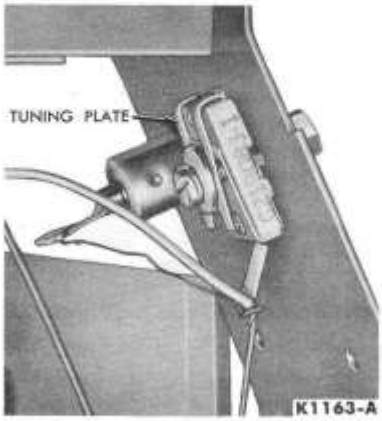

FIG. 4—Antenna Trimmer

MINOR REPAIRS

Minor repairs involve mechanical adjustments and corrections of the tuning mechanism, antenna trimmer, and the replacement of pilot lights and tubes.

ANTENNA TRIMMER

If the antenna trimmer unit will not "peak" the volume when the trimmer knob is rotated in either direction, remove the radio bottom cover and examine the condenser tuning plate (Fig. 4) for movement while the trimmed knob is rotated. If there is no movement of the tuning plate, the knob screw threads are stripped, and the condenser must be replaced (major repair). If the plate does move, replace the R.F. tube (Fig. 3). If this does not cure the trouble, remove the radio for major repair.

PILOT LIGHT REPLACEMENT

1. Remove the radio from the car, and remove the dial retaining plate (Fig. 5).

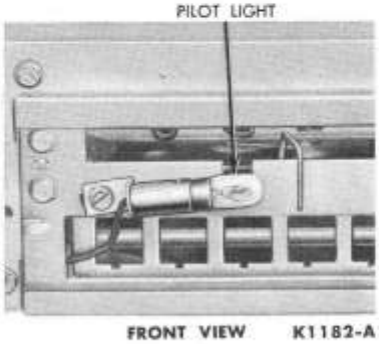

FIG. 5—Pilot Light Location

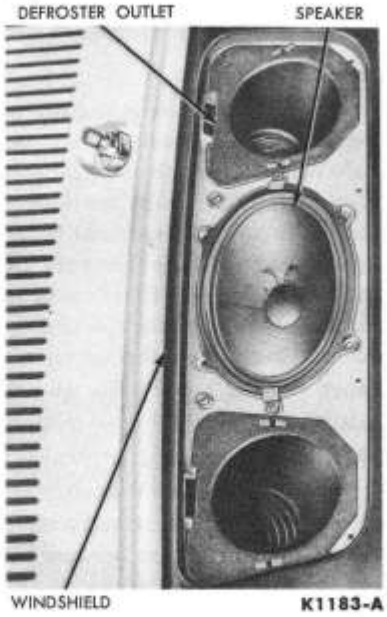

FIG. 6—Radio Speaker Mounting

2. Adjust the manual tuning control knob so that the pointer is at the right end of the dial.

3. Remove the dial. Remove the dial background retaining screws and carefully remove the dial background.

4. Replace the pilot light.

TUBE REPLACEMENT

The radio tubes can be replaced with the receiver mounted in the car by removing the bottom cover (Fig. 3). When the new tube is installed, be sure that it is firmly seated in its socket.

Be sure to turn off the radio before removing or installing any tube.

SPEAKER REPLACEMENT

1. Disconnect the speaker wires from the radio receiver.

2. Remove the defroster and radio speaker outlet grille from the top of the instrument panel.

3. Remove the speaker retaining screws and lift the speaker from the instrument panel (Fig. 6).

4. Install the speaker to the instrument panel with the retaining screws.

5. Install the radio speaker outlet grille.

6. Connect the speaker wires to the radio, and check the radio operation.

3 HEATER

OPERATION

The fresh air heater is designed to function in conjunction with the right duct of the fresh air ventilating system (Fig. 7). The heater blower couples to an outlet provided in the right fresh air valve assembly. A valve in the duct and two valves in the heater housing are operated by controls located on the instrument panel, allowing the selection of outside air for ventilation or heating (Fig. 8).

The defroster control knob operates a valve in the heater plenum chamber. Pull the knob outward for proportionately more air to the defroster registers.

The PULL FOR TEMP knob operates the blend-air valve in the heater blower housing. The blend-air valve controls the amount of air flow through the heater core. Any intermediate position of the blend-air valve allows both cool and heated air to be mixed in the plenum chamber for lower than maximum temperatures.

The PULL FOR HTR knob operates a valve in the right incoming air duct. When the knob is pushed in, air from the cowl grille enters the passenger compartment through an opening under the right side of the instrument panel. A manually operated door closes the opening, or deflects air as desired. Pulling the knob out, allows air to enter the heater blower inlet duct.

The PULL FOR HTR knob also controls the two-speed blower motor. To operate the blower motor, rotate the knob clockwise. The high speed blower position is the first clockwise click and the low speed position is the second click.

HEATER CURRENT DRAW TEST

Connect an ammeter as shown in Figure 9. The blower motor will operate independently of the control switch, and the current draw of the motor will be indicated on the ammeter. Normal current draw should be 5 to 6 amperes for the high speed position (orange wire). The slow speed current draw (red wire) is 4 to 5 amperes.

Figure 10 shows the complete heater motor circuit.

HEATER REPLACEMENT

Most of the heater repairs can be performed with the heater assembly lying on the car floor. Therefore, the following procedure will not remove the heater assembly from the car. The heater core or plenum replacement procedures contain the additional required steps to remove the heater assembly from the car.

REMOVAL

1. Drain the cooling system.
2. Disconnect the defroster control cable at the heater.
3. Disconnect the defroster hoses at the heater plenum.
4. Disconnect the heater hoses at the water pump and the carburetor heater. Remove the heater hoses from the retaining clips.
5. Disconnect the wires at the heater motor and remove the ground wire to the firewall retaining screw.
6. Remove the heater and motor assembly retaining nuts from the firewall.
7. Disconnect the fresh air inlet rubber boot, pull the heater assembly from the firewall, and lay the heater assembly on the floor.

INSTALLATION

1. Position the heater assembly to the firewall and install the retaining nuts.
2. Connect the heater motor wires to the wiring harness, and connect the heater motor ground wire to the firewall with the retaining screw.
3. Connect the heater hoses and install the hose retaining clips.
4. Connect the fresh air inlet boot.

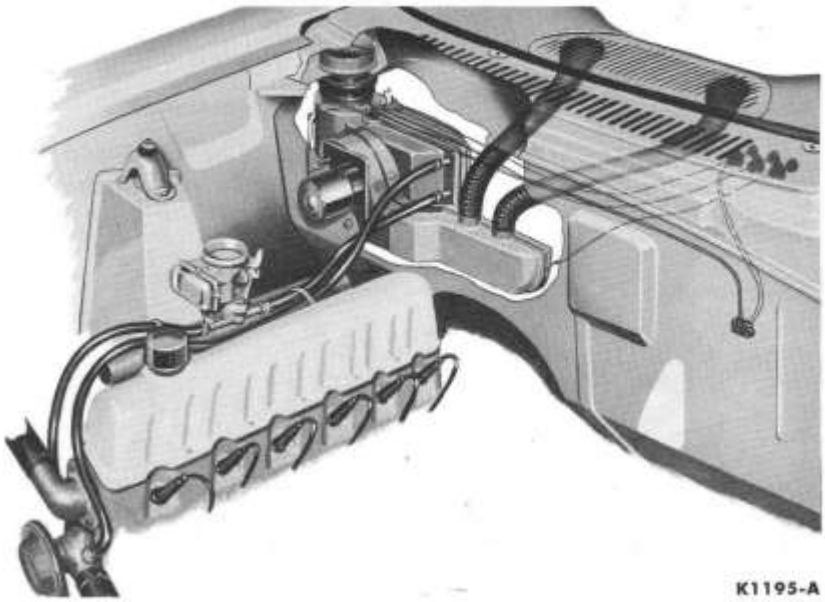

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FIG. 7—Heater System

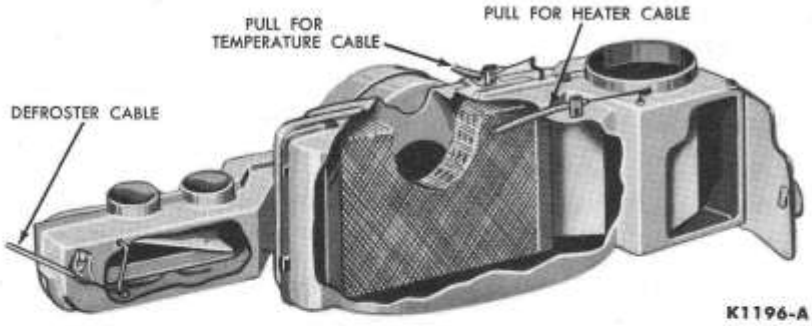

FIG. 8—Heater Control Cables

5. Connect the defroster hoses to the heater plenum.

6. Connect and adjust the defroster control cable to the heater.

7. Fill the cooling system, and check the system for leaks.

HEATER CORE OR PLENUM REPLACEMENT

1. Remove the heater assembly and lay the assembly on the car floor.

2. Remove the blower motor and bracket retaining nuts from the blower housing.

3. Disconnect the temperature control cable and fresh air control cable at the heater assembly.

4. Disconnect the heater hoses at the heater, and remove the heater assembly from the car.

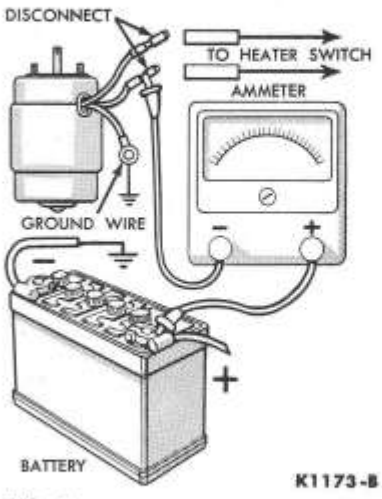

FIG. 9—Heater Motor Current Draw Test

5. Remove the clips retaining the plenum chamber halves together and separate the plenum halves.

6. Lift the heater core from the plenum chamber.

7. Position the heater core in the forward half of the plenum, assemble the plenum, and install the retaining clips.

8. Position the assembly on the car floor.

9. Install the heater motor and bracket to the blower housing.

10. Connect the heater hoses to the heater.

11. Connect and adjust the temperature and fresh air control cables at the heater.

12. Install the heater assembly.

HEATER BLOWER REPLACEMENT

1. Remove the heater assembly and lay the assembly on the car floor.

2. Remove the blower motor and bracket to the blower housing retaining screws and remove the blower assembly.

3. Loosen the blower cage set screw and remove the blower cage from the motor.

4. Remove the blower motor mounting plate from the motor.

5. Install the blower motor mounting plate to the new motor.

6. Install the blower cage and tighten the set screw.

7. Install the heater motor and bracket to the blower housing.

8. Install the heater assembly.

DEFROSTER NOZZLES REPLACEMENT

1. Remove the defroster outlet register retaining screws and remove the register.

2. Disconnect the defroster hose at the defroster nozzle.

3. Remove the defroster nozzle retaining clips and remove the nozzle.

4. Transfer the retaining clips to the new defroster nozzle.

5. Install the defroster nozzle to the instrument panel.

6. Install the defroster outlet register.

7. Connect the hoses to the defroster nozzle.

BLOWER SWITCH AND CONTROL CABLE REPLACEMENT

1. Loosen the heater switch knob set screw and remove the knob.

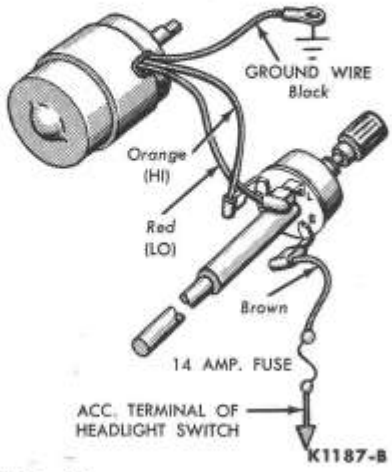

FIG. 10—Heater Motor Circuit

2. Remove the heater switch to instrument panel retaining nut and remove the switch assembly.

3. Disconnect the wires from the switch assembly.

4. Disconnect the fresh air control cable at the heater.

5. Connect the wires to the new switch assembly.

6. Install the heater switch assembly to the instrument panel with the retaining nut.

7. Position the knob to the heater switch and tighten the set screw.

8. Connect and adjust the fresh air control cable at the heater.

9. Check the switch operation.

TEMPERATURE CONTROL CABLE REPLACEMENT

1. Remove the glove box liner retaining screw and remove the liner.

2. Disconnect the temperature control cable at the heater.

3. Remove the nut retaining the control cable to the instrument panel and remove the assembly.

4. Route the temperature control cable through the instrument panel and install the retaining nut.

5. Connect and adjust the temperature control cable at the heater.

6. Install the glove box liner.

DEFROSTER CONTROL CABLE REPLACEMENT

1. Remove the defroster control cable to the heater plenum retaining screw and clip.

2. Remove the defroster cable to the instrument panel retaining nut.

3. Remove the control cable through the hole in the instrument panel.

4. Route the defroster control cable through the instrument panel hole and install the retaining nut.

5. Install and adjust the defroster cable to the heater plenum with the retaining screw and clip.

PART 12-3 AIR CONDITIONING

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2	Operation	12-19
3	Maintenance and Test Procedures	12-22
4	Unit Repairs	12-27

1 AIR CONDITIONING TROUBLE SHOOTING

The trouble shooting procedures for the air conditioner have been set up assuming that the test gauges used are accurate and that the manifold valves are in good condition.

AIR CONDITIONING TROUBLE DIAGNOSIS GUIDE

NO COOLING	**BLOWER SYSTEM** Check the following: **1.** Blower operation. Fuse, blower switch, blower motor. **REFRIGERATION SYSTEM** **1.** Compressor clutch operation	(page 12-20). **2.** Loss of refrigerant. Visually inspect fusible plug, check condenser for stone damage and sight glass for bubbles (page 12-23).
INSUFFICIENT COOLING	**1.** Insufficient refrigerant (page 12-23). **2.** Clogged condenser.	**3.** Body opening air leakage. **4.** System pressures incorrect (page 12-25).
INTERMITTENT COOLING	**BLOWER SYSTEM** **1.** Electrical circuits (page 12-20). Fuse, blower switch, blower motor. **REFRIGERATION SYSTEM** **1.** Icing evaporator (page 12-21).	**2.** Compressor clutch and thermostatic switch electrical circuit (page 12-27). **3.** System pressures incorrect (page 12-25).

2 OPERATION

AIR CONDITIONING SYSTEM

The PolarAire conditioner used on the Falcon uses a receiver, an expansion valve, an evaporator, a compressor, and a condenser. These parts are the standard units which are used in any air cooling system. Besides these major cooling components there is a liquid sight glass, an oil separator (integral with the compressor), a cooling unit thermostatic switch, and a blower assembly.

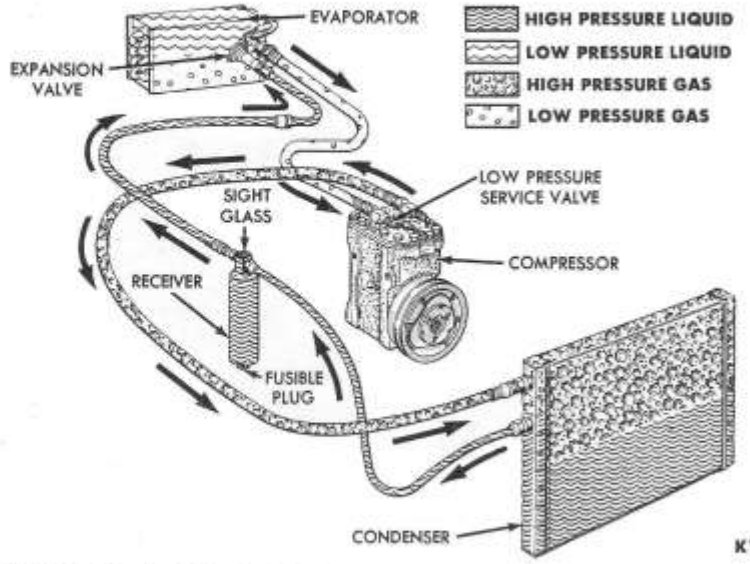

FIG. 1—Air Conditioning System

Figure 1 shows an air conditioning system in schematic form. Arrows indicate the direction of refrigerant flow. Figure 2 shows the electrical control circuit.

The cooling unit mounts under the center of the instrument panel, has several adjustable air outlets, and has controls which are integral with the unit.

RECEIVER UNIT

The air cooling system stores the liquid Refrigerant-12 under pressure in a combination receiver and dehydrator (Fig. 3). The pressure in the receiver normally varies from about 100 to 250 psi, depending on the surrounding air temperature and compressor speed.

The dehydrator serves the purpose of removing any traces of moisture that may have accumulated in the system. Even small amounts of mois-

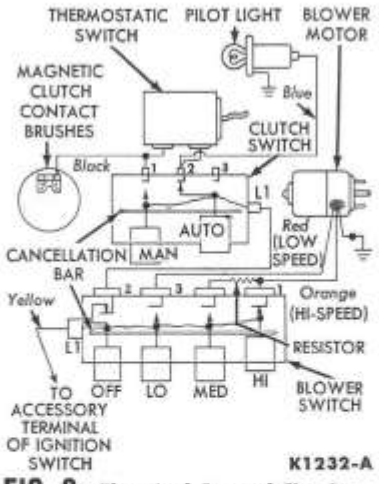

FIG. 2—Electrical Control Circuit

ture will cause an air cooling unit to malfunction. A fusible plug is screwed into the receiver (Fig. 3). This will release the refrigerant before the refrigerant temperature exceeds 231°F.

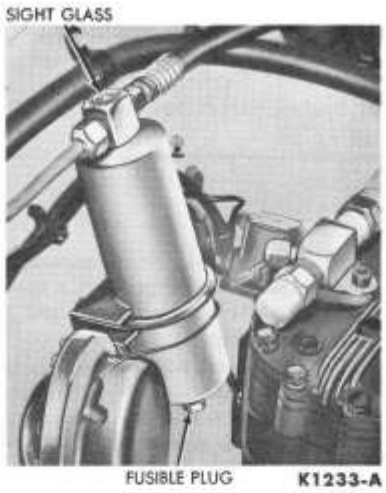

FIG. 3—Receiver Dehydrator

EVAPORATOR UNIT

When the cooling system is in operation, the liquid Refrigerant-12 flows from the combination receiver and dehydrator unit through a flexible hose to the evaporator (Fig. 4), where it is allowed to evaporate at a reduced pressure.

EXPANSION VALVE

The rate of refrigerant evaporation is controlled by an expansion valve (Fig. 5) which allows only enough refrigerant to flow into the evaporator to keep the evaporator operating efficiently, depending on its heat load.

FIG. 4—Evaporator Core

The expansion valve consists of the valve and a temperature sensing capillary tube and bulb. The bulb is clamped to the outlet pipe of the evaporator. Thus the valve is controlled by evaporator outlet temperature.

The restricting effect of the expansion valve at the evaporator causes a low pressure on the low pressure side of the system of 12-50 psi, depending on the surrounding air temperature and compressor speed.

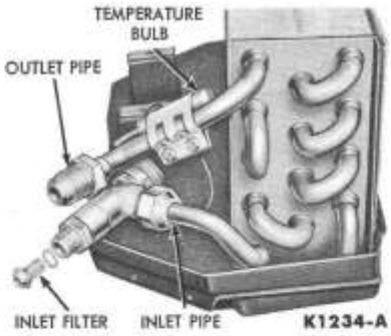

FIG. 5—Expansion Valve Connections

COMPRESSOR UNIT

The evaporated refrigerant leaving the evaporator (now in the form of a gas) at a pressure of 12-50 psi is pumped by the compressor, located on the engine (Fig. 6), into the top of the condenser, located in front of the radiator.

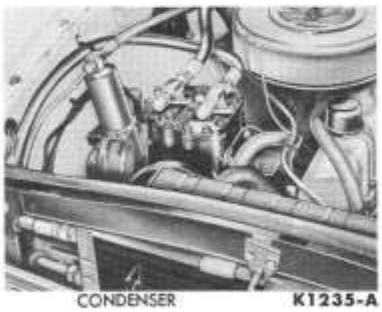

FIG. 6—Condenser

The compressor maintains a pressure on its high pressure side of from 80-300 psi, depending on the surrounding air temperature and compressor speed.

As the now heated and compressed refrigerant gas flows down through the condenser, it is cooled by air passing between the sections of the condenser. The cooled, compressed refrigerant gas condenses to liquid refrigerant which then flows into the receiver.

LIQUID SIGHT GLASS

A liquid sight glass is mounted in the high pressure refrigerant line at the receiver outlet connection (Fig. 3). The sight glass is used to check whether or not there is enough liquid refrigerant in the system.

MAGNETIC CLUTCH

It is necessary to control the amount of cooling that the system produces. To accomplish this, the compressor is electrically cut in and out of operation by the use of a magnetic clutch pulley mounted on the compressor crankshaft (Fig. 7). The magnetic clutch is controlled by a thermostatic switch which has its temperature sensing tube inserted in the fins of the evaporator core.

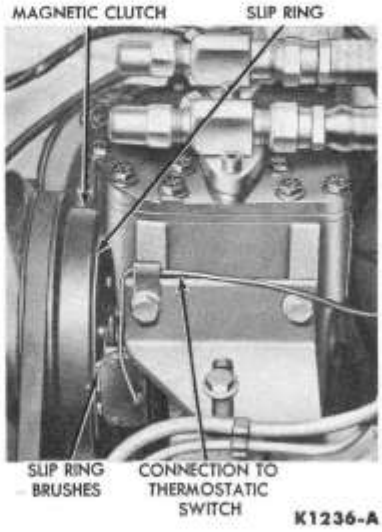

FIG. 7—Magnetic Clutch

THERMOSTATIC SWITCH

The thermostatic switch controls the operation of the compressor by controlling the compressor magnetic clutch. The temperature sensing tube of the switch is placed in contact with the evaporator fins. When the temperature of the evaporator becomes too cold, the thermostatic switch opens the magnetic clutch electrical circuit, disconnecting the compressor from the engine. When the temperature of the evaporator rises to the upper limit at which the thermostatic switch is set, the thermostatic switch closes and energizes the magnetic clutch. This connects the compressor to the engine, and cooling action begins again.

When the ignition switch is off, or the cooling control thermostatic switch (Figs. 9 and 10), is in the off position, the magnetic clutch is not energized, and the compressor can not operate.

When the ignition switch is on (engine running), and the cooling control is in the cooling range, the magnetic clutch is energized, the compressor is connected to the engine and the cooling system is in operation.

The thermostatic switch may be adjusted to maintain an average evaporator temperature of from 30°-60°F. The thermostatic switch operating differential temperature at any one setting is 6°F. The switch is controlled by the cooling control (Fig. 9).

SERVICE VALVES

The service valves on the compressor are used to test and service the cooling system (Figs. 10 and 11). The high pressure service valve, mounted at the outlet to the compressor, allows access to the high pressure side of the system for attaching a pressure gauge, or a servicing hose.

The low pressure valve, mounted at the inlet to the compressor, allows access to the low pressure side of the system for attaching a pressure gauge or a servicing hose.

Both service valves may be used to shut off the rest of the system from the compressor during compressor service.

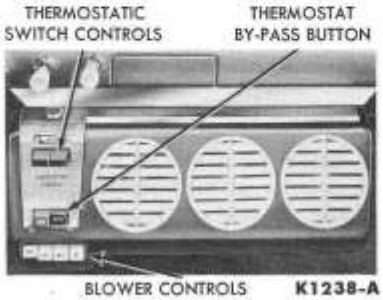

FIG. 8—PolarAire Controls

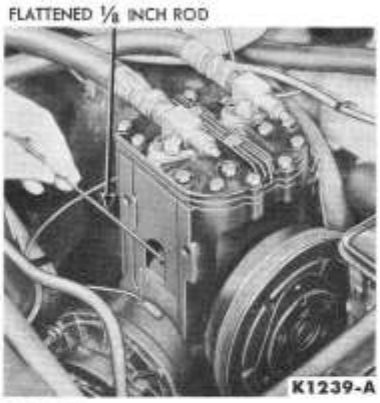

FIG. 9—Oil Level Check

CONTROL OPERATION

The operating controls for the PolarAire Conditioner are shown in Fig. 8. In addition to these controls there are adjustable air louvers at each side and at the front of the evaporator housing.

There are three sets of control buttons for the PolarAire unit (Fig. 8). The top two buttons control the thermostatic switch and thus adjust the temperature at which the evaporator is operating. Pushing the right hand button adjusts the thermostat, in successive steps, for cooler operation. Pushing the left hand button adjusts the thermostat, in successive steps, for warmer operation.

The MAN and AUTO buttons operate the compressor. AUTO indicates that the unit is set for automatic control, the temperature being dependent upon the setting of the thermostatic switch. MAN indicates that the unit is set for manual control of the temperature. The MAN button by-passes the thermostatic switch and thus the compressor runs continuously when this button is pressed.

The OFF button in the bottom row turns the air conditioner off. The three buttons on the right control the blower motor for low, medium, and high speed.

Icing Evaporator. In high humidity areas, continual use of the MAN button will cause the evaporator to ice up and thus cut off the air flow through the evaporator.

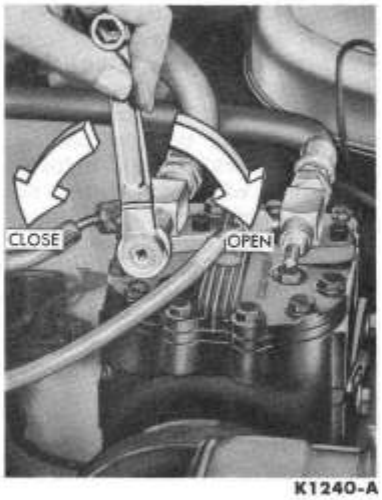

FIG. 10—Low Pressure Service Valve Gauge Port

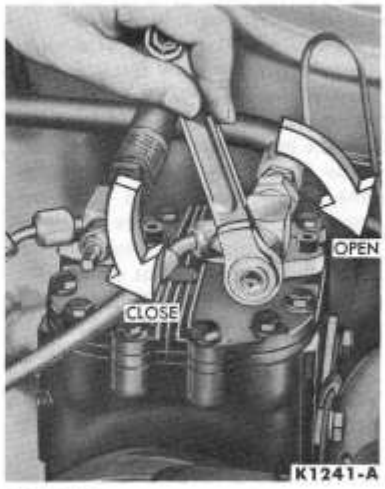

FIG. 11—High Pressure Service Valve Gauge Port

3 MAINTENANCE AND TEST PROCEDURES

SAFETY PRECAUTIONS

The refrigerant used in the air conditioner system is Refrigerant-12. Refrigerant-12 is nonexplosive, noninflammable, noncorrosive, has practically no odor, and is heavier than air. Although it is classified a safe refrigerant, certain precautions must be observed to protect the parts involved and the person who is working on the unit.

Use only Refrigerant-12 in the SelectAire and PolarAire Conditioners.

Liquid Refrigerant-12, at normal atmospheric pressures and temperatures, evaporates so quickly that it tends to freeze anything that it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from coming in contact with the skin and especially the eyes.

Refrigerant-12 is readily absorbed by most types of oil. It is therefore recommended that a bottle of sterile mineral oil and a quantity of weak boric acid solution be kept nearby when servicing the air conditioning system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out, then wash the eyes clean with the weak boric acid solution. Seek a doctor's aid immediately even though irritation may have ceased.

Always wear safety goggles when servicing any part of the refrigerating system.

The Refrigerant-12 in the system is always under pressure. Because the system is tightly sealed, heat applied to any part would cause this pressure to build up excessively.

To avoid a dangerous explosion, never weld, use a blow torch, solder, steam clean, bake body finishes, or use any excessive amount of heat on, or in the immediate area of, any part of the air cooling system or refrigerant supply tank, while they are closed to the atmosphere whether filled with refrigerant or not.

The liquid refrigerant evaporates so rapidly that the resulting refrigerant gas will displace the air surrounding the area where the refrigerant is released. To prevent possible suffocation in enclosed areas, always discharge the refrigerant from an air cooling system into the garage exhaust collector. Always maintain good ventilation surrounding the work area. **If the car is to be undercoated, make certain that the undercoating does not plug the evaporator drain tubes.**

Although Refrigerant-12 gas, under normal conditions, is non poisonous, the discharge of refrigerant gas near an open flame can produce a very poisonous gas. This gas will also attack all bright metal surfaces. This poisonous gas is generated in small quantities when the flame-type leak detector is used. Avoid inhaling the fumes from the leak detector. **Make certain that Refrigerant-12 is both stored and installed in accordance with all state and local ordinances.**

When admitting Refrigerant-12 gas into the cooling unit, always keep the tank in an upright position. If the tank is on its side or upside down, liquid Refrigerant-12 will enter the system and damage the compressor. **In surrounding air temperatures above 90°F., prolonged engine idle will result in excessively high compressor pressures.**

MAINTENANCE AND ADJUSTMENTS

MAINTENANCE

The amount of Refrigerant-12 in an air cooling system is important if maximum efficiency of the system is to be obtained. Check the Refrigerant-12 at the beginning of each operating season.

A check of the refrigerant may be made by observing the liquid sight glass (Fig. 3). Observe the refrigerant flow for a minute with the engine running at 1500 rpm, and the cooling control at the maximum cooling position. If no foam appears in the liquid behind the glass, it may be assumed that there is enough refrigerant in the system, providing that the cooling system is in working order. If foam does appear, add Refrigerant-12 to the system until the bubbles disappear, then add an additional ¼ pound of refrigerant.

During the winter months, it is advisable to operate the air conditioning unit for a few minutes once or twice a month in order to maintain oil on the shaft seal. If the seal becomes dry the refrigerant may leak out.

Compressor oil level check. Under normal conditions, when the air cooling system is operating satisfactorily, the compressor oil level need not be checked. There is no place for the oil to go except inside the sealed system. When the car is first started, some of the oil will be pumped into the rest of the system. After 15 minutes of operation, most of the oil is returned to the compressor crankcase.

Check the compressor oil level only if a portion of the refrigerant system is being replaced, or if there was a leak in the system and the refrigerant is being replaced.

Check the oil after the system has been charged and has been operating at an engine speed of 1500 rpm for 15 minutes in 60°F. surrounding air temperatures or above. Turn off the engine, and isolate the compressor (page 12-28). Remove the oil filler plug from the compressor (Fig. 9), insert a flattened ⅛-inch diameter rod in the oil filler hole until it bottoms. The rod should show ¾ inch of oil. This is equivalent to 9 ounces of oil. It may be necessary to rotate the compressor crankshaft slightly (by hand) so that the dip rod will clear the crankshaft. If additional oil is needed in the compressor, add Suniso 5-G, or Capella D refrigerator compressor oil, or equivalent.

If more than ¾ inch of oil is indicated, as might happen if a new compressor is installed and oil already in the system is pumped back to the compressor, draw out the excess oil until the proper quantity is indicated.

Replace the oil filler plug, then evacuate and connect the compressor back into the system. Be sure to check the compressor filler opening for leaks.

COMPRESSOR BELT ADJUSTMENT

Adjust the belt tension until a ½ inch deflection is obtained midway between the compressor and water pump pulley.

TEST PROCEDURES

To perform the test procedures, a test manifold and gauge set with connecting hoses, a refrigeration ratchet wrench, a supply of Refrigerant-12 (50 pound tank or 1 pound cans) a suitable scale for weighing the Refrigerant-12 if a tank is used, a leak detector, a thermometer, a plug and cap set, and safety goggles are required.

Before making any tests or working on the air conditioning system, be sure to read the safety precautions given.

USE OF SIGHT GLASS

When observing the sight glass for foam, run the engine at 1500 rpm with the thermostatic switch temperature control set for maximum cooling, and the blower on high.

Foam in the sight glass indicates an undercharge of refrigerant. Check the system for leaks, repair if necessary and charge the system with the proper amount of Refrigerant-12.

MANIFOLD GAUGE SET INSTALLATION

Remove the service valve stem covers and make sure that both service valves are at the maximum counterclockwise position (Figs. 10 and 11). Remove the service valve gauge port covers, and attach the flexible hoses to the gauge ports, to a vacuum pump and to a tank of Refrigerant-12 (Fig. 12). Turn both manifold gauge valves to the maximum clockwise position (Fig. 13) and close the vacuum pump valve. **The manifold valves are so arranged that when they are in the maximum clockwise or closed position, the center manifold connection is shut off from the gauges, but the gauges continue to read the pressures in their respective hoses.**

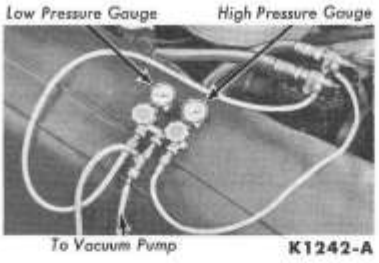

FIG. 12—Manifold Gauge Attached to System

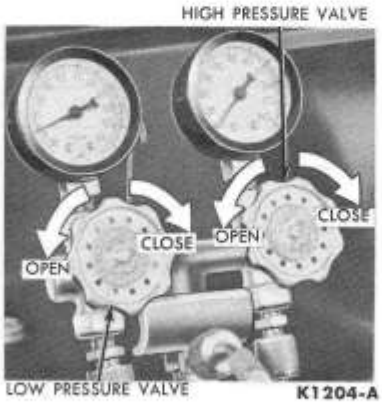

FIG. 13—Manifold Valves

CHECKING FOR LEAKS

Attach the manifold gauge set (Fig. 12). Leave both manifold gauge valves at the maximum clockwise position (Fig. 13). Set both service valves at the center position. Both gauges should now show approximately 60 to 80 pounds pressure at 75°F. If very little or no pressure is indicated, leave the vacuum pump valve closed, open the Refrigerant-12 tank valve, and set the low pressure manifold gauge valve to the counterclockwise position. This opens the system to tank pressure. Check all connections and the compressor shaft seal for leaks, using a flame type leak detector (Fig. 14). Follow the directions with the leak detector. The smaller the flame the more sensitive it is to leaks. Therefore, to insure accurate leak indication keep the flame as small as possible. The copper element must be red hot. If it is burned away, replace the element. Hold the open end of the hose at each suspected leak point for two or three seconds. The flame will normally be almost colorless. The slightest leak will be indicated by a bright colored flame. Be sure to check the manifold gauge set and hoses for leaks as well as the rest of the system.

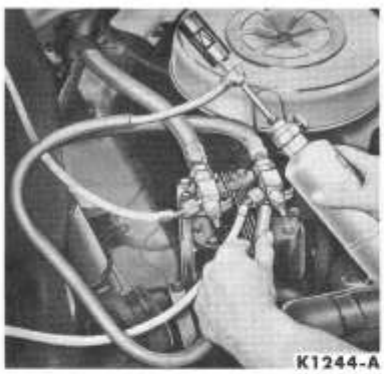

FIG. 14—Using Leak Detector

If the surrounding air is permeated with refrigerant gas, the leak detector will indicate this gas all the time. Good ventilation is necessary to prevent this situation. A fan, even in a well ventilated area, is very helpful in removing small traces of refrigerant vapor.

DISCHARGING THE SYSTEM

Discharge the refrigerant from the system before replacing any part of the system, except the compressor.

To discharge the system, connect the manifold gauge set to the system (Fig. 12). Do not connect the manifold center connection hoses to the Refrigerant-12 tank, or vacuum pump. Place the open end of these hoses in a garage exhaust outlet. Set the high pressure manifold gauge valve at the maximum counterclockwise or open position. Open the high pressure service valve a slight amount (Fig. 11), and allow the refrigerant to discharge slowly from the system.

Do not allow the refrigerant to rush out, as the oil in the compressor will be forced out along with it.

CHARGING THE SYSTEM

The procedure for charging depends on whether a partial charge or a complete charge is being made. When a complete charge is to be made, check for leaks first, then release the pressure and evacuate the system.

EVACUATING THE SYSTEM

Attach the manifold gauge set, a tank of Refrigerant-12 and a vacuum pump to the system (Fig. 12). Make certain that the Refrigerant-12 tank valve is tightly closed. Set both service valves to the mid-position. Open both manifold valves (Fig. 13). Release any pressure in the system. Open the vacuum pump valve and run the pump until the low pressure gauge reads at least 25 inches, and as close to 30 inches of vacuum as possible. Continue vacuum pump operation for 20 to 30 minutes to boil any moisture out of the system. Close the pump valve. Turn off the pump.

MAKING A PARTIAL CHARGE

Attach the manifold gauge set (Fig. 12). Open both manifold valves (Fig. 13). Close the vacuum pump valve. Open the Refrigerant-12 tank valve. Purge the air from the high pressure hose by loosening the high pressure hose at the service valve, for a few seconds. Tighten the connections and set the high pressure manifold gauge valve at the maximum clockwise position. Loosen the low pressure gauge hose slightly at the low pressure service valve, for a few seconds, to purge the air from the hose. Tighten the connection. Set both service valves at the center position.

Run the engine at 1500 rpm with all controls at the maximum cold position. Charge the system until all foam disappears from the sight glass, and then add ¼ pound of Refrigerant-12. Shut the Refrigerant-12 tank valve.

It may be necessary to place the Refrigerant-12 tank in a container of hot water at about 150°F. to force the gas from the tank during charging.

Never heat the Refrigerant-12 tank with a torch. A dangerous explosion may result.

Set both service valves at the maximum counterclockwise position (Figs. 10 and 11). Remove the gauge set, and cap the service valve gauge ports and valve stems.

MAKING A COMPLETE CHARGE

Check for leaks first, release the pressure, then evacuate the system. Leave both service valves at the mid-position and the vacuum pump valve closed. Leave the low pressure manifold gauge valve at the maximum counterclockwise or open position (Fig. 13). Set the high pressure manifold gauge valve at the maximum clockwise or closed position (Fig. 13). Set all controls to the maximum cold position.

Open the Refrigerant-12 tank valve. Run the engine at 1500 rpm. Charge the system until the sight glass is clear of foam, then add an additional ¼ pound of refrigerant.

During the charging, the high pressure may build up to an excessive value. This can be caused by an overcharge of refrigerant, or an overheated engine, in combination with high surrounding temperatures. Never allow the high pressure to exceed 240 pounds while charging. Stop the engine, determine the cause, and correct it.

After the proper charge has been made, close the Refrigerant-12 tank valve, and check the system pressures for proper operation. Set both service valves at the maximum counterclockwise position (Figs. 10 and 11). Remove the gauge set, and cap the service valve gauge ports and valve stems.

Charging From Small Containers. Refrigerant-12 is available in one-pound cans. A scale is not necessary if these small containers are used instead of a tank.

Attach the hose, that would normally attach to the large tank (Fig. 21), to the special valve that is provided for the small cans. Close the valve (maximum clockwise position) and follow the procedure for leak testing, evacuating and charging the system as previously given.

For charging, attach a one-pound can of Refrigerant-12 to the special valve, and open the valve. Keep the can in an upright position. When the can is empty (no frost showing), close the valve, remove the empty can, attach a new one, and open the valve again.

Charge the system until the sight glass clears of foam then add an additional ¼ pound of refrigerant. Estimate the ¼ pound weight by observing the frost line on the 1 pound can.

Check the system pressures, set both service valves at the maximum counterclockwise position. Remove the gauge set, and cap the service valve gauge ports and valve stems.

CHECKING SYSTEM PRESSURES

The pressures developed on the high pressure and low pressure side of the compressor indicate whether or not the system is operating properly.

Before checking the pressures in the system make certain that the gauges being used are accurate, by making a gauge test (page 12-25).

Attach the manifold gauge set (Fig. 12). It will not be necessary to attach the Refrigerant-12 tank unless refrigerant is to be added to the system. Set both manifold gauge valves at the maximum clockwise, or closed, position (Fig. 13). Set both service valves at the center position.

Check the system pressures with the engine running at 1500 rpm, all controls set for maximum cooling and the front of the car at least 5 feet from any wall.

The low pressure gauge should indicate a pressure of from 12-50 pounds. The high pressure gauge should indicate a pressure 6 or 7

TABLE 1—Refrigerant-12 Temperature-Pressure Relationships

Gas Temperature (° F.)	Gas Pressure (psi)	Gas Temperature (° F.)	Gas Pressure (psi)
−10	4.5		
− 5	6.8	70	70.1
0	9.2	75	76.9
5	11.9	80	84.1
10	14.7	85	91.7
15	17.7	90	99.6
20	21.1	95	108.1
25	24.6	100	116.9
30	28.5	105	126.2
35	32.6	110	136.0
40	37.0	115	146.5
45	41.7	120	157.1
50	46.7	125	168.4
55	52.0	130	180.2
60	57.7	135	192.5
65	63.7	140	205.5

times the low pressure or 80-300 pounds.

The actual pressures indicated on the gauges will depend on the temperature of the surrounding air and the humidity. Higher air temperatures along with low humidity, will give higher system pressures.

At idle speed and a surrounding air temperature of 100°-110° F, the high pressure may go as high as 300 pounds or more.

If it becomes necessary to operate the air conditioner under these conditions, keep the high pressure down with a fan directed at the condenser and radiator.

Table 1 shows the temperature pressure relationships for Refrigerant-12. These are the pressures that would occur at the temperatures indicated when the system is not in operation. The temperature is the actual internal temperature of the refrigerant gas.

When the system is in operation, the internal pressures vary from point to point even though the two points in question may be close together and both on the high or low pressure side of the system. Under operating conditions it is very difficult to accurately measure the internal refrigerant gas temperature. Because of these facts, Table 1 should be used with caution.

CHECKING MANIFOLD GAUGE ACCURACY

The data given in Table 1 may be used to check the accuracy of the manifold gauges. The gauges should read zero when they are open to atmospheric pressure, and should read the gas pressure corresponding to the temperature of a Refrigerant-12 container, when connected to the container.

Make certain that the temperature used is the actual temperature of the Refrigerant-12 container. If the container has been sitting overnight in a room and the room temperature has been constant during this time, the temperature of the room may be used to determine the pressure.

INTERPRETING ABNORMAL SYSTEM PRESSURES

Low Pressure Below Normal, High Pressure Normal. These pressures indicate a restriction between the receiver and the expansion valve or between the expansion valve and the low pressure service valve. If the low pressure is actually a vacuum, the expansion valve is probably closed tightly. Shut the system down and allow it to warm to room temperature. Start the engine and if the evaporator will now become cool, the expansion valve was frozen because of moisture in the system. Release the refrigerant, replace the dryer-receiver assembly, check for leaks, then evacuate and charge the system.

Whenever the system has been opened three times, the dryer-receiver should be replaced as a precaution against internal icing of the expansion valve.

Check the system between the receiver outlet and the low pressure service valve for restrictions, by feeling all of the connections and components. Any portion that is cold to the touch or that frosts up, with the pressures as indicated here, is restricting the refrigerant flow.

Low Pressure Above Normal, High Pressure Normal. Observe both pressure gauges. If the low pressure is above normal (12-50 pounds), and the high pressure is at or near normal (80-300 pounds), the expansion valve is not operating properly. This condition may cause the compressor to receive slugs of liquid and thus to be very noisy. Also, the suction side of the compressor and the crankcase and head will be colder than normal and will "frost up."

The expansion valve will allow too much liquid refrigerant to flow to the compressor if it is defective or, if the temperature sensing element is not making close contact with the evaporator outlet pipe. Make sure that the sensing element is securely clamped to the outlet pipe, and properly covered.

High Pressure Below Normal, Low Pressure Above Normal. If the two pressures are equal or within 30 pounds of each other, the compressor may be defective. Perform a compressor volumetric efficiency test. Re-

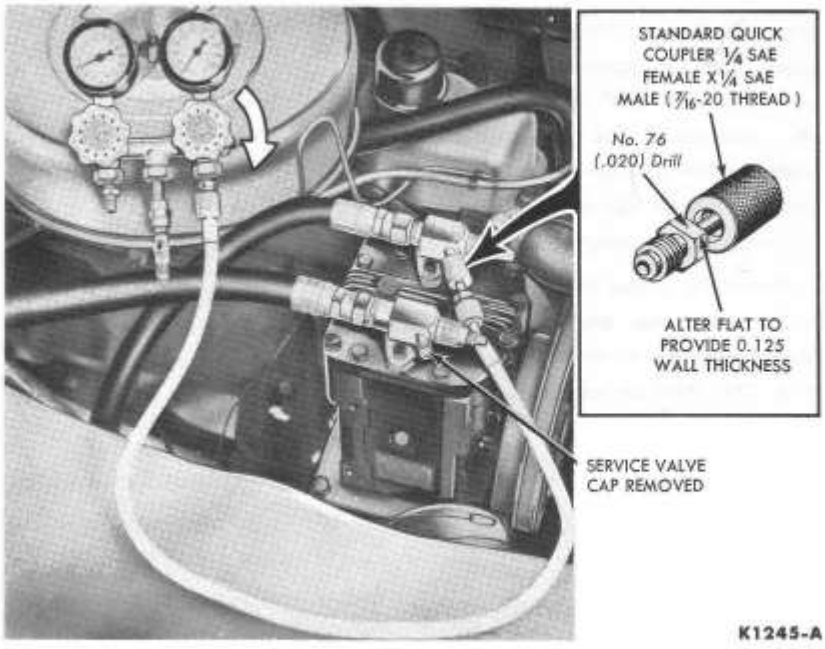

FIG. 15—Volumetric Efficiency Test

pair or replace the compressor as needed.

High Pressure Above Normal. High compressor head pressures are caused by an overcharge of refrigerant, condenser air passages clogged, a restriction between the condenser inlet and the receiver, or high surrounding air temperatures. High head pressures are generally evidenced by a noisy compressor. Discharge excess refrigerant until foam is seen in the sight glass (system operating at 1500 engine rpm), then add refrigerant until the sight glass clears of foam and add an additional ¼ pound of refrigerant.

COMPRESSOR VOLUMETRIC EFFICIENCY TEST

Malfunction of the compressor can be isolated by checking the compressor volumetric efficiency with a special tool. Make the test with the car in a clean dry atmosphere.

Run the engine at 1500 rpm with all controls at maximum cooling for at least 10 minutes. Adjust the engine idle with a tachometer to exactly 515 rpm with the compressor clutch engaged. Turn the engine off and operate the control OFF button. Isolate the compressor, then remove both high and low pressure service valve gauge port caps, allowing the gas in the compressor to escape.

Attach the special tool (calibrated orifice with gauge attached) to the high pressure service valve gauge port (Fig. 15). Start the engine. Engage the magnetic clutch for 15 second intervals, by operating a blower button and the OFF button and observe the maximum gauge pressure at the end of each 15 second interval. **Be sure to allow the gauge pressure to drop to zero between the 15 second intervals.** Stop the engine.

A good compressor will bring the pressure to 200 psi in 15 seconds. If the pressure does not come up to 200 psi, in 15 seconds, clean the compressor intake screen. If the intake screen is clean, remove and inspect the valve plate. Most of the failures to come up to the 200 psi specification will be caused by small foreign particles under the valve plate leaves or a defective valve plate. Clean the valve plate and assemble it to the compressor using new gaskets. If this does not effect a cure, replace the valve plate or the compressor as required.

If no further work is to be done on the system after making the volumetric efficiency test, disconnect the orifice tool and gauge, evacuate the compressor and connect it back into the system.

CHECKING SYSTEM TEMPERATURES

A good indication may be had of overall cooling system operation by measuring the outlet air temperature.

Set all controls for maximum cooling. Place the stem of the thermometer through the right outlet air vent. Run the engine at 1500 rpm.

The thermometer should indicate a temperature of approximately 40°-50°F. at high blower and maximum cooling with the system cycling.

EXPANSION VALVE TEST

Remove the expansion valve from the evaporator. Connect the Refrigerant-12 supply hose to the expansion valve inlet with a suitable adapter. Open the refrigerant supply valve slightly. Refrigerant gas should come out of the expansion valve outlet. If no gas comes out of the outlet, the temperature sensing element has lost its charge and the expansion valve must be replaced.

THERMOSTATIC SWITCH TEST

The switch must be removed for this test. Set the switch cam at the coldest temperature setting (maximum counterclockwise position). Place the sensing tube in a container filled with finely crushed ice and pure water (32°F.). **Use a thermometer to make certain that the water is at 32° F.** If the switch clicks, it is defective and should be replaced. If the switch does not click, leave the sensing tube in the ice and turn the cam counterclockwise until a click is heard. The cam should move through an angle of approximately 30°, from the cold setting stop, which represents the 32° F. setting, or the temperature of the melting ice.

With the sensing tube still in the ice, turn the cam back to the cold temperature setting. If the switch clicks, it is defective and should be replaced. If the switch does not click, remove the unit from the ice and expose the sensing tube to the air (approximately 75°F.). The switch should click almost immediately after removal from the ice. If it takes longer than 5 or 6 seconds for the switch to click, it is defective and should be replaced. Air temperatures more or less than 75°F. will cause the switch to click sooner or later respectively. A known good thermostatic switch can be used as a comparison.

ELECTRICAL UNIT CURRENT DRAW

The current drawn by various electrical units of the air conditioner at a voltage of 12 volts, is as follows:

Blower	Hi	7.5 amperes
	Med	4.5 amperes
	Low	3.0 amperes
Magnetic Clutch		1.8 amperes

4 UNIT REPAIRS

Possible malfunction of the various units that comprise the air conditioning system is determined by trouble shooting and test procedures presented in previous sections. With the exception of the compressor, replacement rather than repair of the individual unit is always recommended. In the case of the compressor, replacement kits for certain components are available. When the use of such kits does not eliminate the trouble, the compressor must be replaced. This section presents detailed removal and installation procedures for each unit and for the compressor replacement kits.

Replacement of the blower and motor assembly, the compressor, or the thermostatic switch can be effected without losing the refrigerant.

Replacement of all other units or lines in the system requires complete discharge of the refrigerant before removal, and recharge after installation.

When any part of the refrigerant circuit is broken for service operation, install a new metal gasket in any fitting when the fitting mating surfaces are scored. Use of an old gasket or no gasket, when the mating surfaces are scored, may cause refrigerant leakage.

HEATER, EVAPORATOR AND RELATED PARTS

BLOWER AND MOTOR REPLACEMENT

1. Demount the evaporator. It is not necessary to disconnect the refrigerant lines.

2. Remove the fan protection screen and loosen and remove the fan blades.

3. Remove the front cover panel, and disconnect the motor wires from the blower switch.

4. Remove the motor mounting screws and clamp, and remove the motor (Fig. 16).

5. Place the new motor in position, position the mounting clamp, position the motor ground lug under one of the screws, and attach the mounting screws.

6. Route and attach the motor wire to the blower switch. Then install the front cover panel.

7. Install the fan blades on the motor shaft, and check for fan blade clearance. Install the fan protection screen, and mount the evaporator unit.

THERMOSTATIC SWITCH REPLACEMENT

1. Remove the four front panel to evaporator housing mounting screws. Pull the front panel away from the housing and pull the thermostatic switch temperature sensing tube from between the evaporator fins.

2. Remove the control button trim plate mounting nut and remove the trim plate emblem and trim plate.

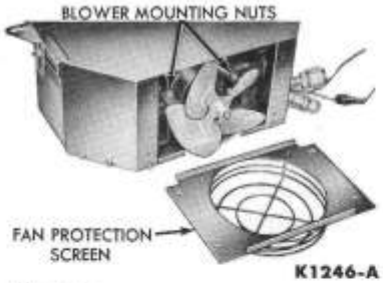

FIG. 16—Blower Motor Mounting

3. Disconnect the wires from the thermostatic switch, remove the two actuator assembly mounting bolts, and remove the switch and actuator assembly.

4. Remove the two switch mounting screws and remove the switch.

5. When installing the new switch to the actuator assembly, engage the switch shaft with the actuator, then attach the switch mounting screws. Attach the wires to the thermostatic switch (Fig. 17).

6. Push the end of the temperature sensing tube between the evaporator fins. Make certain that the temperature sensing tube goes all the way through the evaporator and makes good contact with the fins.

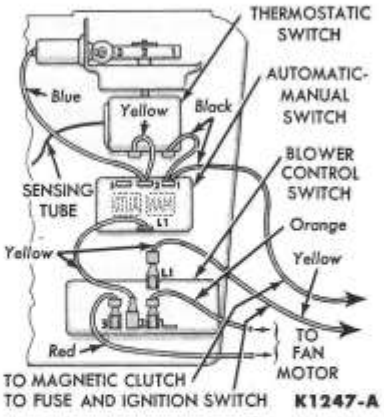

FIG. 17—Thermostatic Switch Wiring

7. Install the control button trim plate and install the front cover.

EXPANSION VALVE REPLACEMENT

1. Discharge the refrigerant from the system. Disconnect the two wires from the unit, demount the evaporator assembly, and set the unit on the car floor.

2. Remove the front cover mounting screws and lay the cover and controls along side of the unit. Remove the back cover and the fan protection screen. Remove the main cover mounting screws and slide the cover up and off of the assembly.

3. Carefully slit the insulation covering the temperature bulb and remove the temperature bulb clamp. Then disconnect the valve from the inlet pipe and remove the valve.

4. Connect the new valve to the inlet pipe, and leak-test the connection. Position the temperature bulb to the outlet pipe, and install the bulb clamp. Be sure that the bulb, pipe, and clamp are clean and that the clamp is tight.

5. Wrap the insulating material around the temperature bulb, pipe,

and valve, and position the rubber seal over the pipe connections.

6. Slide the cover down over the evaporator and install the cover mounting screws. Mount the front cover, making sure that the temperature sensing tube is making good contact with the evaporator fins. Install the back cover and fan protection screen.

7. Remove the inlet filter from the old expansion valve and install it in the new valve. Set the assembly on the car floor, and attach the refrigerant hoses.

8. Check for leaks, mount the evaporator assembly, and evacuate and charge the system.

EVAPORATOR REPLACEMENT

The evaporator assembly must be removed from the vehicle before removing the evaporator core from the housing.

1. Discharge the refrigerant from the system.

2. Disconnect the two wires from the unit, demount the evaporator assembly and set the unit on the car floor.

3. Disconnect the refrigerant hoses and remove the unit from the car.

4. Remove the front panel, covers and the expansion valve from the unit.

5. Remove the thermostatic switch temperature sensing tube from between the evaporator fins, remove the evaporator-to-base mounting screws and remove the screen and evaporator from the base.

6. Attach the old expansion valve to the new evaporator and leak-test the connection.

7. Position the evaporator and screen on the base (Fig. 4) and install the two evaporator-to-base mounting screws.

8. Push the thermostatic switch sensing tube through the screen and evaporator at about the center of the evaporator, then install the covers and front panel.

9. Set the assembly on the car floor, attach the refrigerant lines and leak test the connections.

10. Mount the assembly, connect the two wires, evacuate and charge the system.

CONDENSER REPLACEMENT

1. Discharge the refrigerant from the system.

2. Remove the front grille to radiator support bracket, and the hood latch.

3. Disconnect the two refrigerant lines from the condenser. Remove the condenser mounting screws and remove the condenser.

4. Position and mount the new condenser, attach the refrigerant hoses (Fig. 6), and install the grille to radiator support bracket and hood latch.

5. Check for leaks, evacuate and charge the system.

RECEIVER REPLACEMENT

Discharge the refrigerant, disconnect the two fittings at the receiver, remove the mounting clamp and remove the receiver assembly. Position the receiver to the mounting bracket and install the mounting clamp finger tight. Connect the copper tube and hose at the top of the receiver, then tighten the receiver mounting clamp. Test for leaks, evacuate and charge the system.

COMPRESSOR SERVICE

The compressor is not completely disassembled for service. All necessary repairs can be made by replacement of certain parts which are available in service kits. If none of the service kits restore normal operation, replace the compressor assembly.

Service kits for the valve plates and the suction and discharge fittings can be installed without removing the compressor from the car. Procedures for installing such kits precede compressor replacement.

All compressor service operations, except belt replacement, can be performed only after the unit has been isolated from the rest of the system as described below.

ISOLATING THE COMPRESSOR

To isolate the compressor from the system, turn both the high and the low pressure service valves to the extreme clockwise position (Figs. 10 and 11). Loosen the cap on the high pressure service valve gauge port, and allow the gas to escape until the compressor is relieved of refrigerant pressure.

Loosen the cap a small amount only, and do not remove it until the pressure is completely relieved.

To connect the compressor back into the system, evacuate the compressor at the high pressure service valve gauge port, close the vacuum pump valve, turn both service valves to the maximum counterclockwise

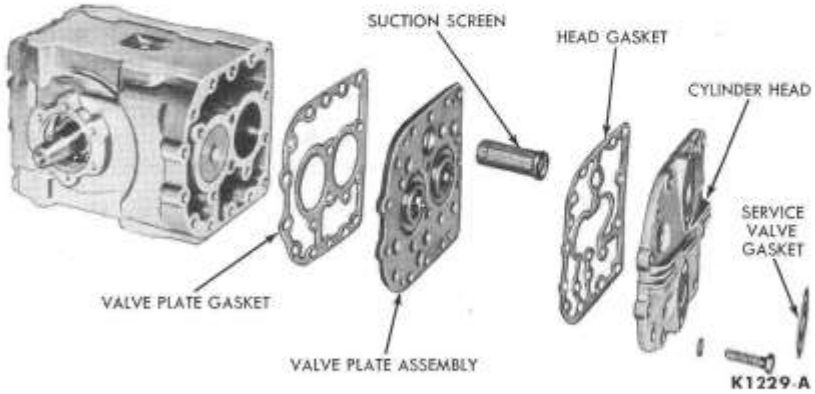

FIG. 18—Cylinder Head and Valve Assembly

position, and cap the high pressure service valve gauge port and service valve stems.

VALVE PLATE REPLACEMENT

Isolate the compressor, disconnect the service valves, and remove the compressor. Remove the head bolts.

Tap the cylinder head and valve plate lightly to loosen them, and remove these parts from the top of the compressor body (Fig. 18).

Remove and discard all gaskets, and be sure to clean gasket shreds from all gasket surfaces. Examine the cylinders and top of the pistons, particularly in case of valve breakage. If there are score marks, replace the compressor assembly.

If the cylinders and pistons are in good condition, check the valve plate and valve leaves for damage. If the valve plate assembly is in good condition, it can be used again. If the valve plate is damaged, install the entire replacement kit which includes the valve plate, valve leaves, and the two gaskets (Fig. 18).

When the valve plate assembly is reused, wash it in clean solvent and dry in dry air. Check the oil for dirt. If the system is not clean, replace the oil.

Starting with the valve plate gasket, assemble the parts in the order shown in Fig. 18. Insert the cylinder head bolts carefully to avoid damaging the gaskets.

Tighten all bolts finger tight, then torque the bolts a quarter turn at a time to 12-16 ft-lbs.

Connect the compressor into the system. Check the oil level in the compressor (page 12-22) and add or remove oil if necessary.

SERVICE VALVE REPLACEMENT

Discharge the refrigerant from the system. Remove the refrigerant hoses from the valves. Remove the attaching screws, fittings and gaskets.

Install the necessary replacement parts as shown in Figs. 18 and 20. If the suction screen in the low pressure service valve fitting is not being replaced, clean it before installing it. Tighten the service valve bolts to 10-12 ft-lbs.

COMPRESSOR REPLACEMENT

Isolate the compressor and disconnect the two service valves and hoses from the compressor. Energize the clutch and loosen and remove the clutch mounting bolt. Install a 5/8-11 bolt in the clutch drive shaft hole. With the clutch still energized, tighten the bolt to loosen the clutch from the shaft. Disconnect the clutch wire at the bullet connector. Loosen the compressor mounting bolts and the belt tension adjusting bolt (Fig. 20). Slide the compressor toward the center of the engine, remove the drive belt and the clutch, and then remove the mounting bolts and the compressor. With the compressor on the work bench, remove the key from the shaft.

Carefully remove any burrs or dirt that may be on the new compressor shaft. The shaft must be dry and brightly polished. Then install the key in the shaft. Mount the clutch on the shaft and install the mounting screw and washer, finger tight. Place the compressor on the mounting bracket and install the four mounting bolts finger tight. Connect the clutch wire, energize the clutch and torque the clutch mounting bolt to 18-22 ft-lbs. **If the new compressor was shipped with a bolt and washer in the end of the crankshaft, remove and discard the bolt and use a bolt with a nylon insert in it.** Install and adjust the drive belt, and tighten the mounting bolts.

Install the service valves on the compressor (Fig. 20), using new gaskets. Tighten the service valve bolts to 10-12 ft-lbs. Leak test the compressor, then evacuate it and connect it back into the system.

Check the oil level in the compressor and add or remove oil if necessary.

CRANKSHAFT SEAL REPLACEMENT

1. Energize the clutch and loosen and remove the clutch mounting bolt.

2. Install a 5/8-11 bolt in the clutch drive shaft hole. With the clutch still energized, tighten the bolt to loosen the clutch from the shaft.

3. Remove the magnetic clutch, belt, and the slip ring brush assembly.

4. Remove the remaining seal plate bolts, and remove the plate and gasket.

5. Remove the carbon seal ring and seal housing assembly from the crankshaft. A disassembled view of the crankshaft seal assembly is shown in Fig. 19.

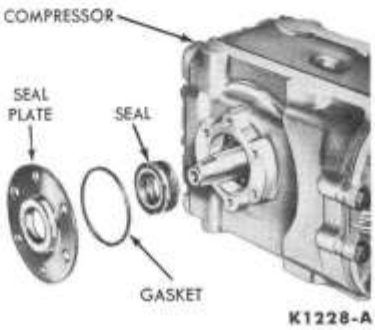

FIG. 19—Crankshaft Seal Replacement

6. Clean all old gasket material from the seal plate and the compressor. Make certain that the shaft, seal plate and compressor gasket surfaces are completely clean before installing the new seal.

FIG. 20—Belt Replacement

7. Lubricate the new shaft seal parts in clean compressor oil, and position the seal assembly on the crankshaft.

8. Position the new gasket on the compressor and install the seal plate, attaching the slip ring brush assembly with two of the seal plate bolts.

9. Torque the bolts to 6-9 ft-lbs, and connect the clutch wire.

10. Make certain that there are no burrs or dirt on the compressor shaft. Then install the key, belt, and clutch.

11. Install the clutch mounting bolt and washer. Energize the clutch, and torque the bolt to 18-22 ft-lbs.

12. Adjust the belt tension.

BELT REPLACEMENT

1. Loosen the five compressor mounting bolts, and the belt tension adjusting bolt (Fig. 20).

2. Slide the compressor toward the center of the car and remove the belt.

3. Place the new belt in position, slide the compressor toward the outside of the car, tighten the belt tension bolt (Fig. 20), and tighten the five mounting bolts.

4. Adjust the belt for ½-inch deflection.

1961 FORD FALCON SHOP MANUAL

GROUP 13

BODY

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PART 13-1 DOORS, DECK LID, AND TAILGATE

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1 DOORS

REPLACEMENT

A replacement door is furnished as a sheet metal shell in prime paint. It has no hinges, trim, glass, runs, or hardware. When a door is replaced, make any needed minor repairs to the new shell, drill holes necessary for mouldings, paint the door, and transfer the usable parts.

If only a door outer panel is seriously damaged, the whole door need not be replaced. A replacement outer panel is available, and the replacement procedure is included in Part 13-3.

ALIGNMENT

Front door hinge-to-pillar bolts are accessible after removal of the cowl side trim panel. Rear door hinge-to-pillar bolts are accessible after removal of the center body pillar inside finish panel. See Figs. 1 and 2 for adjustment points.

After adjustment at the hinge attaching points, check the alignment between the lock rotor and striker plate for proper door closing. **Do not cover up poor door adjustment with striker plate adjustment.**

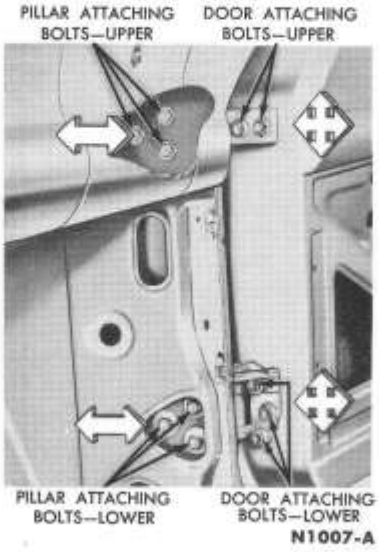

FIG. 1—Front Door Hinges

LOCKS

The accessible parts of the locking mechanism should usually be lubricated in the course of a service operation, as well as periodically (see Part 16-2). A seized lock can sometimes be freed by using lock lubricant or powdered graphite. Lubricate as follows in the course of a service operation:

1. Apply stainless stick-type lubricant to the striker plate, the nylon sliding block contact surfaces, and the rotor teeth.
2. Apply one or two drops of fine oil to the rotor bearing.
3. Apply three or four drops of lock fluid to the lock cylinder.

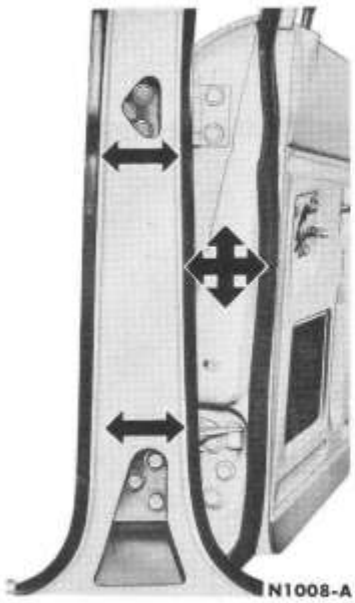

FIG. 2—Rear Door Hinges

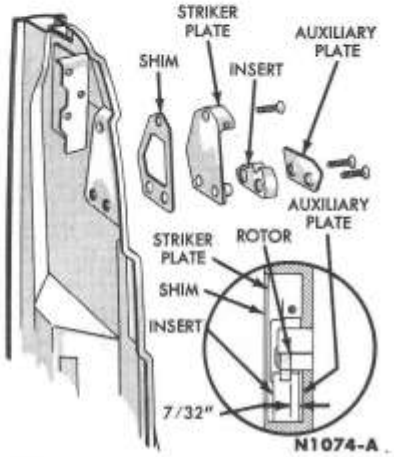

FIG. 3—Typical Door Striker Plate Adjustment

4. Apply silicone lubricant to all new moving parts and to the window regulator mechanism.

STRIKER PLATE ADJUSTMENT

The striker plate can be adjusted laterally and vertically as well as fore and aft. **The striker plate should not be adjusted to correct door sag.** The striker plate should be shimmed to get about $\frac{7}{32}$-inch clearance between the auxiliary plate and the lock rotor (Fig. 3). To check this clear-

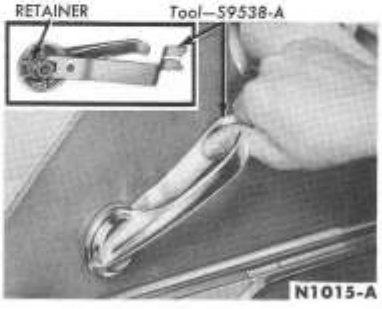

FIG. 4—Typical Inside Door Handle Removal

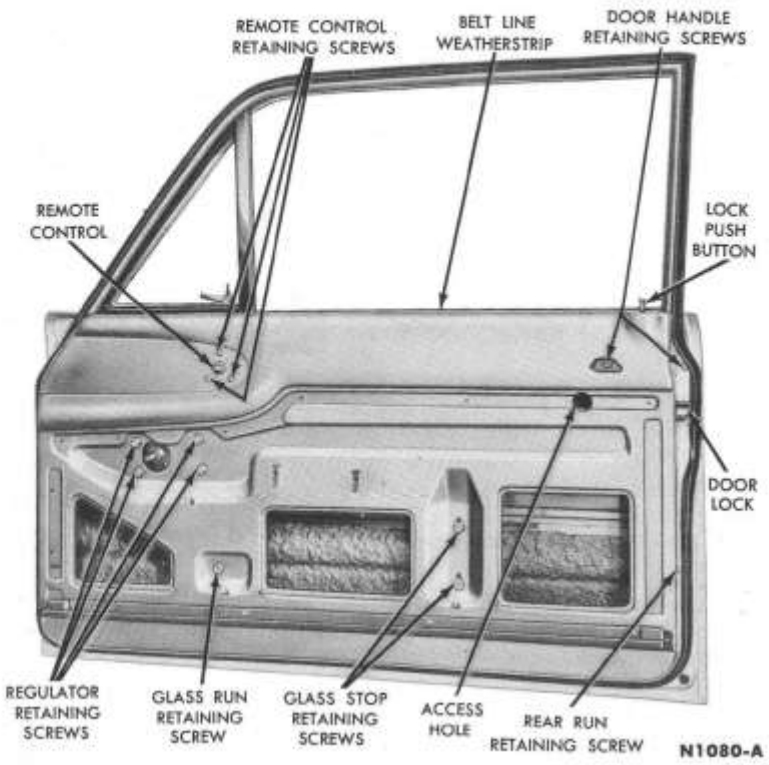

FIG. 5—Front Door

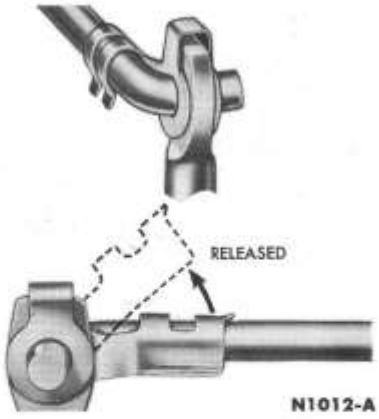

FIG. 6—Typical Remote Control Link Removal

ance, clean the rotor and striker areas, and then apply a thin layer of dark grease. As the door is closed and opened, a measurable pattern will result. Move the striker assembly laterally to provide a flush fit at the door and the pillar or quarter panel.

FRONT DOOR LOCK REPLACEMENT

1. Remove the trim panel and the trim panel upper retainer. Pull the water shield away from the access holes.

2. After removing the lock inside door handle (Fig. 4), remove the three remote control retaining screws (Fig. 5).

3. Working through the access hole, disconnect the remote control link at the remote control (Fig. 6).

4. After lowering the glass, remove the rear run retaining screw, and pull the lower end of the run forward and up.

5. Remove the lock push button, the lock retaining screws, and the lock (along with the two links).

6. After applying silicone lubricant to the push button surface of the lock release lever and transfering the links to the new lock, position the assembly in the door, and install the lock retaining screws.

7. Position the remote control, connect the link, and install the retaining screws finger-tight. Install the handle.

8. Adjust the remote control as necessary, and tighten the screws.

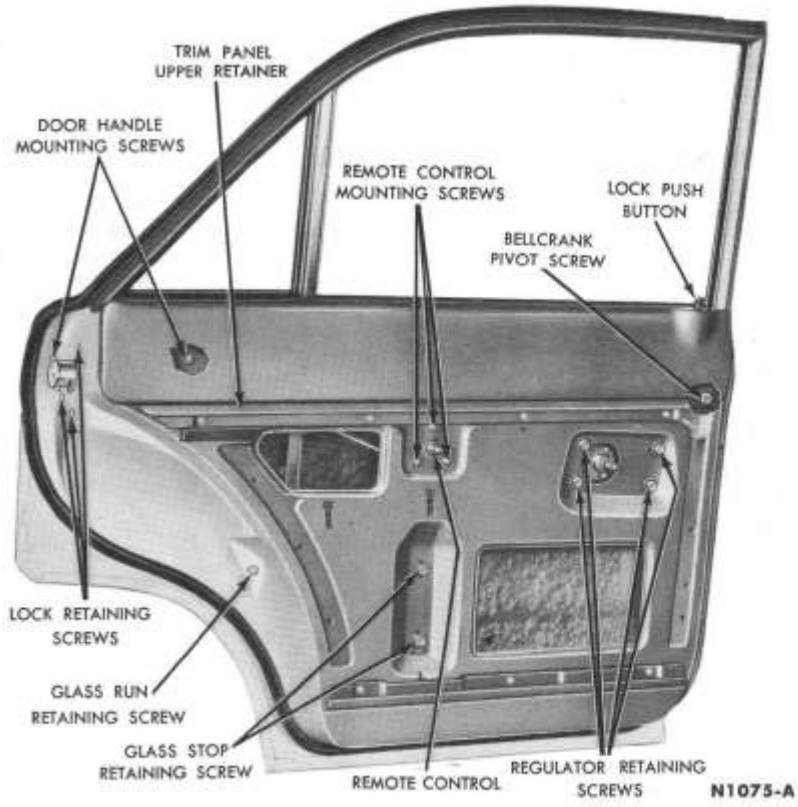

FIG. 7—Rear Door Lock Replacement

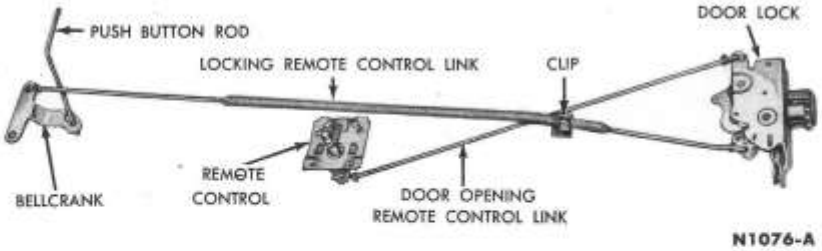

FIG. 8—Rear Door Lock and Remote Control

9. Install the rear run retaining screw, adjusting the run as necessary.

10. Install the lock push button and check the operation of the lock. If necessary, adjust the lock striker plate.

11. Carefully cement the water shield to the inner panel, and install the trim panel upper retainer and the trim panel.

REAR DOOR LOCK REPLACEMENT

1. Remove the trim panel and the trim panel upper retainer. Pull the water shield away from the access holes.

2. Remove the remote control mounting screws (Fig. 7), and then remove the remote control and link.

3. After raising the glass and removing the lock retaining screws, remove the lock, and disconnect the locking remote control link (Fig. 8).

FIG. 9—Door Lock Cylinder Removal

4. Apply silicone lubricant to the push button surface of the lock release lever.

5. Transfer the links to the new lock, position the assembly in the door, and install the lock retaining screws.

6. Connect the remote control to its link, and install the mounting screws finger-tight. Connect the locking remote control link.

7. Adjust the remote control, and tighten the mounting screws.

8. Check the operation of the lock. If necessary, adjust the lock striker plate.

9. Carefully cement the water shield to the inner panel, and install the trim panel upper retainer and the trim panel.

LOCK CYLINDER REPLACEMENT

1. On a front door, carefully pull aside the weatherstrip, remove the lock cylinder retaining clip (Fig. 9), and withdraw the cylinder. The keyhole cover and its spring are serviceable.

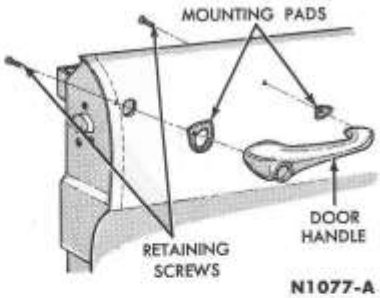

FIG. 10—Outside Door Handle Removal

2. Transfer the lock operating lever to the new lock cylinder.

3. Position the cylinder and insert the clip, making certain that the outer surface of the clip is tight against the door inner panel.

4. Cement the weatherstrip in place.

OUTSIDE HANDLE REPLACEMENT

1. Remove the trim panel and the trim panel upper retainer. Pull the water shield away from the door handle screw access hole.

2. Remove the handle retaining screws (Fig. 10), and remove the handle.

3. Transfer parts as necessary (Fig. 11).

4. After cementing the pads to the handle, install the handle.

5. Cement the water shield to the inner panel, install the trim panel upper retainer, and install the trim panel.

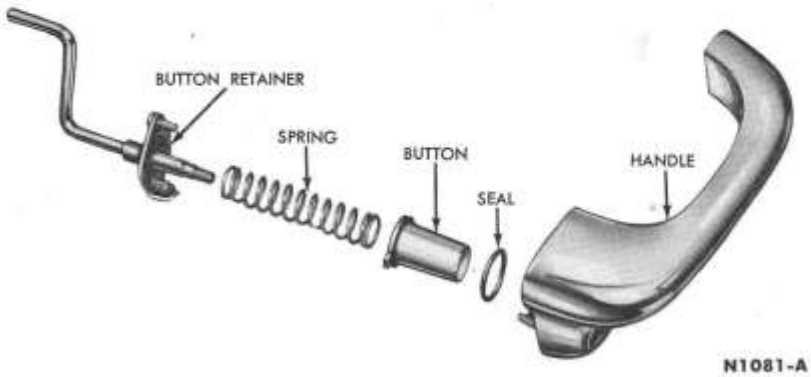

FIG. 11—Typical Door Handle Disassembled

2 DECK LID

ADJUSTMENT

Deck lid adjustments are shown in Fig. 12. After the deck lid has been fitted for exterior appearance, check the weatherstrip fit at the flange to prevent dust and water leaks. To make this check, chalk the flange all the way around, and close the deck lid. Open the deck lid and check for a chalk mark all the way around the weatherstrip. Carefully bend the flange at any point where the chalk misses. After adjustment of the deck lid, check the operation of the latch, adjusting it if necessary (Figs. 13 and 14).

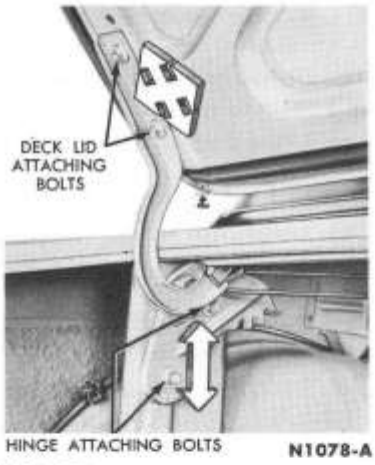

FIG. 12—Deck Lid Adjustments

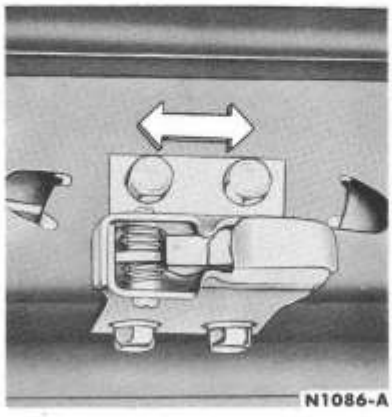

FIG. 13—Deck Lid Lock Adjustment

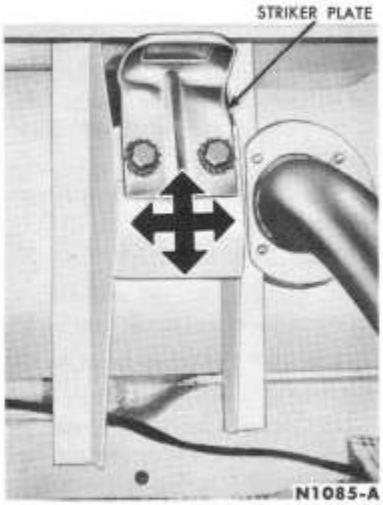

FIG. 14—Deck Lid Striker Plate Adjustment

DECK LID TORSION BAR REPLACEMENT

Once the anchor end of a torsion bar is disengaged, the bar may be readily removed. To disengage the bar, prop the deck lid and then use a pair of Vise-Grips or channel locks on that part of the bar which is on the outboard side of the hinge. Twist the upper part of the bar forward until the anchor end can be disengaged from the adjustment slot (Fig. 15).

FIG. 15—Deck Lid Torsion Bar Replacement

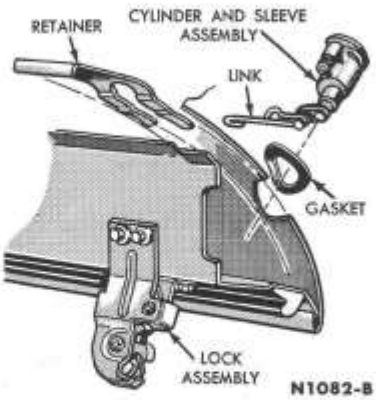

FIG. 16—Deck Lid Lock

When the bar is installed, apply Lubriplate and adjust tension as necessary; the slot farthest forward provides the least tension.

DECK LID HINGE REPLACEMENT

Remove both torsion bars and then remove the hinge attaching bolts (Fig. 12). After the new hinge is installed, adjust the deck lid and the lock if necessary.

DECK LID LOCK CYLINDER AND/OR SLEEVE REPLACEMENT

After disconnecting the link, remove the sleeve retainer and then remove the sleeve assembly (Fig. 16). The key hole cover and its spring are serviceable (Fig. 17). Reverse the procedure for installation.

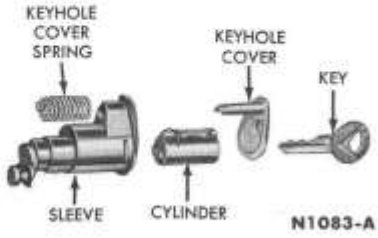

FIG. 17—Deck Lid Lock Disassembled

3 TAILGATE

The replacement of the tailgate lock and window mechanism is covered in Part 14-2.

TAILGATE ADJUSTMENT

The tailgate can be moved vertically and horizontally by loosening the hinge screws (Fig. 18), and then shifting the tailgate as required.

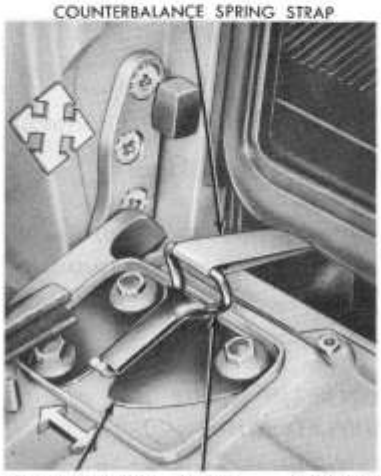

FIG. 18—Tailgate Hinge Adjustment

A tailgate striker plate can be adjusted after loosening the retaining screws. Shims are available to increase the latch contact area, if necessary.

LATCH RELEASE LEVER AND LINK REPLACEMENT

1. Roll down the rear window, and open the tailgate.
2. Support the tailgate, and remove the bolt and washer retaining the hinge support to the tailgate.
3. Remove the tailgate cover panel retaining screws and remove the panel.
4. Remove the retaining screws from the right or left latch assembly, rotate the latch 90 degrees, and remove the latch (Fig. 19). If only the latch requires replacement, proceed to step 9.
5. Pull the knob from the tailgate latch release lever.
6. Remove the latch release lever retaining screws and remove the lever and link.
7. Connect the link to the latch on the tailgate, position the release lever on the tailgate, and install the retaining screws.
8. Install the knob on the latch actuating lever.
9. Install the latch.
10. Remove the old sealer from the cover panel and apply new sealer.
11. Install the cover panel to the tailgate.
12. Connect the tailgate hinge supports and remove the temporary support.

TAILGATE HINGE REPLACEMENT

1. Support the tailgate in the open position.
2. Disconnect both hinge supports at the tailgate.
3. Remove the screws retaining the tailgate cover panel assembly to the tailgate and remove the cover panel.
4. Crank the window regulator enough to gain access to the hinge area. Remove the hinge to cover seal.
5. Insert a screwdriver into the tailgate counterbalance spring strap to prevent the strap hook from entering the spring compartment when the hinge is removed.
6. Loosen the locknut on the tailgate glass run lower adjusting screw to provide clearance for the removal of the hinge upper retaining bolt.
7. Partially close the tailgate and remove the hinge to tailgate retaining bolts, strap hook, and hook retainer plate.
8. Pull off the tailgate support anti-rattle pad.
9. Scribe the hinge location to the body and remove the screws retaining the hinge. Pull the tailgate slightly away from the body and remove the hinge.
10. Position the hinge on the tailgate and snugly install the hinge retaining screws to the body.
11. With the tailgate partially closed, install the tailgate counterbalance spring strap hook and hook retainer plate to the hinge.
12. Remove the screwdriver from the spring strap.
13. Tighten the tailgate glass run lower adjusting screw.
14. Lower the glass and check and adjust the tailgate alignment. Tighten the hinge retaining screws and bolts.
15. Install the tailgate support anti-rattle pad and the hinge to cover seal.
16. Clean off the old sealer from the cover panel and apply new sealer.
17. Install the inner panel to the tailgate.
18. Install the tailgate hinge supports and remove the temporary support.

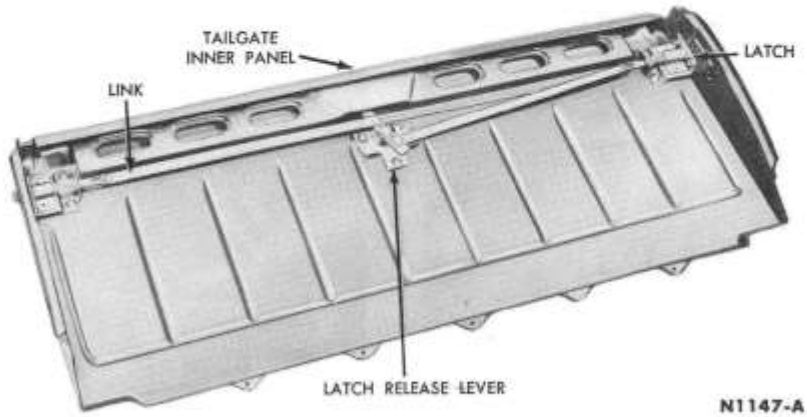

FIG. 19—Latch Release Lever Assembly

TAILGATE COUNTERBALANCE SPRING REPLACEMENT

1. Remove the spring access cover (Fig. 20).

2. From inside the vehicle and with the tailgate in the closed position, insert a 12-inch screwdriver through the hooked end of the spring and into the hole provided in the member, and unhook the spring from the retaining pin (Fig. 20).

3. Unhook the spring from the tailgate strap and remove the spring.

4. Remove the strap from the counterbalance spring strap hook.

5. Position the strap on the hook.

6. Position the spring in the spring compartment and connect it to the strap.

7. With a long screwdriver and the tailgate in the closed position, hook the spring to the retaining pin.

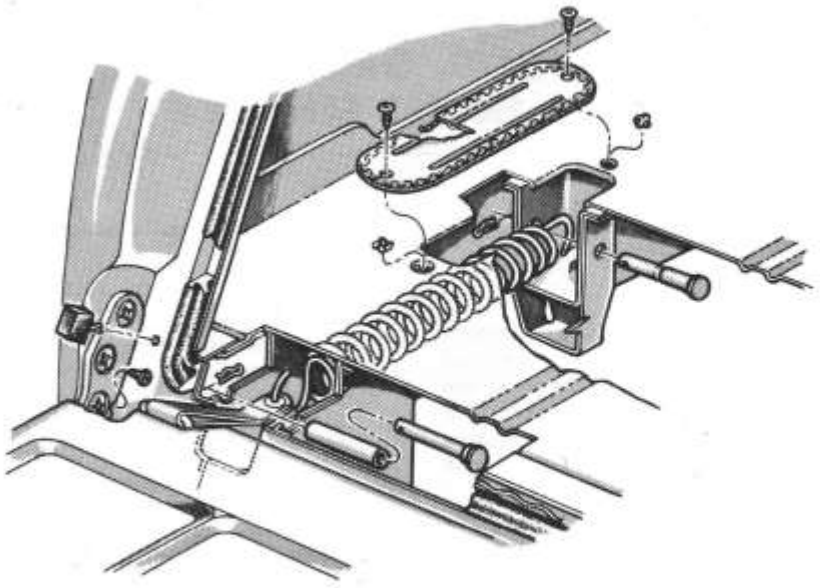

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FIG. 20—Tailgate Counterbalance Spring

8. Clean the old sealer from the access cover and floor pan.

9. After applying new sealer, install the access cover.

PART 13-2 HOOD, GRILLE, AND FRONT FENDER

HOOD

The hood is mounted on scissors type hinges. The hood lock is located at the front center of the hood and radiator grille center support. The hood will stay in a raised position when opened by positioning the hood support rod.

HOOD HINGE REPLACEMENT

1. Open the hood and scribe the hinge mounting locations.
2. Place a wood block between the hood panel and the cowl to support the hood.
3. Remove the hinge retaining bolts (Fig. 1).
4. Position a new hinge to the front fender apron and install the retaining bolts.
5. Remove the wood block and adjust the hood and lock for proper alignment (Fig. 1).

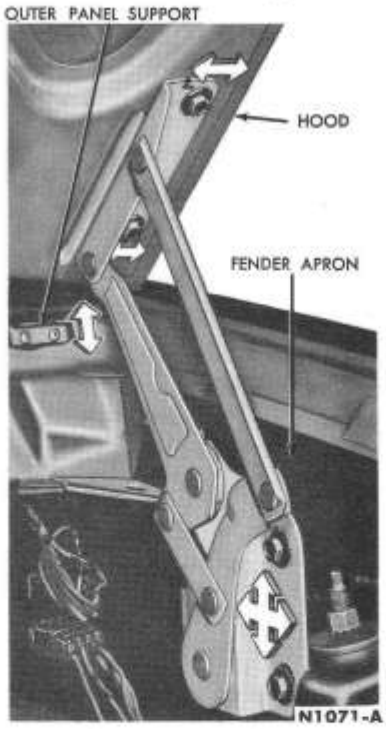

FIG. 1—Hood Hinge

HOOD ADJUSTMENTS

The hood is provided with fore and aft, vertical, and side-to-side adjustments (Fig. 1). These directions refer to the position of the hood when it is fully lowered. The elongated bolt slots in the hinge at the hood provide the side-to-side adjustment. The enlarged holes in the hinge at the fender apron provide both vertical and fore and aft adjustments.

The outer panel support (Fig. 1) is adjustable to provide proper fit of the hood at the cowl pad.

The hood locking latch and hook are also adjustable (Fig. 2). The elongated mounting bolt slots in the hood lock provide side-to-side adjustment. The elongated mounting bolt slots in the hook provide the latching adjustment.

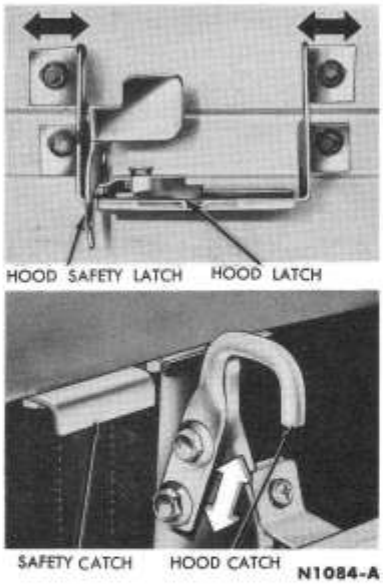

FIG. 2—Hood Latch

GRILLE REPLACEMENT

1. Raise the hood and disconnect the parking lamp wires at the connectors.
2. After removing the bumper, remove the grille retaining bolts, and remove the grille (Fig. 3).
3. Transfer the parking lamps to the new grille. Position the new grille and install the retaining bolts and nuts. Install the bumper.
4. Connect the parking lamp wire connectors.

FRONT FENDER REPLACEMENT

1. Open the hood and, as a precaution against damage, remove the front headlamp rim.
2. Remove five fender to radiator shroud retaining bolts and three stone deflector to fender bolts (Fig. 4).
3. Remove seven fender to fender apron bolts.
4. Remove three fender to front pillar retaining bolts. Lift the fender up and out, and remove it from the car.
5. Transfer any fender ornaments and mouldings to the new fender.
6. After applying sealer to all the attaching screw holes and to the upper edge of the fender apron, position the fender and loosely install the attaching bolts. **To prevent damage to the fender, do not close the front door before the fender alignment is made and bolts tightened.**
7. Shift the fender to the best alignment and fit, using shims where necessary, and tighten all bolts.
8. Position the headlamp rim and install the retaining screws.

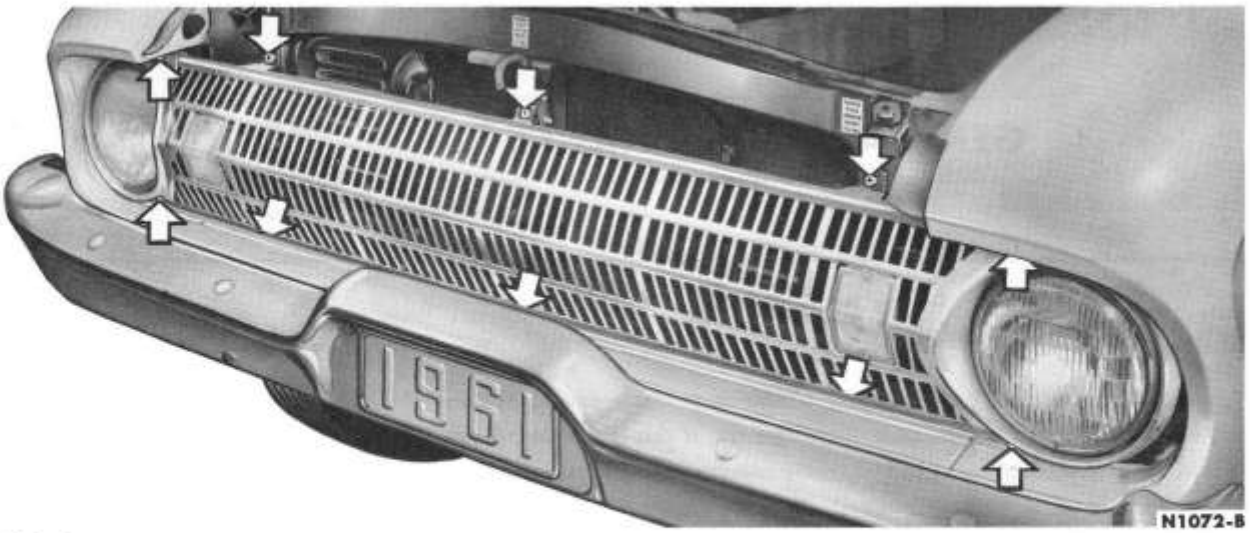

FIG. 3—Grille Retaining Bolt Locations

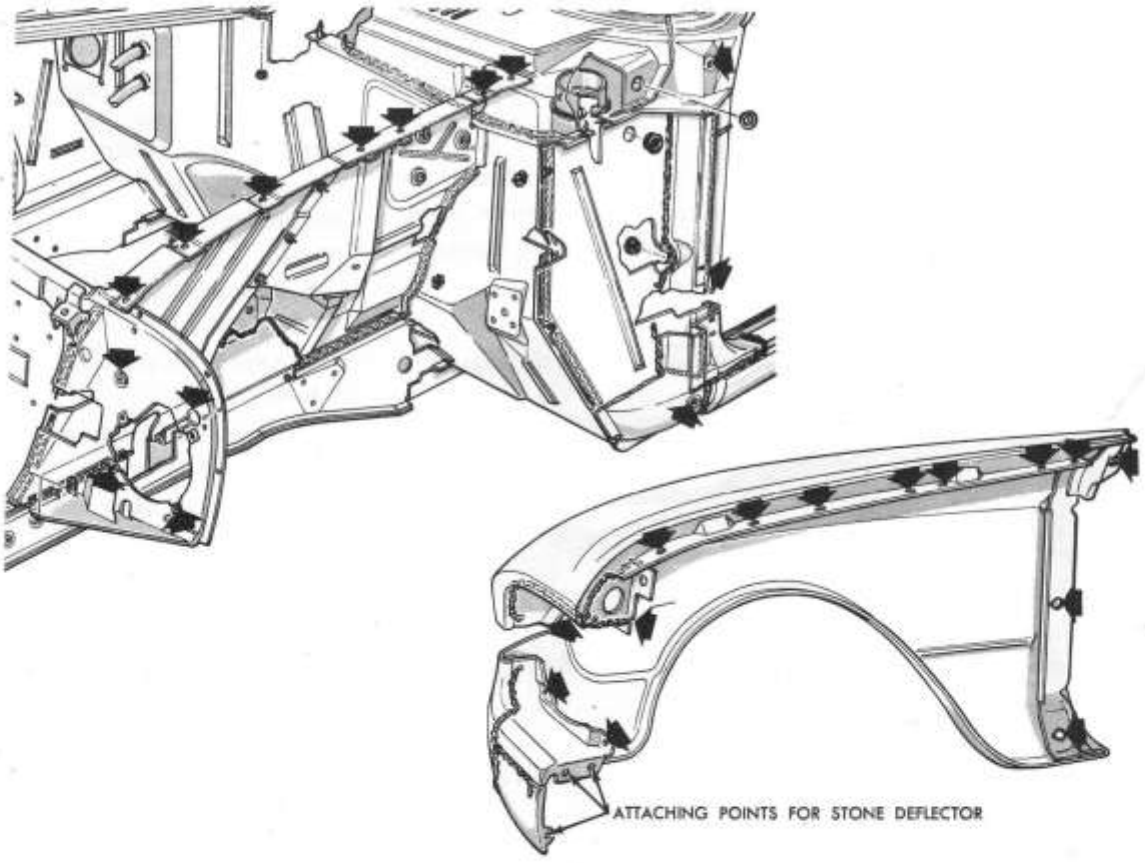

FIG. 4—Front Fender Attaching Points

PART 13-3 GENERAL MAINTENANCE

Section		Page
1	Body Tune-Up	13-10
2	Panel Repair	13-11
3	Door Outer Panel Repair	13-12
4	Paint Refinishing	13-12
5	Body Sealers and Application	13-16

1 BODY TUNE-UP

Most rattles are caused by a loose bolt or screw. Foreign objects such as nuts, bolts, or small pieces of body deadener in the door wells, pillars, and quarter panels are often the source of rattles. Door wells can be checked by carefully striking the underside of the door with a rubber mallet. The impact made by the mallet will indicate if loose objects are in the door well.

In the event that tightening the bolts and screws, located on such assemblies as the doors, hood, and deck lid, does not eliminate the rattles, the trouble is probably caused by misalignment. If this is the case, follow the adjustment and alignment procedures for these assemblies.

Rattles and squeaks are sometimes caused by weatherstripping and antisqueak material that has slipped out of position. Apply additional cement or other adhesive, and install the material in the proper location to eliminate this difficulty.

Drain holes (Fig. 1), located on the underside of each rocker panel, quarter panel, and door, should be cleared periodically.

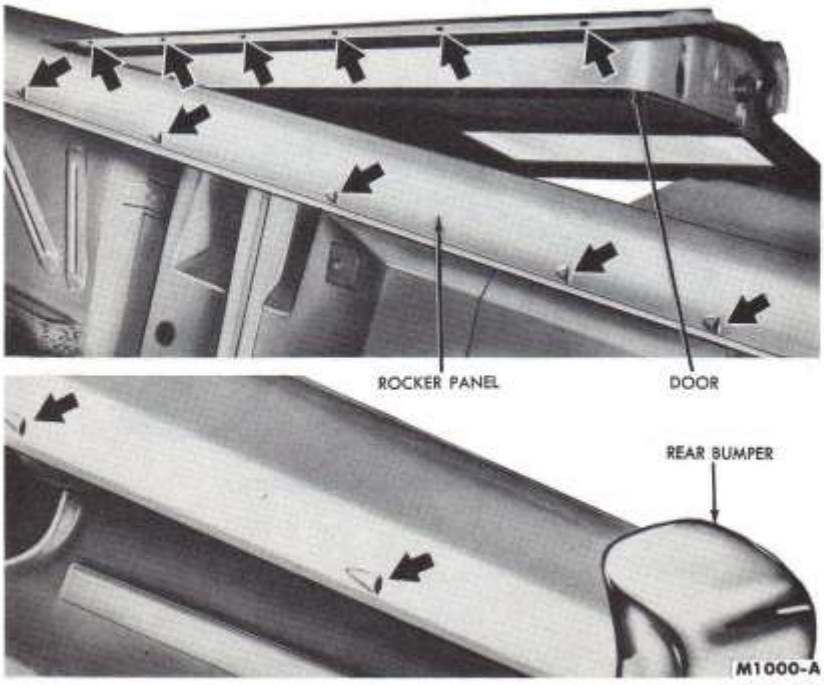

FIG. 1—Drain Holes

A regular body tune-up preserves the car's appearance and reduces the cost of maintenance during the life of the car. The following steps are suggested as a guide for a regular body tune-up:

1. Vacuum the interior thoroughly and wash the car.

2. Check all openings for water leaks, and seal where necessary.

3. Cement all loose weatherstrips which are still usable. Apply silicone lubricant to the weatherstripping.

4. Replace all door and deck lid weatherstrips which are unfit for service.

5. Replace all cracked, fogged, or chipped glass.

6. Align hood, doors, and deck lid if necessary.

7. Inspect windshield wiper blades and replace if necessary.

8. Tighten sill plate and garnish moulding screws.

9. Clean the seats, door trim panels, and headlining. If the seats are worn or torn, install seat covers, or reupholster.

10. Touch-up or paint chipped or scratched areas.

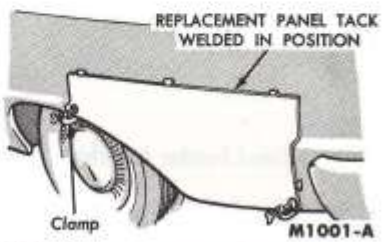

FIG. 2—Typical Sheet Metal Repair

2 PANEL REPAIR

With proper equipment, an experienced body repair man can repair a damaged area by one of three methods: first, repair and use the original panel; second, cut out the damaged area and replace with a section of suitable sheet metal; or third, replace the complete panel.

Figure 2 illustrates typical sheet metal repair. If the complete panel requires replacement, refer to Group 15 "Body Construction Drawings" which will assist in locating the hidden weld joints which fasten the quarter panel to the body.

See Group 17 for the Falcon underbody dimensions.

PANEL REPAIR PROCEDURE

The following procedure is one of several methods that can be used for cutting out and replacing a portion of the panel. This procedure is used here for quarter panel repairs and can be applied to other sections of the body as well.

Rough out and shape as much of the damaged area as possible. Measure the piece of metal to be cut out (Fig. 2). This measurement should be taken from a definite point, such as a moulding or bead.

Make the corresponding measurements on the suitable sheet metal. Be sure measurements are taken from the same points. Scribe a line around the area to be cut from the sheet metal (preferably straight-line cuts).

Drill a ¼-inch hole at any one corner of the scribed line as a starting point for cutting. Use a suitable cutting tool and cut the new piece out along the scribed line.

Straighten the edge of the piece that was cut out, and position it over the damaged area as a template. Secure the cut-out section of the service panel over the damaged area of the body, and scribe a line around the panel. Cut out the damaged area.

If the piece to be replaced is at the pillar post or at any point where the panel is spot-welded to other parts of the body, the damaged piece should be split at the weld if possible. To split a spot-weld, drive a sharp chisel between the two pieces of metal at the weld. In difficult cases, a spot-weld may be split by drilling a ¼-inch hole into the center of the weld.

Straighten the cut edge of the panel. Fit the service panel portion into the cut-out area in the body panel. Be sure that the two parts do not overlap. Tack-weld at intervals as shown in Fig. 2, then make a continuous weld around the two pieces. Weld about six inches at a time. Stagger the welds to prevent excessive distortion. Typical welding operations are shown in Fig. 3.

Hammer the weld below the contours of the surface not more than 1/16 inch with a grooving dolly.

Metal-finish the repaired area and file it smooth, taking care to produce the correct contour.

Grind the welded area clean, and tin it.

Fill in with solder, taking care that sufficient solder is applied so that the final metal finish will not have indentations.

Metal-finish the panel to prepare it for painting.

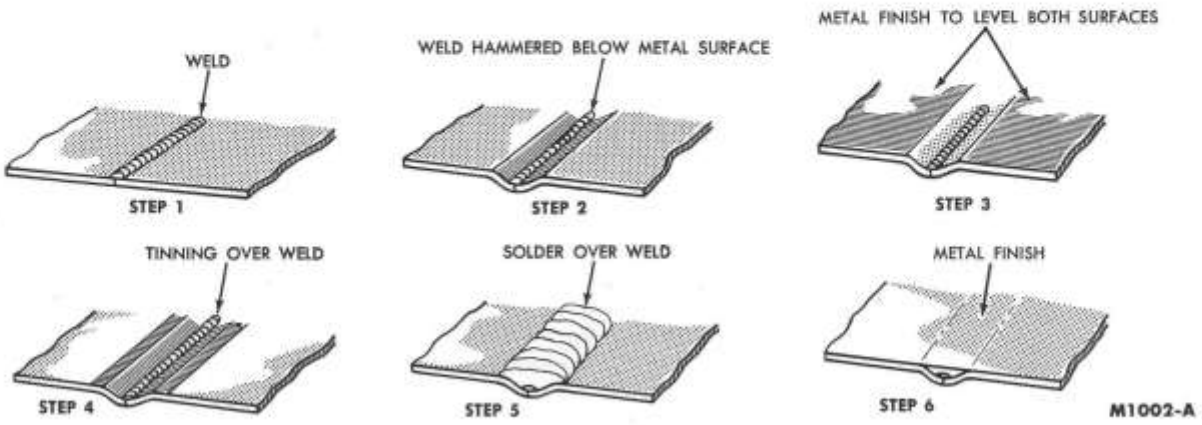

FIG. 3—Typical Welding Operations

3 DOOR OUTER PANEL REPAIR

If a door outer panel is severely damaged, and the door inner panel is undamaged or in repairable condition, a door outer panel is available for service as well as a complete door.

Remove the door assembly and remove all chrome, hardware, and trim. It is not necessary to remove the window regulator and remote control mechanism, lock and runs.

Place the door on a flat surface with the door edges extended over the edge, and grind completely around the outer edges (Fig. 4). Remove the hem flange and repair any distortion of the inner panel. Position the new outer repair panel and bend the hem flange over the inner panel. Spot braze the hem flange to the inner panel. Metal finish the exterior surface, paint it, and assemble the interior trim and hardware.

On a door with an outer panel reinforcement, it will be necessary to break the weld (Fig. 4). Spot braze the reinforcement when assembling the new outer panel.

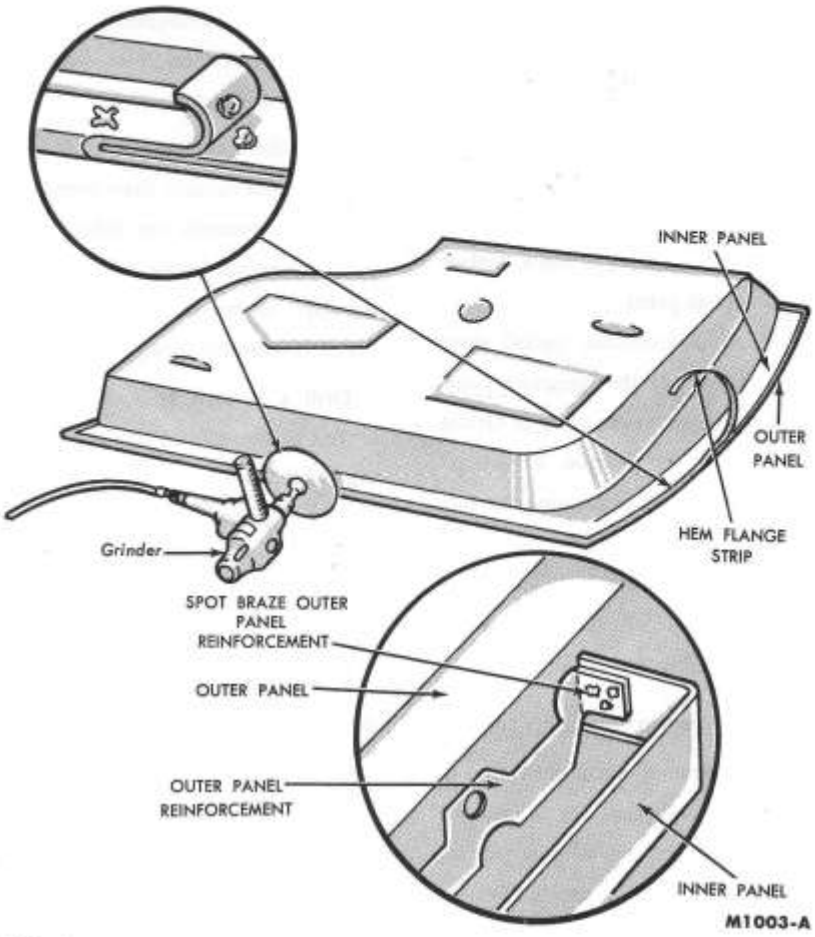

FIG. 4—Door Outer Panel Replacement

4 PAINT REFINISHING

In order to simplify the handling of paint problems, a description of abnormal paint conditions is given here. Any of these conditions can be corrected by one of the three repair procedures given under "Paint Repair Procedures."

PAINT PROBLEMS

Listed here are some of the abnormal paint conditions that may be encountered. It is very important to identify the paint condition correctly so that the proper repair procedure may be followed. For each of the following paint conditions described, the recommended repair procedure will be indicated.

BLISTERING

Blistering is the formation of bubbles or pin points on the surface of the finished work (Figs. 5 and 6). Unless inspected by a magnifying glass, this condition is very hard to identify. In some instances, this complaint may be confused with dirt in the paint. To verify blistering, prick the suspected areas, and note whether a hole exists under the bubble. This condition is caused by rust, moisture, or oil between the coats, metal not properly cleaned, or uneven temperatures between the metal and the paint being sprayed. **Use repair procedure 1.**

BRONZING

Bronzing is a type of film cast over the original paint, resulting in a bronze effect (Fig. 7). **Use repair procedure 3.**

CHALKING

Chalking is evidenced by the formation of a white or gray film on the

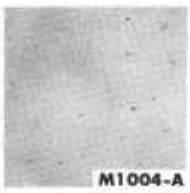

FIG. 5—Random Blisters

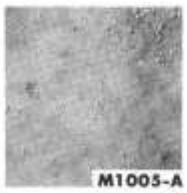

FIG. 6—Pattern Blisters

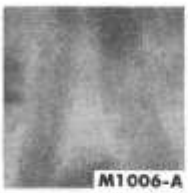

FIG. 7– Bronzing

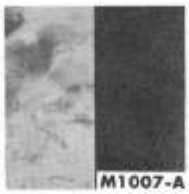

FIG. 8– Chalking

paint surface (Fig. 8). **Use repair procedure 3.**

CHECKING

"Line checking" has the appearance of thin, straight lines crisscrossing each other (Fig. 9). These lines may be from one-half inch to four inches, or longer, increasing in length as the finish ages. **Use repair procedure 2.**

CHIPPING AND STONE BRUISES

Chipping occurs when the surface of the finish coat of paint has been broken by a sharp blow, and small particles of paint have flaked off (Fig. 10). Frequently, stone bruises result in chipping (Fig. 11). **Use repair procedure 2.**

COLOR CHANGE

This may be identified by one panel changing color more quickly than another panel and is usually due to repainting of individual panels in repair. **Use repair procedure 2.**

CRACKING

Cracking is evidenced by the paint curling. Frequently cracking starts at the edge of a panel (Fig. 12). This is caused by poor mixing of the paint, or by temperature changes during the various painting stages. **Use repair procedure 1.**

FIG. 9– Line Checking

FIG. 10– Chipping

FIG. 11– Bruises

FIG. 12– Cracking

CROW FOOTING

Crow footing may be described as small lines branching off from a point in all directions and giving the appearance of a crow's foot (Fig. 13). Crow footing is usually caused by spraying a second coat before the first coat is dry, by spraying an excessively thick coat or by thinners which evaporate too fast. **Use repair procedure 1 or 2.**

DIRT IN PAINT

Patches where dirt appears (Fig. 14) should be sanded smooth and refinished. In most cases, removal of the dirt can be accomplished without having to sand down to the primer coat of paint. It is possible to confuse this condition with blistering. To verify the condition, prick the suspected areas, and note whether there is foreign material under the surface. **Use repair procedure 2.**

MILDEW

Mildew growth is most commonly found in a very dark gray or black color, and occurs along radial lines (Fig. 15). **Use repair procedure 3, and if this does not correct the condition, use procedure 2.**

OFF-COLOR

The term off-color is applied to adjacent areas on which the colors do not match (Fig. 16). It may also appear when making spot repairs. **Use repair procedure 2.**

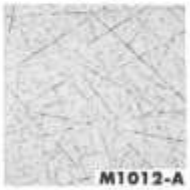

FIG. 13– Crow Footing

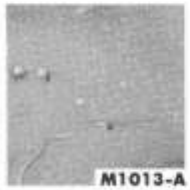

FIG. 14– Dirt in Paint

FIG. 15– Mildew

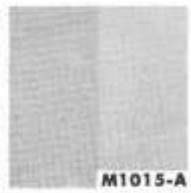

FIG. 16– Off-Color

ORANGE PEEL

Orange peel is a term used to describe an uneven, mottled appearance on the paint surface (Fig. 17). This is usually caused by improper thinning of the paint. **Use repair procedure 3.**

OVERSPRAY

Overspray is evidenced by a rough, dull finish of the area surrounding the paint repair (Fig. 18). **Lightly sand out the overspray and apply a properly thinned finish coat, or use repair procedure 3.**

PEELING

Peeling occurs when large areas of the enamel or primer coat separate from the metal or prime coat (Fig. 19). This is usually caused by wax, grease, rust, or oil under the paint. Do not confuse this with "Orange Peel." **Use repair procedure 1.**

PITS AND CRATERS

Pits and craters may be identified by the appearance of small round depressions in the paint (Figs. 20 and 21). These may be caused by not allowing the first coat to dry sufficiently before applying the second coat or from failure to remove silicone polishes before repainting. **Use repair procedure 2.**

FIG. 17– Orange Peel

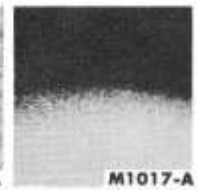

FIG. 18– Overspray

FIG. 19—Peeling

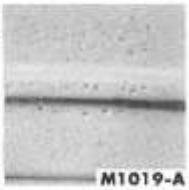

FIG. 20—Pits

PRIMER SHOWS

The primer will show through the finish coat as a result of an excessively thin color coat, or application of the color coat before the surface is dry (Fig. 22).

When this condition exists, clean the surface, and spray two finish coats of paint over the affected area. **Use repair procedure 2.**

RUNS, SAGS, AND WRINKLES

The uneven collections of paint on the finished surface are referred to as runs or sags (Fig. 23). The collections may appear in the form of tear drops or sagging lines. Usually these lines are quite soft and sometimes they may be wrinkled (Fig. 24). This is usually caused by over-application of paint or hesitation in the stroke of the gun. **Use repair procedure 2.**

SCRATCHES

Scratches are thin marks or tears that may partially or completely penetrate the surface of the finish coat of paint (Fig. 25). Where the penetration is very deep, remove the paint from the surrounding area and refinish. **Use repair procedure 2.**

SPOT DISCOLORATION

This is evidenced by brown spots or stains on the surface. Stains or spots can be caused by road tar, acid, or alkali-bearing water from the streets. **Use repair procedure 3, and if this does not correct the condition, use procedure 2.**

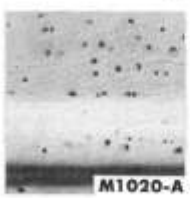

FIG. 21—Craters

FIG. 22—Primer Shows

FIG. 23—Runs and Sags

FIG. 24—Wrinkles

WATER SPOTTING

Water spotting is evidenced by a milky pattern where water drops have fallen (Fig. 26). **Use repair procedure 3, and if this does not correct the condition, use procedure 2.**

PAINT REPAIR PROCEDURES

The original paint on Ford cars is baked enamel. When refinishing part or all of a car, baking enamel or air dry enamel should be used. Baking enamel is preferred if drying facilities are available.

Use of lacquer paint for spot refinishing will usually prove unsatisfactory. Even though the color is matched precisely, lacquer paint has a different sheen than enamel and the spot will invariably show. Even if the spot were good enough to pass initial inspection, it would show up in a few months because lacquer has a different oxidation rate than enamel.

Spot refinishing with enamel requires a high degree of skill to produce an acceptable job. Enamel does not lend itself readily to rubbing out with compound; therefore it is very difficult to blend the new paint with the old. Usually the best course to follow is to paint the entire panel.

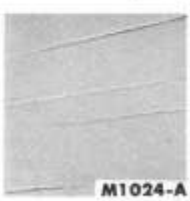

FIG. 25—Scratches

FIG. 26—Water Spotting

When attempting to match colors on finishes that may be slightly faded, polish a small area near the damaged section. Wet the polished area with water so it will more closely resemble the gloss of the wet enamel to be tinted. Then make small "brush outs" or "spray outs" on the damaged section to compare color. Use light or dark enamel tint bases as may be required to obtain the desired color match.

If there is any doubt about the type of paint on a particular car, dip a finger in lacquer thinner and rub it on a small area. If the finish rubs off easily and starts to dissolve, it is lacquer. If it does not, it is most likely enamel. Some of the newer lacquer paints leave an insoluble outer skin. Reveal the under surface by carefully sanding, and use the lacquer thinner test.

PAINT APPLICATION

Heavy coats of enamel should be avoided. One mist coat followed by one heavier coat will usually be sufficient to provide good coverage. One coat of enamel is equivalent in film thickness to several coats of lacquer. One coat consists of a right and left movement of the spray gun, not just movement of the gun in one direction.

When enamel is sprayed, the gun should be held 8 to 12 inches from the surface. Move the gun parallel to the surface and not in an arc. Do not tilt the gun or "fan" it.

REPAIR PROCEDURE 1. REFINISHING COMPLETE CAR OR PANEL

If the complete car is to be painted, remove the windshield wiper arms, and cover the front and rear bumpers, all exterior mouldings, all plastic ornaments, windshield wiper brackets, weatherstrips, etc. with masking tape. Acetate-fibre, clear tape is recommended where liquid paint strippers are used.

Remove Paint. Remove all damaged paint from the exterior surfaces of the body by sand blasting, shot blasting, disc grinding, or liquid stripping. If liquid stripper is used, carefully follow the supplier's instructions.

After the paint has been removed, wash off any accumulation of surplus material.

If the paint was removed with liquid stripper, carefully follow the supplier's instructions for neutralization of excess material.

Prepare metal. Apply metal conditioner to all areas from which the paint was removed. Avoid using an execessive amount, and carefully follow the supplier's instructions. Before applying the paint, remove all remaining traces of metal conditioner according to the supplier's instructions. **The metal must be properly prepared before prime and color coats are applied.**

Apply Primer Surfacer. Remove any dust from the surfaces with clean tack cloths. **Do not touch the metal with bare hands. The result is an oily film and poor paint adhesion.**

Spot-glaze any bad metal with a suitable glazing putty. Wipe the area with a tack cloth, and spray two coats of sanding type primer in accordance with the supplier's recommendations.

After the primer has dried as specified, lightly scuff-sand the primer to remove dirt and overspray.

Spray a final, wet, double coat of synthetic primer surfacer and allow to dry according to the supplier's recommendations.

Apply Finish Coat. Water-sand the surface with No. 360 sandpaper. Avoid cutting through to the bare metal. Rinse well, blow off all water from seams, cracks, etc., and dry thoroughly.

Wipe the work with a tack cloth, and spray one mist, and one wet finishing coat of paint. Follow the supplier's instructions carefully.

The car is now ready for whatever drying process is available.

Remove the masking tape, and carefully touch up any portions missed by the spray.

When the job is entirely dry, install the hardware, etc.

REPAIR PROCEDURE 2. SPOT REPAIRING

The end result of spot repairing depends upon the skill and knowledge of the operator doing the repair. In most cases, a more satisfactory repair may be obtained by finishing the complete panel involved.

Remove Paint. Before sanding the surfaces to be painted, use a good wax and grease remover to eliminate all traces of wax, polish, and grease. Dry the panel with a clean cloth. If the car has been polished with a wax or polish containing silicone, remove the silicone base as instructed under "Removal of Silicone Polishes."

Feather-edge any broken spots with coarse sandpaper. Treat any rusty metal with a metal conditioner. Follow the supplier's instructions for removal of any remaining traces of conditioner.

Apply Primer Surfacer. Spot-spray bare and feathered edges with primer surfacer, reduced according to the supplier's recommendations. Permit each coat to become dull (after all thinner has dried off) before applying additional coats. Before sanding, allow the final coat to dry for the length of time specified by the supplier. Sand the primer surfacer according to recommendations. If any imperfections still show, smooth out with spot glazing putty. Allow the putty to dry for the length of time specified, and sand the same as primer surfacer.

Sand the patches and the entire panel to remove scratches in the old finish and overspray. Wipe clean, using a cloth dampened with enamel thinner.

Spray the area to be painted with one medium coat of a sealer, reduced according to the supplier's instructions. Allow to dry for the length of time specified and, if necessary, scuff lightly with fine sandpaper to remove nibs.

Wipe the area with a tack cloth and spray one mist, and one wet finishing coat of paint according to the supplier's recommendations.

Remove the masking tape, etc., and allow the paint to dry according to the supplier's recommendations.

Removal of Silicone Polishes. All traces of wax and polish containing silicone must be removed from the painted surfaces before refinishing. Any paint surface suspected of having been treated with these substances should be tested as follows: Spray enamel of any color on a small vertical area of the car that is to be refinished. If "fish eyes" or craters form on the surface of the sprayed area, silicone polish has been used.

The following procedure for removing silicone polishes from painted surfaces is recommended:

1. Using clean cloths saturated with a known brand of silicone remover or good enamel thinner, wash off the area to be painted. Before the solution has a chance to dry, wipe off with CLEAN, dry cloths, changing these frequently. Do not re-use these cloths anywhere in the shop, but dispose of them immediately. If the silicone residue gets on any refinished surface, "fish eyes" will result when the area is painted.

2. Water-sand the area with No. 320 sandpaper, wash with water, and dry off.

3. Saturate clean cloths with a silicone remover or a good enamel thinner, and wipe off the entire sanded area.

4. Change to dry, clean cloths and remove any excess solution. Be sure that all accumulated polish is removed from crevices of drip rails, doors, mouldings, etc.

The importance of keeping the paint shop clean and free from the silicone materials on cloths, clothing, or spray equipment cannot be overemphasized. Do not use a spray gun to spray refinishing materials after it has been used to apply silicone polishes. Make sure that refinishing work is not done near an area where silicone or wax polishes are applied.

REPAIR PROCEDURE 3. POLISHING

In cases where the paint condition calls for repair procedure 3, apply FoMoCo polish to the affected area as directed on the container.

5 BODY SEALERS AND APPLICATION

A wide variety of sealers are used by manufacturers. Since it would be difficult to stock all of these sealers, the all-purpose sealers described below have been selected for service use. The method and points of application are given under each sealer type. For illustrations refer to Part 15-1.

BODY SEALER B8A-19562-A

This white sealer will not run, is fast drying, and remains semi-elastic. It duplicates the vinyl-type sealer used in assembly. It is easily cleaned up with a dry cloth, followed by solvent if necessary, and provides an excellent surface for paint. This sealer is used for all seam sealing jobs such as are found in the floor pan, wheelhouse, dash panel, rocker panel, door opening, quarter panel, or drip rail. It is also used to seal trim panel and outside moulding clip holes, and for windshield and back window installation.

BLACK CAULK AND SEALER B6A-19563-B

The combination black caulk and sealer is of the same composition as body sealer, and is used in the same areas. The color is gloss black instead of white, and this sealer is to be used with dark colored paint or in areas that are not visible.

BODY SEALER M-5397-B

This sealer has a plastic base with an asbestos filler, is heavy bodied, and is commonly known as "permagum." It is used on spotweld holes, around moulding clips, or between two surfaces not properly sealed by a gasket. Apply the sealer with a putty knife.

CAULKING CORD AB-19560-A

Caulking cord is body sealer (M-5397-B) in a convenient cord form.

M-2G17-A CEMENT

This cement is recommended for instrument panel safety cover and body panel plastic water shield installation. It is also useful for repair or replacement or other vinyl and rubber trim.

RUBBER CEMENT 8A-19552-B

This rubber cement is a quick-drying, strong adhesive material. It is designed to cement weatherstripping to doors, bodies, deck lids, cowl ventilators, and the surrounding metal. Windows and windshields which are set in rubber can be effectively sealed against leakage by flowing cement into affected areas.

Clean all grease, dirt, and old sealer from the surfaces to be cemented. Wash the surface thoroughly with a rag moistened with clean gasoline or cleaner's naphtha. For best results, apply a medium coat of cement to both surfaces, allow it to dry until tacky, and press both surfaces firmly together.

CLEANING SOLVENT B6A-19563-D

A general clean-up solvent is used to clean off new or old cement smears, wax, tars, oils, grease, caulk and sealer. When desired, it can be used to thin caulk and sealer. It is harmless to cured paint, and will be useful in new car pre-delivery.

SILICONE LUBRICANT

This lubricant is to be used on the door window weatherstrips. It is recommended that silicone lubricant be applied to the upper weatherstrips at every regular lubrication period. Its use makes the doors easier to close, avoids weatherstrip squeaks, retards excess weatherstrip wear from chafing between the door glass upper frame and the weatherstrip, and helps to retain door window alignment by reducing friction between the glass frame and rubber weatherstrip.

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GROUP 14

INTERIOR TRIM, SEATS, AND WINDOWS

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PART 14-1 INTERIOR TRIM AND SEATS

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1 DOOR AND QUARTER TRIM PANEL REPLACEMENT

Basically, all door and quarter trim panels are retained in the same manner. In view of this, one removal and installation procedure will cover all models.

1. Remove the window regulator handle with the tool shown in Fig. 1. **Insert the tool between the control handle and the friction plate.** Press the tool against the spring clip until the handle can be released from the shaft.

2. Remove any screws retaining the trim panel to the inner panel, such as the arm rest retaining screws (Fig. 2). To reveal the quarter panel arm rest forward retaining screw, slide the ash tray assembly forward.

3. With a putty knife, pry the trim panel retaining clips out of the inner panel at each side.

4. Bow the trim panel out of the retainers, and carefully loosen the plastic water shield, if necessary.

FIG. 1—Typical Handle Removal

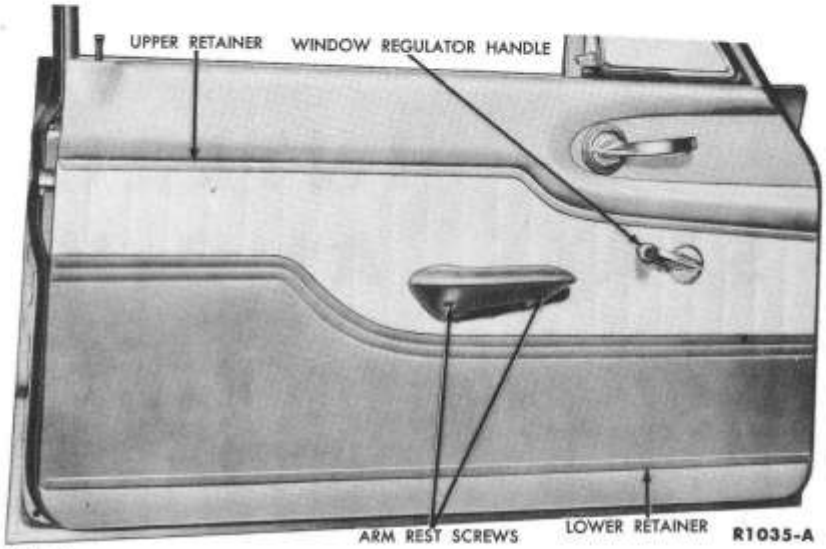

FIG. 2—Typical Door Trim

5. Place a daub of M-5397-B sealer over each trim retaining clip hole to seal the retaining clips when they are pushed into the door. Also, apply this sealer around the window regulator shaft, and other existing holes.

6. Fasten the plastic water shield to the inner panel with M-2G17-A cement (see Part 15-3).

7. Make sure all the retaining clips are installed in the trim panel. Place the upper edge of the trim panel in the retainer, insert the lower edge of the trim panel in the retainer and push the retaining clips into the holes in the door inner panel.

8. Install the arm rest retaining screws.

9. Insert the spring clip in the handle, position the regulator handle spring, place the friction plate against the trim panel and push the handle onto the shaft until the spring clip snaps into the groove.

2 FRONT SEAT

SEAT CUSHION AND/OR BACK REPLACEMENT

Work, other than that of minor nature, is more easily performed when the front seat assembly is removed from the car.

1. Disconnect and remove the front seat retracting springs from the seat track (Fig. 3).

2. Remove the nuts retaining the seat tracks to the floor pan and lift the seat assembly from the car.

3. Disconnect and remove the tie rod from the eye bolt on the frame. Remove the seat tracks from the frame.

4. Transfer the seat adjusting lever knob to the new left hand track assembly.

5. On a car with a solid seat back, remove the bolts and washers attaching the seat back. Remove the hairpin clips from the pivot pins.

6. On a car with a split front seat back, remove the hairpin clip from the center seat back studs.

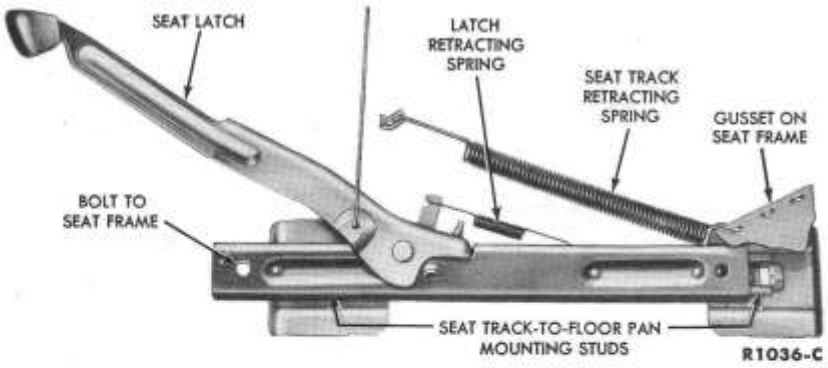

FIG. 3—Front Seat Mechanism

7. Remove the seat back.

8. Position the seat back assembly on the seat. On cars with the split back seat, install the hairpin clip at the seat center bracket.

9. Install hairpin clips on the seat back pivot pin. On a car with a solid seat back, install the bolts and washers attaching the seat back to the seat.

10. Position the new seat tracks on the frame and install the retaining bolts and tie rod.

11. Position the seat assembly in the car and install the retaining bolts and nuts. Install the retracting springs.

TIE ROD ADJUSTMENT

Tie rod maladjustment will affect only the passenger side of the seat. In case the latch retaining the track fails to release, turn the tie rod turnbuckle clockwise enough turns to shorten the tie rod travel sufficiently to release the track latch. If the latch fails to secure the seat travel, turn the tie rod turnbuckle counterclockwise to lengthen the tie rod travel enough to allow the latch to snap into locking position.

SEAT CUSHION COVER AND/OR PAD INSTALLATION

Repairs to seat cushions or seat backs are performed out of the car and are usually limited to replacement of torn or burned seat covers.

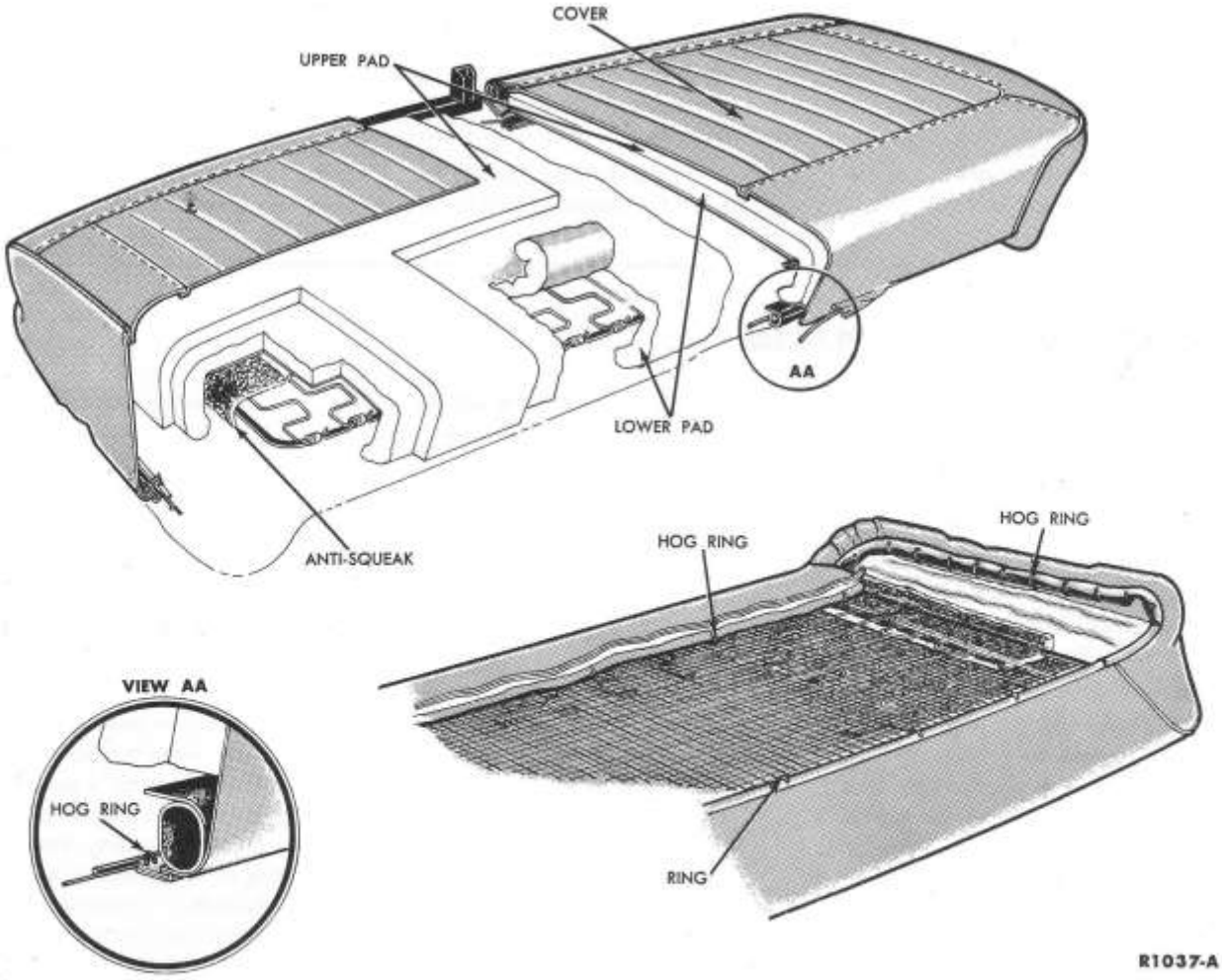

FIG. 4—Typical Front Seat Cushion Build-up

In a few instances, the pads may be damaged and require replacement.

Figure 4 shows a front seat cushion buildup. Seat cushions for all other models are built up in basically the same manner. Therefore, when installing new seat cushion covers or pads, refer to Fig. 4 for the location of listing wires, hog rings, antisqueak pads, and seat pad stack-up.

When installing a new seat cushion cover, follow these basic instructions:

1. With the seat cushion assembly right side up, make sure the pads are stacked properly and centered; then place the cover over the pads to hold them in position.

2. Carefully turn over the seat assembly so that the pads do not shift out of position.

3. After centering the cover and straightening the seams along the front edge of the cushion, fasten the cover to the front of the seat frame with hog rings. Make sure the hog rings encircle the listing wire. Install one hog ring in each hole provided in the seat cushion frame.

4. At the rear of the seat assembly, pull the cover taut over the pads, and install two hog rings at the center elements of the spring assembly and one hog ring at every other element out to the edge.

5. Fasten the sides of the cover to the seat frame side with hog rings through the holes provided (Fig. 4).

3 INSTRUMENT PANEL SAFETY COVER REPLACEMENT

1. Unsnap the three-piece chrome trim moulding from the instrument panel safety cover edge.

2. Remove the safety cover end plate at each door pillar.

3. Remove the lower and side garnish mouldings and note the screw sizes.

4. Remove the speaker and defroster grille assembly.

5. Pull the safety cover from the instrument panel.

6. Using solvent B6A-19563-D, clean the old cement from the instrument panel mounting surfaces.

7. Position the cover temporarily, and then mark the cover and the instrument panel at several locations.

8. Using a wide brush, quickly apply M-2G17-A cement to both the instrument panel and to the safety cover around the outside and the inside edges only.

9. Press the safety cover into position.

10. Install the speaker and defroster grille assembly.

11. Install the garnish mouldings, safety cover end plates, and the three-piece trim moulding.

4 HEADLINING REPLACEMENT

The following headlining replacement procedure applies to all models in general. If some of the steps in these procedures do not apply to the particular model being serviced, proceed to the next step.

1. Remove the windshield side garnish mouldings, sun visor assemblies, dome lamp lens, and rear view mirror.

2. Remove the rear seat cushion and seat back to provide working space. Slide the package tray out from the back window weatherstrip and remove it from the shelf. Remove the coat hooks, center pillar garnish mouldings, and quarter window garnish mouldings.

On station wagons, remove the stationary window garnish mouldings and the tailgate window side and upper runs as indicated on page 14-13.

3. Cut the headlining along the edge of the windshield, back window, and stationary window weatherstrips. Disconnect the headlining along the side rails, and then starting at the front of the car, push the ends of the roof bows out of the roof side rails. At the rear bow, release the two rear bow retainers from the roof rear rail, and then remove the headlining.

4. Check the tabs on the headlining side retaining strips. If any tabs are bent or flattened, repair them and tighten the retaining strips.

5. Transfer the headlining bows in sequence to the new headlining.

Roof bows are color coded at each end. When ordering new roof bows, be sure to note the color at each end of the bow.

6. Install the rear bow in the side rails, and connect the rear bow retainers to the roof rear rail. Install the other headlining bows, working from the rear toward the front of the car. The headlining should be centered and the seams straight.

7. Apply trim cement to the windshield header along the edge of the windshield weatherstrip. Cement the headlining to the windshield header, starting from the center. Trim the headlining approximately ½ inch below the windshield weatherstrip edge and then install the headlining under the windshield weatherstrip.

8. Apply trim cement to the back

window upper frame, along the edge of the window weatherstrip.

On a station wagon, apply trim cement to the tailgate window upper run mounting area.

Cement the headlining in place, starting from the center.

9. Trim the headlining around the back window. On the sedan and Ranchero models, trim the headlining approximately ½ inch below the back window weatherstrip edge. Place the headlining under the back window weatherstrip.

10. Pull the headlining down at the sides to remove the wrinkles. Cut the headlining bow retainers to eliminate gathering of the material. Trim the headlining at the door openings to approximately 1½ inches below the windlace. Starting at the front on each side of the car, use a putty knife (with rounded corners) to work the headlining up under the retaining strip. Be sure the headlining catches on the tabs.

11. Apply trim cement to the roof side rail at the quarter window opening. Pull the headlining to remove wrinkles, and cement it in place.

12. On station wagons, apply trim cement to the roof side rail at the edge of the stationary quarter window weatherstrip and cement the headlining in place. Trim the headlining approximately ½ inch below the weatherstrip edge and install the headlining under the weatherstrip.

13. Install the window garnish mouldings, tailgate window runs, coat hooks, seat back and seat cushion, sun visor assemblies, and rear view mirror.

14. Cut a hole in the headlining for the dome lamp. **Be sure the dome lamp lens will cover the hole.** Install the dome lamp lens.

Use warm water on a sponge to dampen a cloth headlining that sags or is slightly wrinkled, or spray it with live steam. On vinyl headlinings, live steam must be applied to the backside of the headlining through the dome lamp opening. As it dries the headlining will shrink slightly, removing most wrinkles and sags.

PART 14-2 WINDOWS

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1 VENT WINDOW

The vent window glass itself may be removed and/or installed by using the tool shown in Fig. 1. When installing new glass, use new glass tape, and apply sealer to the frame horizontal channel and to the other channel in the area of the upper pivot.

ADJUSTMENT

The vent glass and/or the vent window frame may be adjusted in various ways as follows:

1. With the vent glass installed, lower pivot spring tension may be adjusted with a socket, extension, and ratchet used through the access hole in the door inner panel. Adjust so that the glass will stay open at highway speeds.

2. The door frame mounting holes (Fig. 2) are elongated to provide a tight fit for the vent window frame in the door frame.

3. The upper pivot mounting holes are slotted to help provide a weatherproof fit of the glass frame within the vent window frame (Fig. 3).

VENT WINDOW FRAME AND VENT WINDOW WEATHERSTRIP REPLACEMENT

1. Remove the trim panel and the upper retainer. Pull the water shield away from the access holes.

2. Remove the glass stop (Fig. 4) and the front run bracket retaining bolt. Loosen the front run retaining bracket at the inner panel (Fig. 5). Lower the window completely.

FIG. 1—Glass Channel Replacement

3. Pry the door glass front run out of the vent window division bar and remove the run.

4. Remove the vent window frame mounting screw from the belt line of the door (Fig. 2).

5. After carefully pulling away the door weatherstrip from the upper forward area of the door frame, remove the remaining frame mounting screws and the vent window and frame.

6. Remove the upper pivot from the frame, and remove the lower pivot spring assembly. **Note the position of the stop washer and the flat washers.**

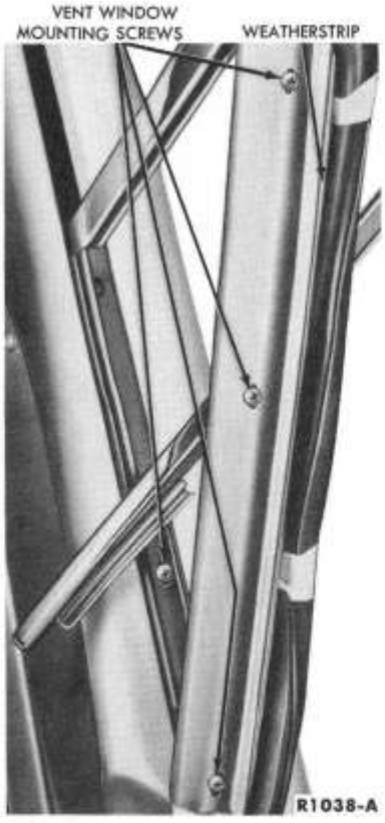

FIG. 2—Vent Window Installed

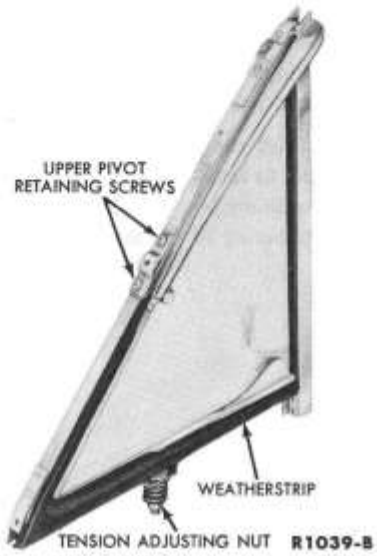

FIG. 3—Vent Window Assembly

7. Remove the weatherstrip.

8. Install the weatherstrip.

9. Install the pivot and the pivot spring assembly. Adjust the spring tension so that the vent glass will stay open when the car is driven at highway speeds.

10. Install the vent window and frame in the door frame.

11. Install the front run and its bracket, adjusting the bracket position to get correct door glass lateral position and snug fore-and-aft door glass fit.

12. Install the stop, adjusting it for proper door glass height at the belt line with the glass lowered.

13. Install the water shield, the trim panel retainer, and the trim panel.

2 FRONT DOOR WINDOW

DOOR GLASS ADJUSTMENT

The trim panel must be removed to make any of the following adjustments.

Fore-and-aft adjustment for snug glass fit within the runs may be made by using suitable shim stock between the front run and the vent window division bar. The front and/or the rear run may also be shimmed at the lower attaching point(s). See "Glass Replacement" for run removal procedure.

Vertical adjustment is possible by means of the single stop (Fig. 4). When the glass is fully lowered, the upper edge should be even with the belt line.

Lateral adjustment for smooth movement of the glass within the runs can be made by moving the lower attaching points of the run (Fig. 5).

GLASS REPLACEMENT

1. Remove the trim panel and the trim panel upper retainer. Pull the water shield away from the access holes.

2. After removing the stop (Fig. 4), lower the glass until the regulator arm roller is out of the glass channel.

3. Unsnap and remove the belt weatherstrips, loosen the front run attaching bolt at the mounting bracket, and remove the bracket attaching bolt from the inner panel.

4. Remove the front run from the division bar by pulling rearward on the edges of the run.

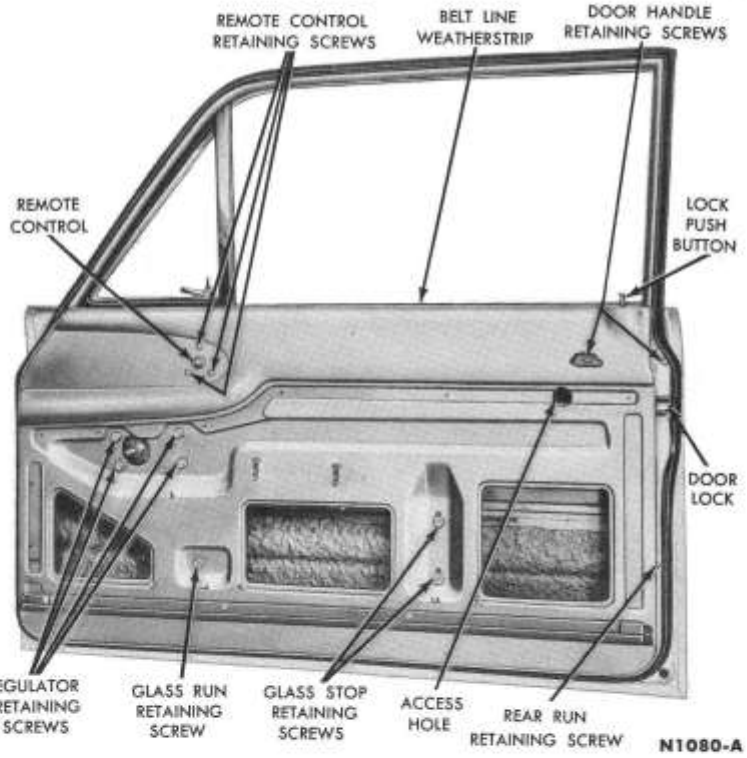

FIG. 4—Front Door

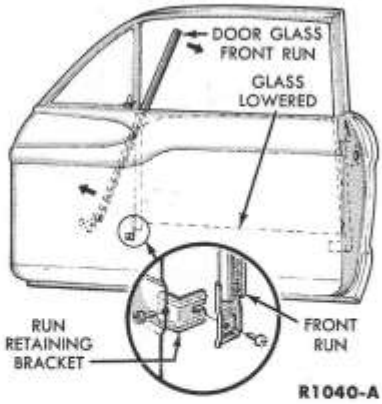

FIG. 5—Door Glass Run Removal

5. Remove the glass (Fig. 6).

6. Using the tool shown in Fig. 1, remove the channel from the glass.

7. Install the channel, using new glass tape.

8. Simultaneously, position the glass and run in the door, and install the belt weatherstrips.

9. Position the regulator arm roller in the channel, and finally position the run in the division bar.

10. Connect the run and bracket, making necessary lateral adjustment.

11. Install the stop, making necessary adjustment.

12. Install the water shield, the trim panel upper retainer, and the trim panel.

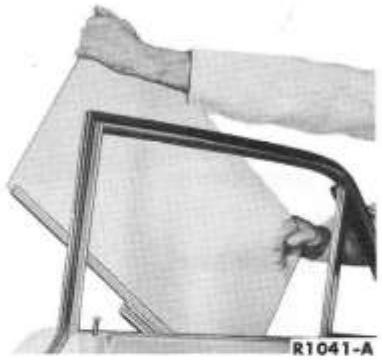

FIG. 6—Door Glass Removal

3 REAR DOOR WINDOWS

DOOR GLASS ADJUSTMENT

The trim panel must be removed to make any of the following adjustments.

Fore-and-aft adjustment for snug glass fit within the runs may be made by using suitable shim stock between the front run and the door frame.

Vertical adjustment is possible by means of the single stop (Fig. 7). When the glass is fully lowered, the upper edge should be even with the belt line.

Lateral adjustment for smooth movement of the glass within the runs can be made by moving the lower attaching points of the runs (Fig. 7).

DOOR GLASS REPLACEMENT

1. Remove the trim panel and the trim panel upper retainer. Pull the water shield away from the access holes.
2. Remove the window regulator and the stop, and lower the window to the bottom of the door.
3. Remove the belt weatherstrips, and remove the rear run adjusting nut (Fig. 7). Disconnect the remote control anti-rattle clip (Fig. 8).
4. Pull down the rear run enough to clear the door frame, and then remove it by pulling it forward and out of the division bar.

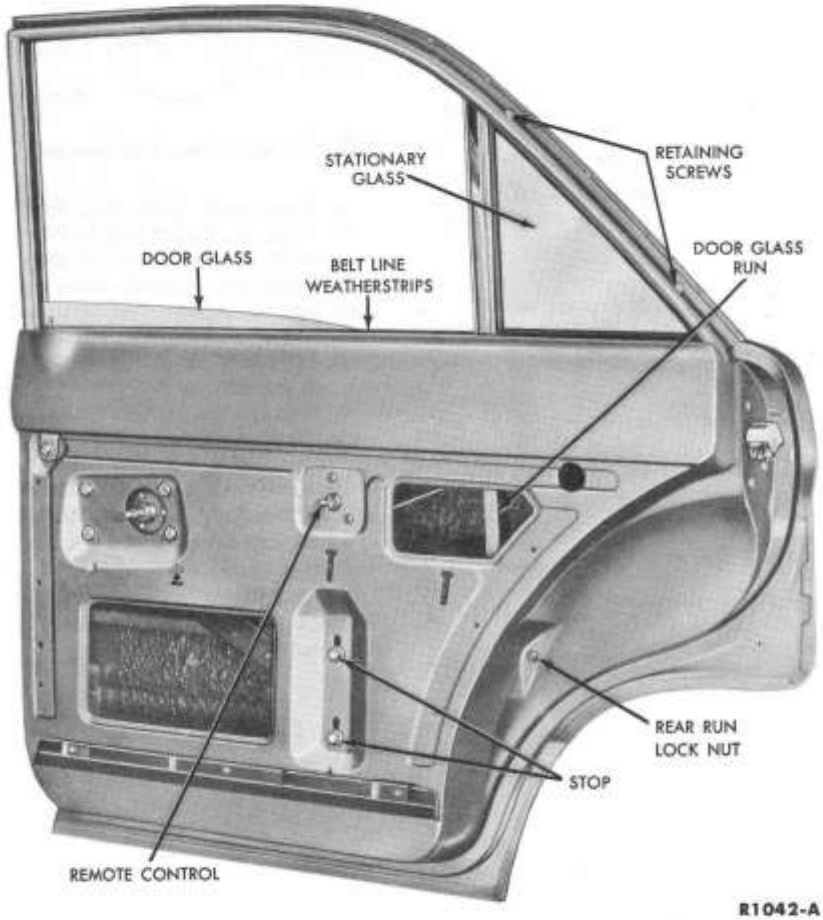

FIG. 7—Rear Door

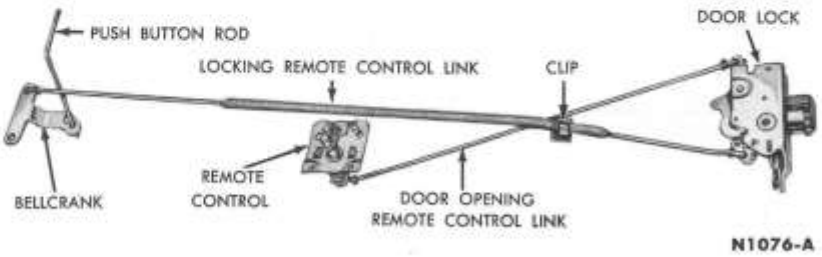

FIG. 8—Rear Door Lock and Remote Control

5. Tilt the rear edge of the glass to the bottom of the door and then remove the glass.
6. Transfer the channel or the glass, using the tool shown in Fig. 1.
7. Simultaneously position the glass and the run in the door, and install the belt weatherstrips.

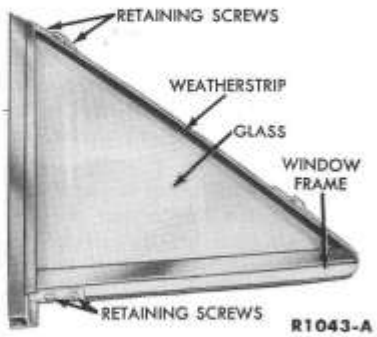

FIG. 9—Stationary Glass

8. Finally position the run, press it into the division bar, and install the run adjustment nut finger-tight.
9. Install the regulator and the stop, adjusting the stop as required.
10. Connect the anti-rattle clip, and make any necessary lateral adjustment in the runs. Tighten the adjustment nuts.
11. Install the water shield, the trim panel upper retainer, and the trim panel.

STATIONARY GLASS REPLACEMENT—SEDAN

1. Remove the rear run adjustment stud lock nut, pry the run from the division bar, and remove the run (Fig. 7).
2. Carefully pull aside the door weatherstrip, remove the window frame retaining screws (Fig. 7), and remove the window frame.
3. Disassemble the window frame (Fig. 9), and install the glass.
4. Install the glass frame in the door, and cement the door weatherstrip in place.
5. Install the run, adjusting it as necessary.

STATIONARY GLASS REPLACEMENT—STATION WAGON

1. Remove the rear door glass.
2. Pull down the upper run from the door frame.
3. From under the door weatherstrip, remove the stationary glass frame retaining screws.

4. Move the stationary glass assembly forward, tilt the assembly, and remove it from the door.

5. Remove the frame retaining screws, and remove the frame and weatherstrip from the glass.

6. Place the weatherstrip on the glass and install the frame. Install the stationary glass assembly in the door and cement the door weatherstrip in place.

7. Simultaneously position the glass and the rear run in the door, and install the belt weatherstrips.

8. Press the rear run into the division bar, and install the run adjustment nut finger-tight. Install the upper run.

9. Install the regulator and the stop, adjusting the stop as required.

10. Connect the lock remote control anti-rattle clip, and adjust the runs as required.

11. Install the water shield, the trim panel upper retainer, and the trim panel.

4 QUARTER WINDOW

ADJUSTMENT

Fore-and-aft adjustment is made at the rear run (Fig. 10). Make this adjustment for a snug fit of the glass within the runs.

MOVABLE GLASS REPLACEMENT

1. Remove the rear seat cushion and back.

2. Remove the trim panel and the trim panel upper retainer. Pull the water shield away from the access hole.

3. Remove the lower and front garnish mouldings.

4. Remove the rear run.

5. Lower the window until the regulator rollers are accessible, and disconnect the front roller from the channel.

6. Lower and tilt the glass as shown in Fig. 11, and remove it.

7. Transfer the channel, using tool shown in Fig. 1.

8. Position the glass in the quarter panel, and connect the front rollers.

9. Install the rear run, adjusting it as necessary.

10. Install the garnish mouldings, the water shield, the trim panel upper retainer, and the trim panel.

11. Install the seat cushion and back.

STATIONARY GLASS REPLACEMENT

1. From inside the car, remove the plug button and the corner garnish moulding from the rear pillar. Remove the nuts retaining the pillar outside moulding studs to the pillar and remove the pillar outside moulding.

2. Remove the quarter panel stationary window outside upper moulding retaining screw at the rear pillar.

3. Working from inside the car, loosen the weatherstrip from the opening flange, and push the quarter panel stationary window, weatherstrip, and mouldings out of the opening.

4. Remove the mouldings and remove the weatherstrip from the glass.

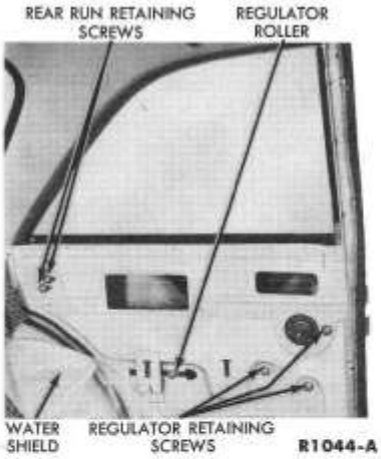

FIG. 10—Quarter Window

5. Using solvent, clean the opening flange and the weatherstrip or glass. Apply a bead of sealer to the window opening.

6. Position the weatherstrip on the glass and install the outside mouldings in the weatherstrip.

7. Position a draw cord in the weatherstrip and apply Ru-Glyde to the weatherstrip surfaces that will contact the window opening flange.

8. Position the window in the opening, and with a helper applying pressure from the outside, use the draw cord to pull the lip of the weatherstrip over the opening flange. Pull the cord across the top and around each lower corner, finishing at the bottom center of the window. Using a sealer gun, apply sealer between the weatherstrip and the inner surface of the glass.

9. Install the outside top moulding retaining screw, pillar moulding, and access hole covers.

FIG. 11—Quarter Window Glass Removal

5 WINDSHIELD AND BACK WINDOW

WINDSHIELD AND/OR WEATHERSTRIP REPLACEMENT

1. Remove the windshield wiper arms and blades.

2. Tape the roof panel at the upper corners to prevent scratching, and remove the moulding joint covers (Fig. 12). The covers are retained by a snap fit.

Since some windshield side mouldings are retained to the pillar by screws, these screws must be removed. The screw heads (hidden by the weatherstrip) can be located by ob-

FIG. 12—Moulding Joint Cover Removal

FIG. 13—Windshield Top Moulding

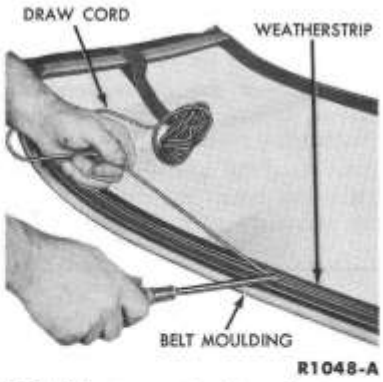

FIG. 14—Draw Cord Installation

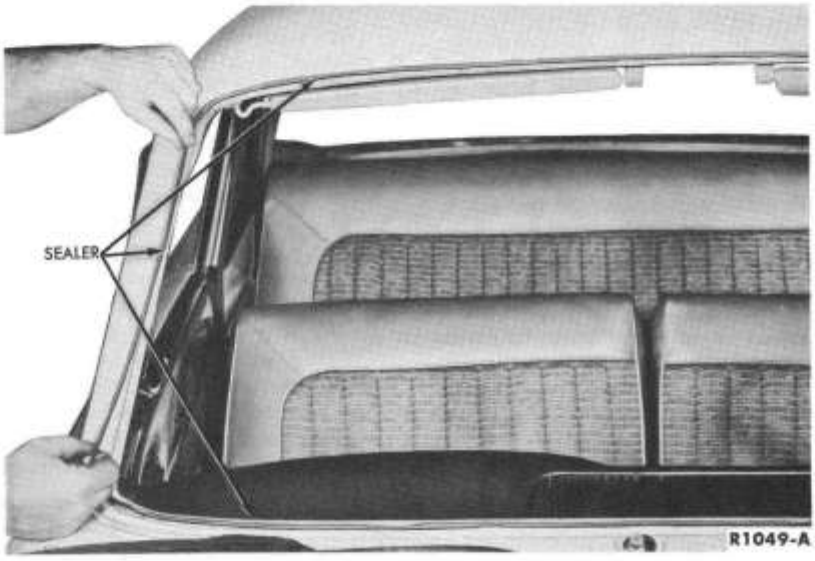

FIG. 15—Sealer Application

FIG. 16—Windshield Installation

serving the weatherstrip along the side moulding edge for a puncture mark.

3. Remove the top moulding retaining screws (Fig. 13).

4. Remove the side garnish mouldings and the rear view mirror.

5. Push outward along the edges of the windshield, and remove the windshield (with the weatherstrip and the outside mouldings).

6. Remove the outside mouldings and then remove the weatherstrip from the glass.

7. Clean the glass or the weatherstrip and the opening flange.

8. Position the weatherstrip on the glass, and then install the outside mouldings in the weatherstrip.

9. Insert the draw cord in the weatherstrip (Fig. 14), and apply Ru-Glyde to the weatherstrip surfaces that will contact the windshield opening flange.

10. Apply a bead of sealer to the windshield opening flange. (Fig. 15).

11. Install the windshield assembly (Fig. 16), using the draw cord to pull the weatherstrip over the

FIG. 17—Back Window Outside Moulding Screw

flange, and then use a caulking gun to apply sealer between the glass and the weatherstrip.

12. Install the rear view mirror and the garnish mouldings.

13. Install the top moulding screws and the moulding joint covers. Remove the tape.

14. Check for leaks, and install the wiper arms and blades.

15. Clean the glass and mouldings.

BACK WINDOW GLASS AND/OR WEATHERSTRIP REPLACEMENT MODELS 58 AND 64

1. After removing the moulding joint covers, remove the outside moulding retaining screws (Fig. 17).

2. Since some rear window side mouldings are retained to the roof panel by metal screws, it will be necessary to remove these screws. The screw head, which is hidden by the weatherstrip, can be located by observing the weatherstrip along the side moulding edge for a puncture mark.

3. Push out the back window, including the weatherstrip and the outside mouldings.

4. After removing the mouldings from the weatherstrip, remove the weatherstrip from the glass.

5. Clean the glass or the weatherstrip. Clean the back window opening, and apply a bead of sealer to the window opening flange.

6. Position the weatherstrip on the glass, and install the outer mouldings in the weatherstrip.

7. Install a draw cord in the weatherstrip, and apply Ru-Glyde to the weatherstrip surfaces that will contact the back window opening flange.

8. Install the back window, using the draw cord to pull the weatherstrip over the flange, and then use a caulking gun to apply sealer between the glass and the weatherstrip.

9. Install the outside moulding retaining screws and the moulding joint covers.

10. Check for leaks, and then clean the glass and mouldings.

BACK WINDOW GLASS AND/OR WEATHERSTRIP REPLACEMENT MODEL 66

1. Remove the screws retaining the garnish mouldings to the roof rear pillars and remove the mouldings.

2. From the outside of the car, pry the weatherstrip loose around the edge of the back window opening. After the bottom and side edges of the weatherstrip are free from the body window opening flange, remove the glass and weatherstrip from inside the car.

3. Remove the weatherstrip from the glass.

4. Clean the glass edge and/or weatherstrip.

5. Clean the back window opening flange.

6. Position the weatherstrip on the glass and install a draw cord in the weatherstrip. Apply Ru-Glyde to the weatherstrip surfaces that will contact the back window opening flange.

7. From inside the car, position the upper edge of the glass and weatherstrip to the window opening. With a helper applying pressure to the window from inside the car, use the draw cord to pull the weatherstrip over the flange.

8. With a caulking gun, apply sealer between the glass and the weatherstrip and between the weatherstrip and the body flange.

9. Install the garnish mouldings, check for leaks, and clean the glass.

6 STATION WAGON TAILGATE WINDOW

POWER WINDOW TROUBLE DIAGNOSIS

WINDOW WILL NOT OPERATE

1. Check for battery voltage on both sides of the 30 ampere circuit breaker. Replace or repair the wiring or replace the circuit breaker as required (Fig. 18).

2. Temporarily separate the red-orange stripe wire connector under the instrument panel and check for battery voltage. Replace or repair the wiring if required.

3. Connect a lead temporarily from the ungrounded side of the 13.5 ampere circuit breaker, in the spare tire well, to a good electrical ground. Operate each of the tailgate window switches. If the window operates, repair or replace the ground wire and/or replace the circuit breaker.

4. In the right taillight area (Fig. 18) separate the blue connector enough to insert a voltmeter test lead and still leave the connector functional. Check for battery voltage at the red-orange stripe lead. Repair or replace the wire if necessary.

5. If the window regulator mechanism failed with the glass raised, remove the window side and upper runs, following the procedure on page 14-13, and open the tailgate. Separate the tailgate motor wire connector and connect one lead of a self-powered test light to the black ground wire. Then with the other lead, test the red (field up circuit), green (armature circuit), and yellow (field down circuit) wires. Repair or replace the defective components.

ONE SWITCH WILL NOT OPERATE PROPERLY

1. With a self-powered test light, test the switch (Fig. 18). The tailgate switch can be tested from the switch wire connector. Replace the switch if necessary.

2. Test the red-orange stripe wire at the switch to assure availability of battery voltage. Repair or replace the red-orange stripe wire as required.

3. Inspect the switch wires for loose connections or an open circuit.

WINDOW WILL NOT GO DOWN

1. In the right taillight area, separate the blue wire connector enough to insert a voltmeter test lead and still leave the wire connector functional. Check for battery voltage at the red-orange stripe lead. If voltage is not available, trace and check the red-orange stripe wire to the battery terminal of the starter relay (Fig. 18) and repair or replace as necessary.

2. With the blue connector in step 1 disconnected, connect a self-powered test light from the yellow female terminal of the connector and the ungrounded side of the 13.5 ampere circuit breaker. A completed circuit will indicate that the wires through the motor and back are good. If the

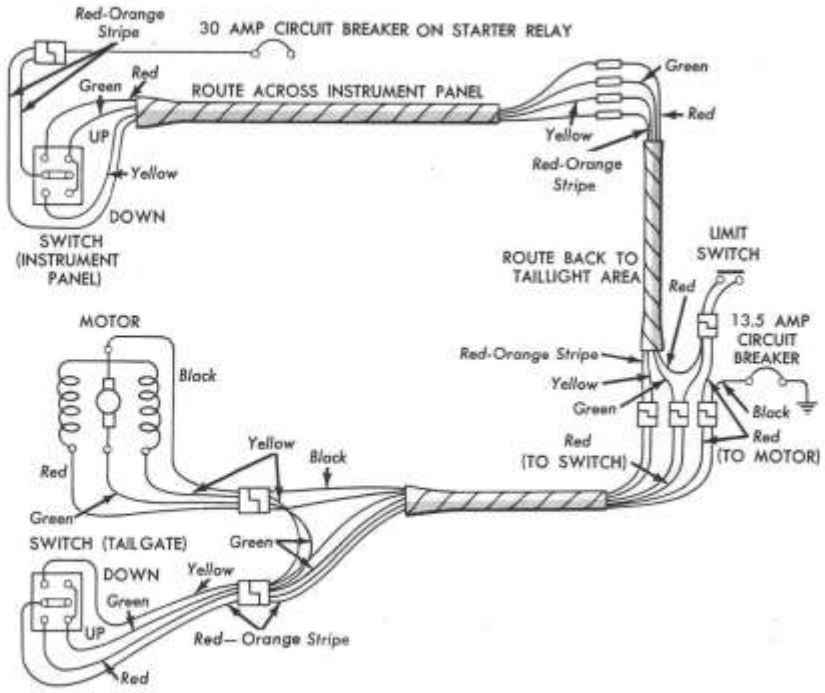

FIG. 18—Tailgate Power Window Wiring Diagram

test light indicates an open circuit, repair or replace the wires or motor as required.

WINDOW WILL NOT GO UP

1. In the right taillight area (Fig. 18), separate the blue wire connector enough to insert a voltmeter test lead and still leave the wire connector functional. Check for battery voltage at the red-orange stripe lead. If voltage is not available, trace and check the red-orange stripe wire to the battery terminal of the starter relay (Fig. 18) and repair or replace as necessary.

2. Disconnect the limit switch wires at the black connector (Fig. 18). Connect a self-powered test light to the limit switch wires and test the switch. The limit switch contacts are open when the tailgate is open. Repair or replace the switch or wires as required.

3. In the right taillight area, disconnect the white wire connector that connects the motor red wire and the black ground wire. Connect a self-powered test light across the male (black) and female (red) terminals of the wire connector. A completed circuit will indicate that the wires through the motor and back are good. If the test light indicates an open circuit, repair or replace the wires or motor as required.

WINDOW ADJUSTMENT

Both tailgate window lower stops can be adjusted up or down to align the glass edge, in the lowered position, with the tailgate.

The tailgate regulator has enlarged mounting holes so that the regulator arms can be aligned to the glass channel.

To adjust the tailgate glass runs, remove the tailgate cover panel and then hold the tailgate in the closed position. Roll up the window and observe the runs for alignment. Lower the window, open the tailgate, and adjust the window runs as required (Fig. 19).

GLASS AND LOWER WEATHERSTRIP REPLACEMENT

1. Open and temporarily support the tailgate.

2. Disconnect the tailgate hinge supports at the tailgate.

3. Remove the tailgate cover panel retaining screws and remove the panel.

4. Remove the window regulator arm roller retaining pins, disconnect the arms from the rollers, and remove the rollers from the glass channel.

5. Remove the window from the tailgate.

6. With a glass remover tool, remove the glass upper retainer, and then remove the glass lower retainer and channel, and weatherstrip.

7. Clean the upper retainer glass groove and then install the glass with glass tape to the upper retainer.

8. Remove the weatherstrip from the glass lower retainer and channel assembly, and then clean the glass groove.

9. Position the weatherstrip into the glass lower channel. Install the weatherstrip and channel to the glass.

10. Slide the window assembly into the glass runs and connect the regulator arms and rollers to the glass lower channel.

11. Apply Lubriplate to the glass rollers and adjust the window lower stops.

12. Clean the old sealer from the tailgate cover panel and apply new sealer.

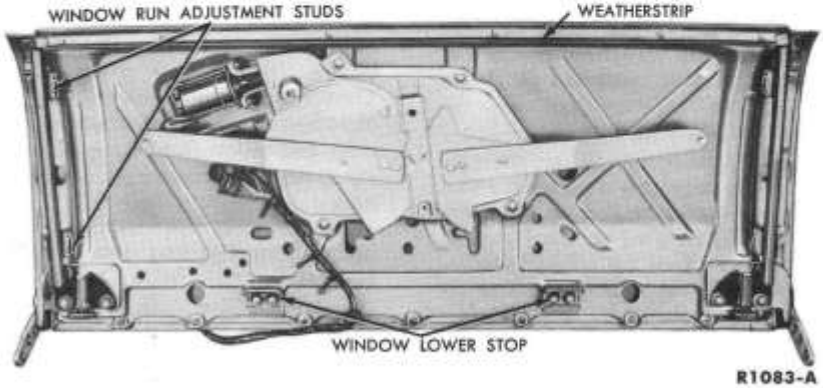

FIG. 19—Tailgate Window Run Adjustments

13. Install the tailgate cover panel to the tailgate.

14. Connect the tailgate hinge supports and remove the temporary support.

WINDOW REGULATOR

If the tailgate window regulator mechanism should fail with the window in a partially closed or closed position, the tailgate can be opened by removing the window side and upper runs.

WINDOW SIDE AND UPPER RUN REPLACEMENT

1. From inside the car, remove the plug button and the corner garnish moulding from the rear pillar.
2. Remove the nuts retaining the pillar outside moulding studs to the pillar and remove the pillar outside mouldings.
3. From inside the car, remove the side and upper run retaining screws from the pillar and roof rails.
4. Release the tailgate latch, and carefully lower the tailgate, window, and runs.
5. Apply M-5397 sealer to the window side and upper run mounting surfaces, and then install the runs.
6. Install the pillar outside mouldings and access hole covers.

MANUAL REGULATOR REPLACEMENT

1. Remove the tailgate window from the tailgate and scribe the regulator mounting location.
2. Remove the regulator retaining bolts and remove the regulator.
3. Place the regulator manual drive spline into the handle, align the regulator, and install the regulator retaining bolts.
4. Install the window in the tailgate.
5. Adjust the window regulator handle as described on Page 14-14 "Handle and Lock Replacement."

POWER REGULATOR REPLACEMENT

1. Remove the tailgate window from the tailgate.
2. Disconnect the motor leads from the wiring harness in the tailgate.
3. Scribe the regulator mounting location, remove the regulator retaining bolts, and remove the regulator with the motor attached.
4. **Do not remove the electric regulator drive assembly for transfer to the new regulator until the regulator counterbalance spring is unloaded.** To unload the regulator counterbalance spring, place the spring in a vise so that the spring can not unwind, disconnect the spring from the outer retaining tab, and then slowly loosen the vise jaws.
5. Remove the screws retaining the regulator drive assembly and the motor to the regulator and remove the drive assembly and motor.
6. Position the drive assembly and motor to the new regulator and install the retaining screws.
7. Drill out the rivets retaining the manual clutch gear and housing assembly to the regulator. Remove and discard the manual drive assembly. **The manual clutch and gear assembly should not be removed until the electric drive assembly is installed.**
8. Install the regulator assembly on the tailgate and align the regulator as required.
9. Connect the wiring harness to the motor and secure the harness in place with the retainer.
10. Install the tailgate window.

REGULATOR MOTOR REPLACEMENT

1. Remove the window from the tailgate.
2. Disconnect the motor wires from the tailgate wiring harness.
3. Remove the nuts and washers retaining the motor to the drive assembly, and then remove the motor with the drive coupling.
4. Transfer the drive coupling to the replacement motor.
5. Position motor and drive coupling to the drive assembly and install the retaining nuts and washers.
6. Connect the motor wires to the tailgate harness and install the wire retainer.
7. Actuate the limit switch and check the operation of the motor.
8. Install the window in the tailgate.

SWITCH REPLACEMENT

LOCK AND SWITCH—ON TAILGATE

1. Remove the window from the tailgate.
2. Remove the regulator.
3. Remove the nuts retaining the lock and switch, and then remove the lock and lock cylinder from the tailgate (Fig. 20).

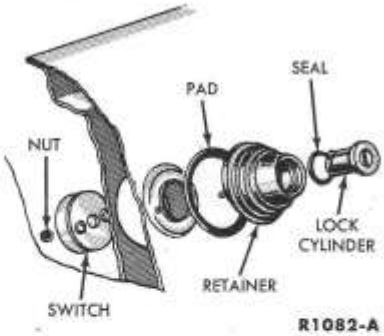

FIG. 20—Tailgate Switch and Lock

4. If the switch requires replacement, disconnect the switch wires from the tailgate wiring harness and remove the switch and wires.
5. To remove the lock cylinder, depress the lock cylinder retaining pin, insert the key and rotate the cylinder until the retaining pin drops, and then remove the lock cylinder.
6. To install the lock cylinder, insert the key in the lock cylinder and slide the cylinder into the retainer.
7. To install the switch assembly, route the wiring harness through the tailgate to the tailgate harness switch connector.
8. Place the lock assembly and gasket to the tailgate and position the switch to the lock assembly. It may be necessary to rotate the lock cylinder to align the switch and the lock. Install the retaining nuts.
9. Install the window regulator.
10. Install the tailgate window.

SWITCH—ON INSTRUMENT PANEL

1. From under the instrument panel, disconnect the tailgate window switch wire connector from the switch.
2. Remove the switch retaining nut and bezel from the instrument panel, and then remove the switch.
3. Position the switch on the instrument panel and install the bezel and retaining nut.
4. Connect the wire connector to the switch and check the switch operation.

LIMIT SWITCH

1. Open the tailgate and remove the inside corner access panel behind the right taillight.
2. Disconnect the limit switch wires from the main wiring harness.

3. Remove the screws retaining the limit switch and remove the switch and wires.

4. Install the limit switch and connect the wires.

5. Install the access panel.

HANDLE AND LOCK REPLACEMENT

1. With the tailgate window in the closed position, unlock the tailgate handle, and rotate the handle assembly to reveal the mounting screws (Fig. 21).

2. Remove the handle mounting screws, and then remove the handle assembly and pad.

3. To remove the lock cylinder turn the key in the cylinder to align the cylinder locking pin with the access hole in the handle assembly. Depress the locking pin and remove the lock cylinder.

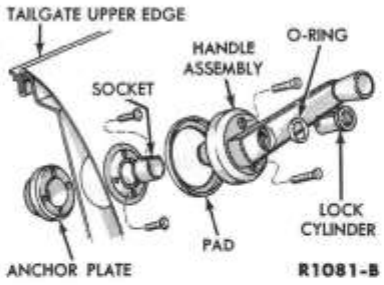

FIG. 21—Tailgate Window Regulator Handle

4. To replace the lock cylinder, transfer the O-rings, and then with the key in the cylinder, install the lock cylinder in the handle assembly.

5. If the window regulator has been replaced, it may be necessary to reposition the handle assembly so that it hangs in a vertical position, with the tailgate window in a closed position. To adjust the handle position, remove the snap ring and socket from the window regulator stem, and then install the socket with the notch at the top (Fig. 21).

6. Install the pad and handle assembly (Fig. 21).

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GROUP 15

BODY INSTALLATION DRAWINGS

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PART 15-2 SOLDER APPLICATION 15-11

PART 15-3 WATER SHIELDS 15-13

PART 15-4 EXTERIOR MOULDINGS 15-14

PART 15-1 BASIC BODY CONSTRUCTION

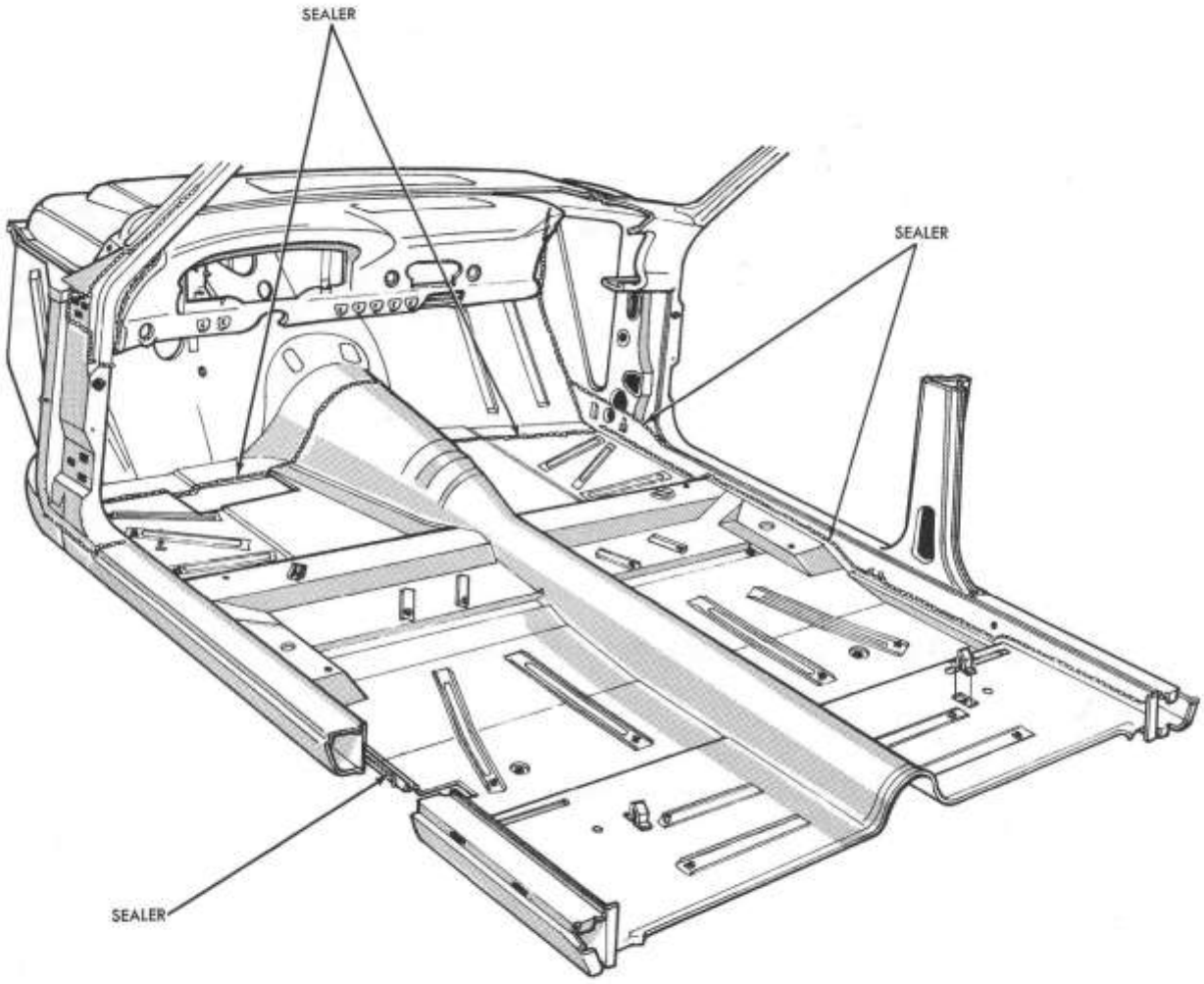

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FIG. 1—Front Floor Pan, Cowl Side, and Instrument Panel

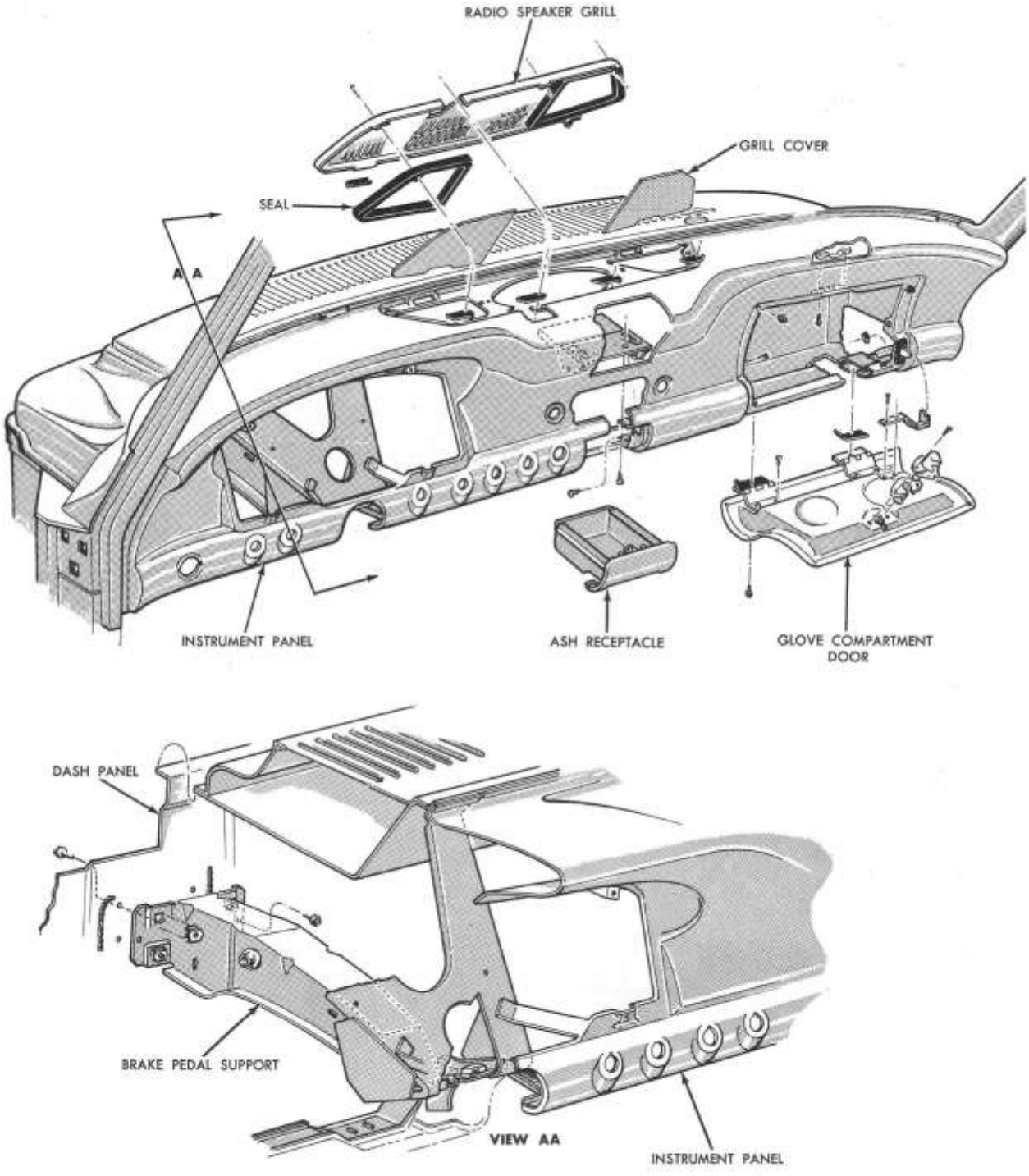


FIG. 2—Instrument Panel and Pedal Support

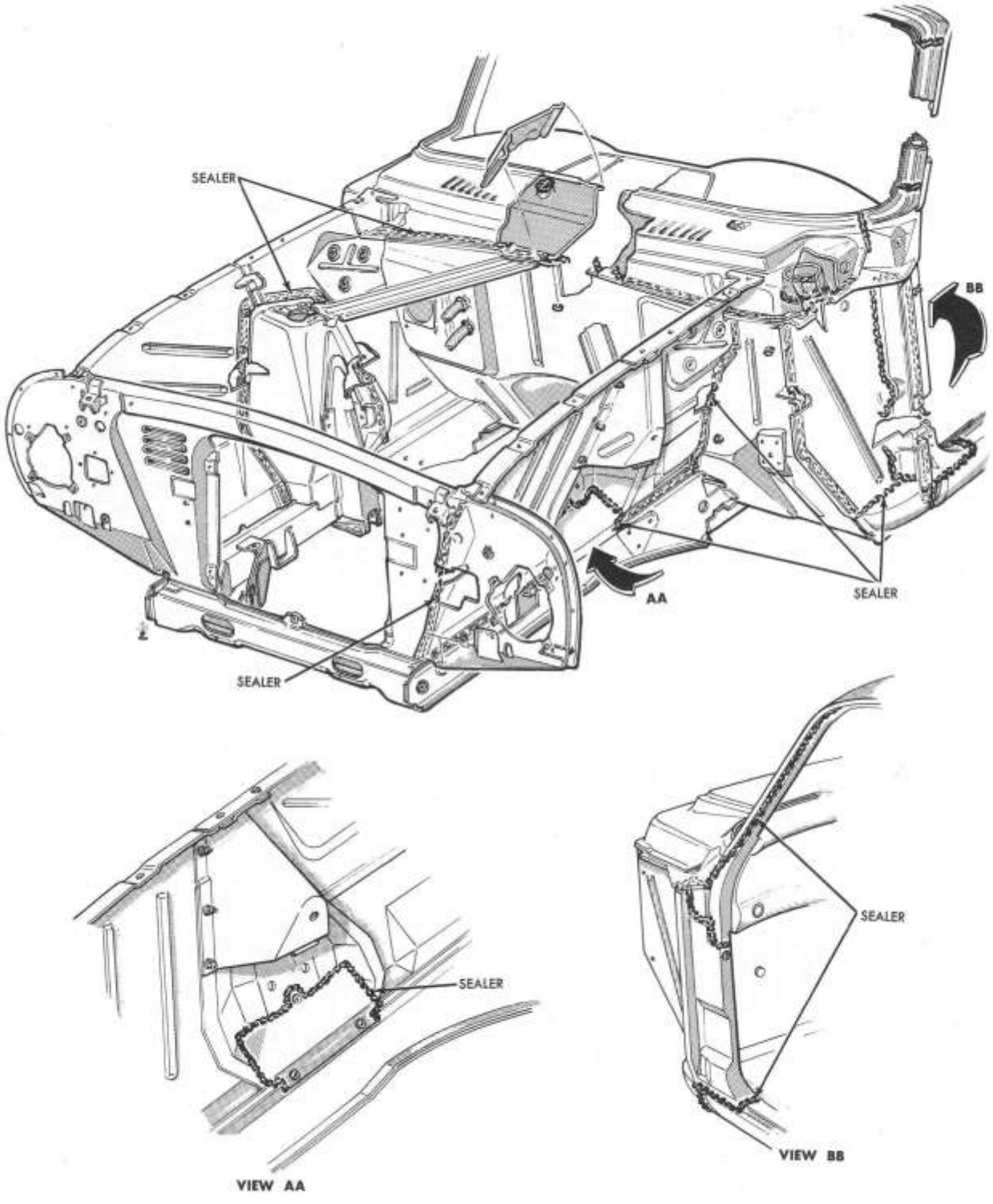


FIG. 3—Radiator Shroud, Cowl, and Fender Apron

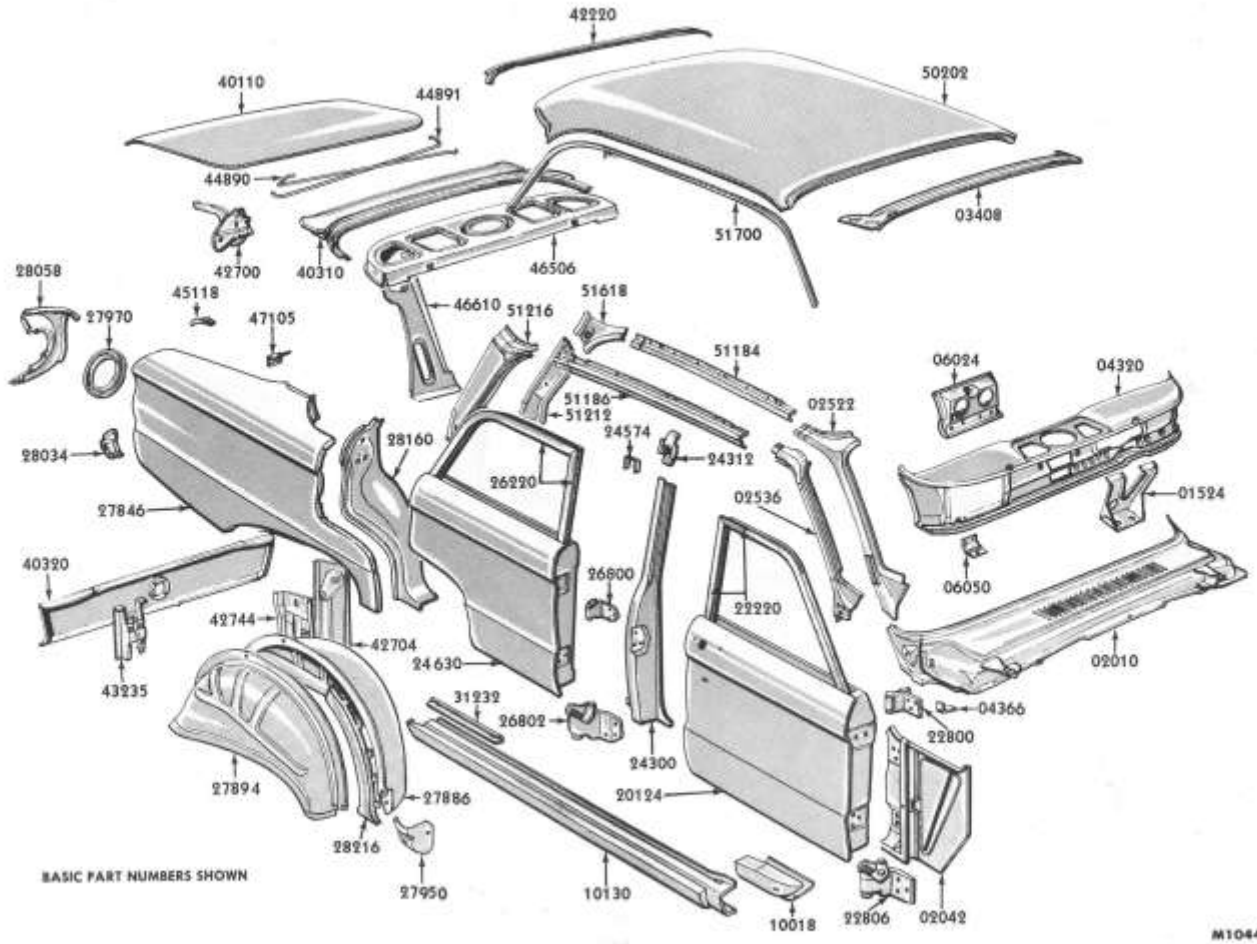


FIG. 4—4-Door Sedan Upper Body

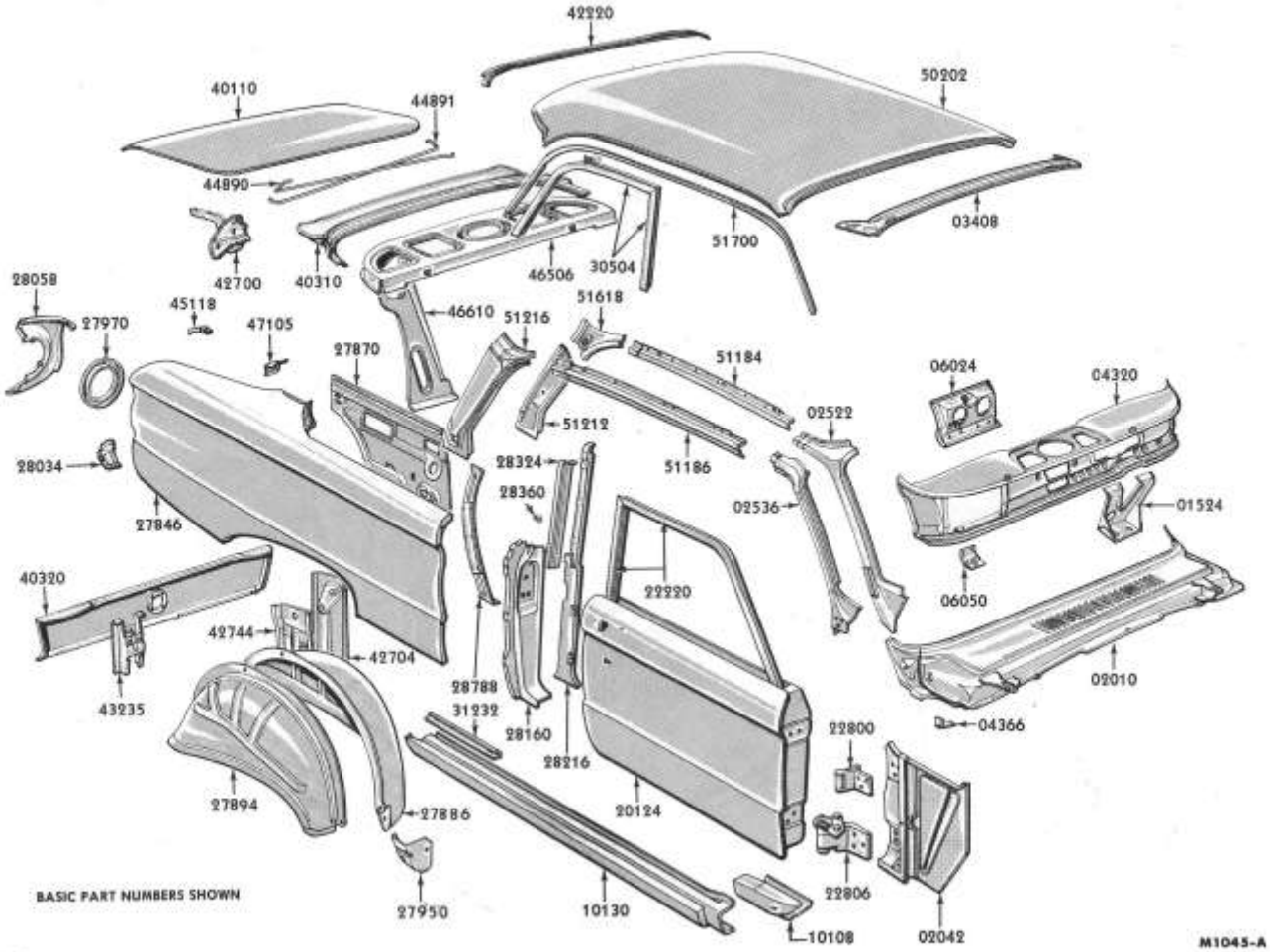


FIG. 5—2-Door Sedan Upper Body

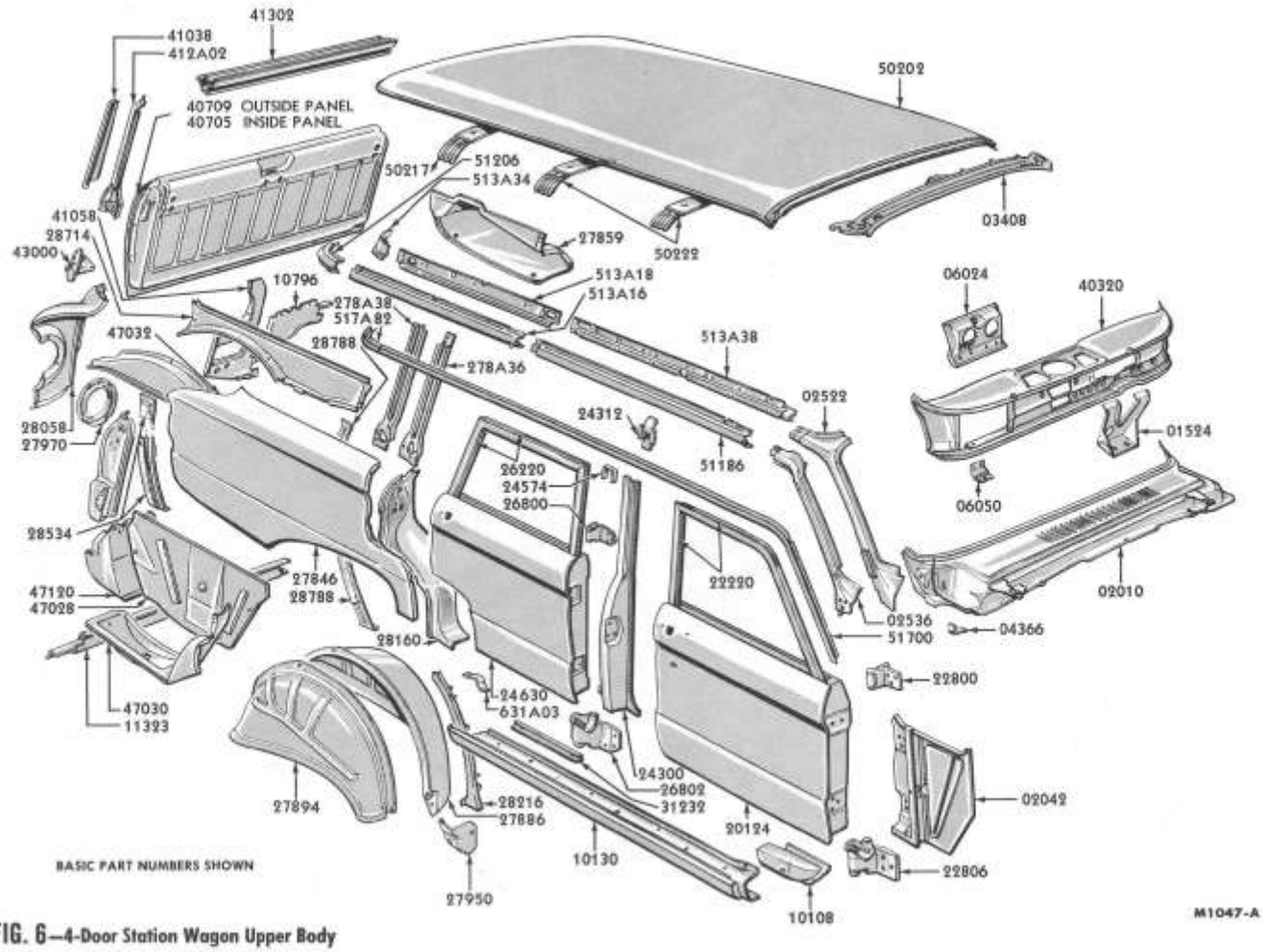


FIG. 6—4-Door Station Wagon Upper Body

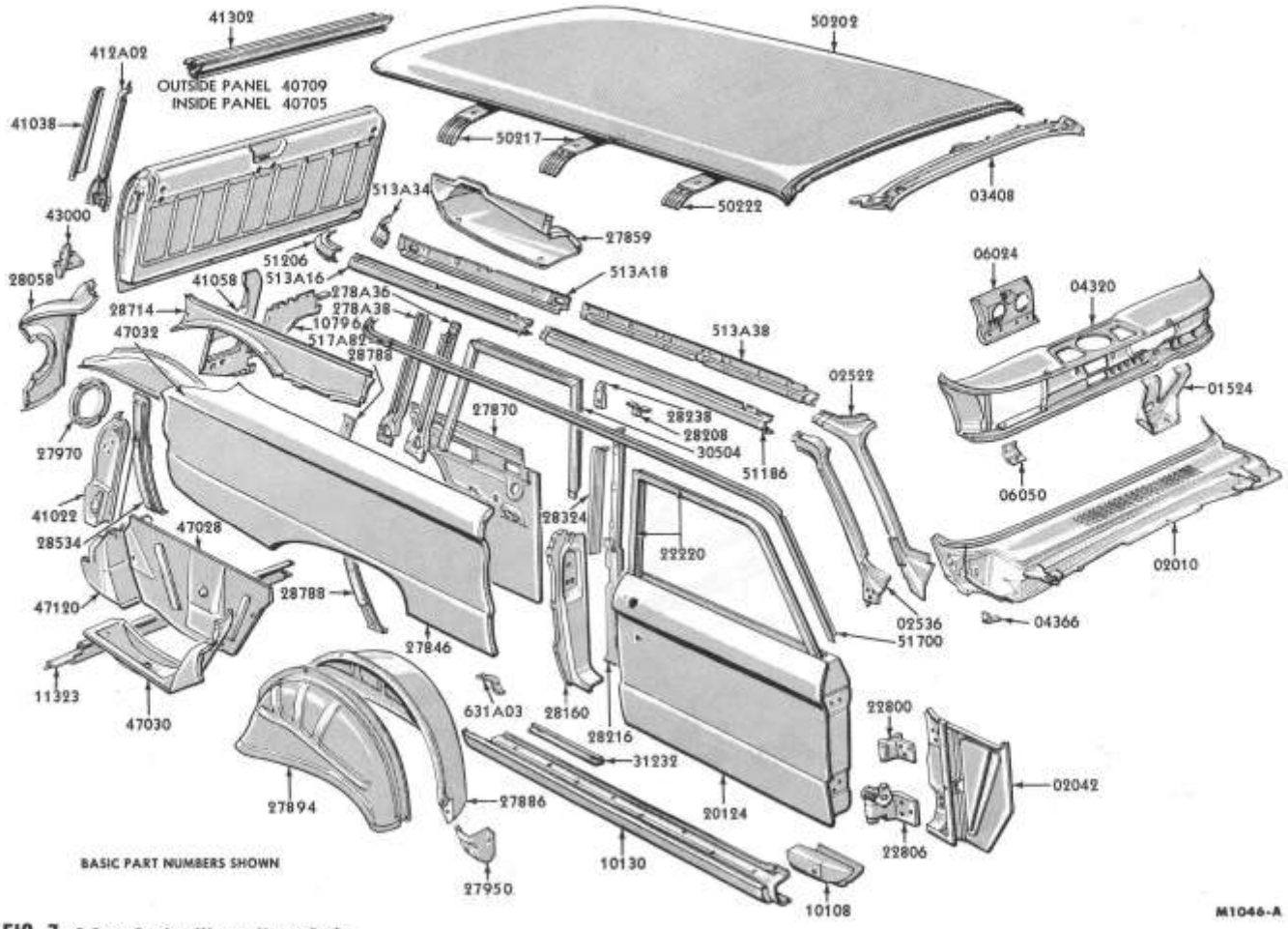


FIG. 7—2-Door Station Wagon Upper Body

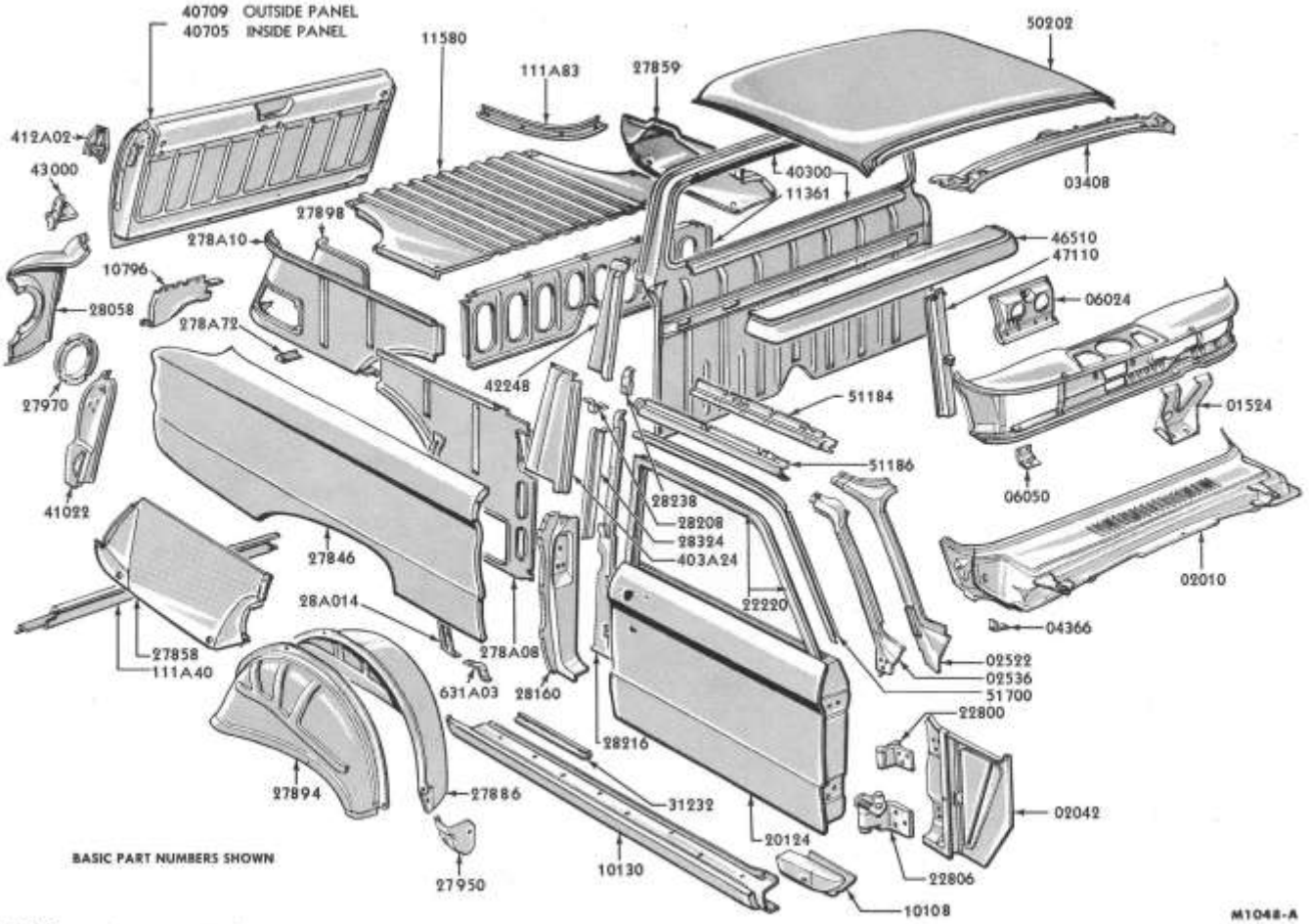


FIG. 8—Ranchero Upper Body

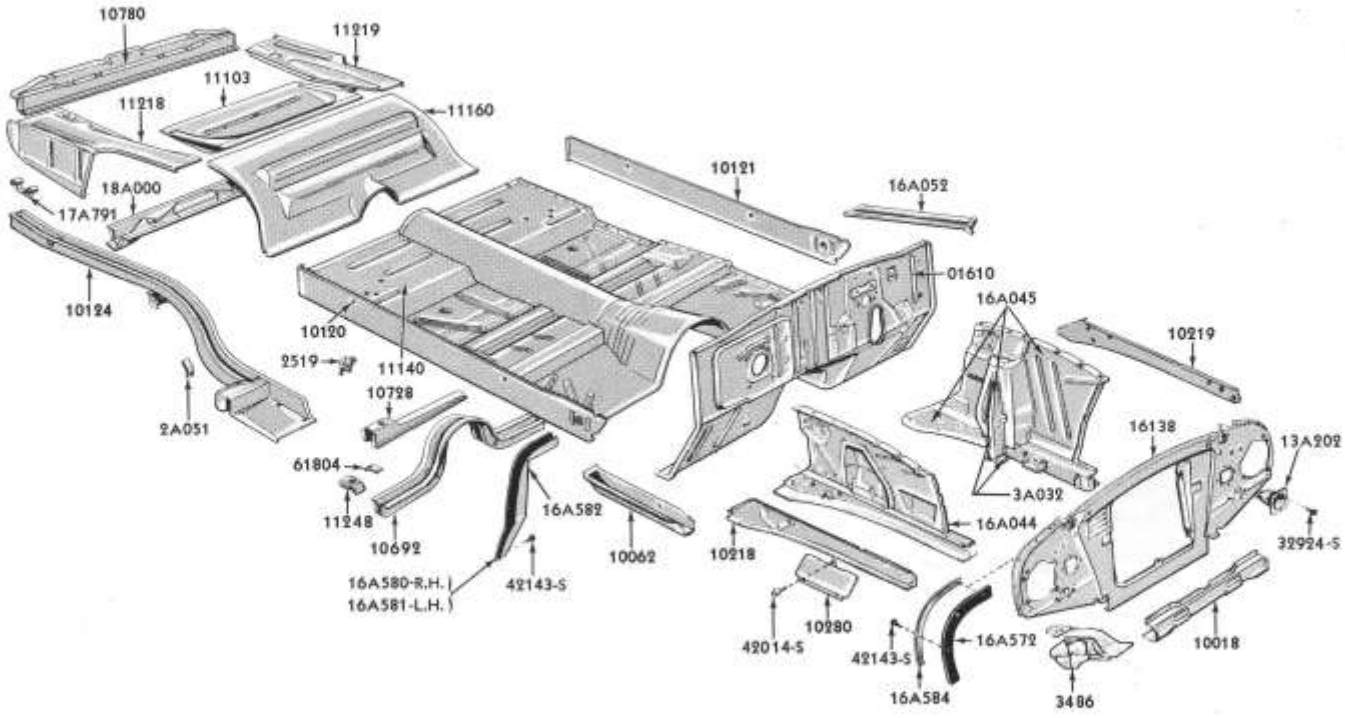


FIG. 9—Underbody

PART 15-2 SOLDER APPLICATION

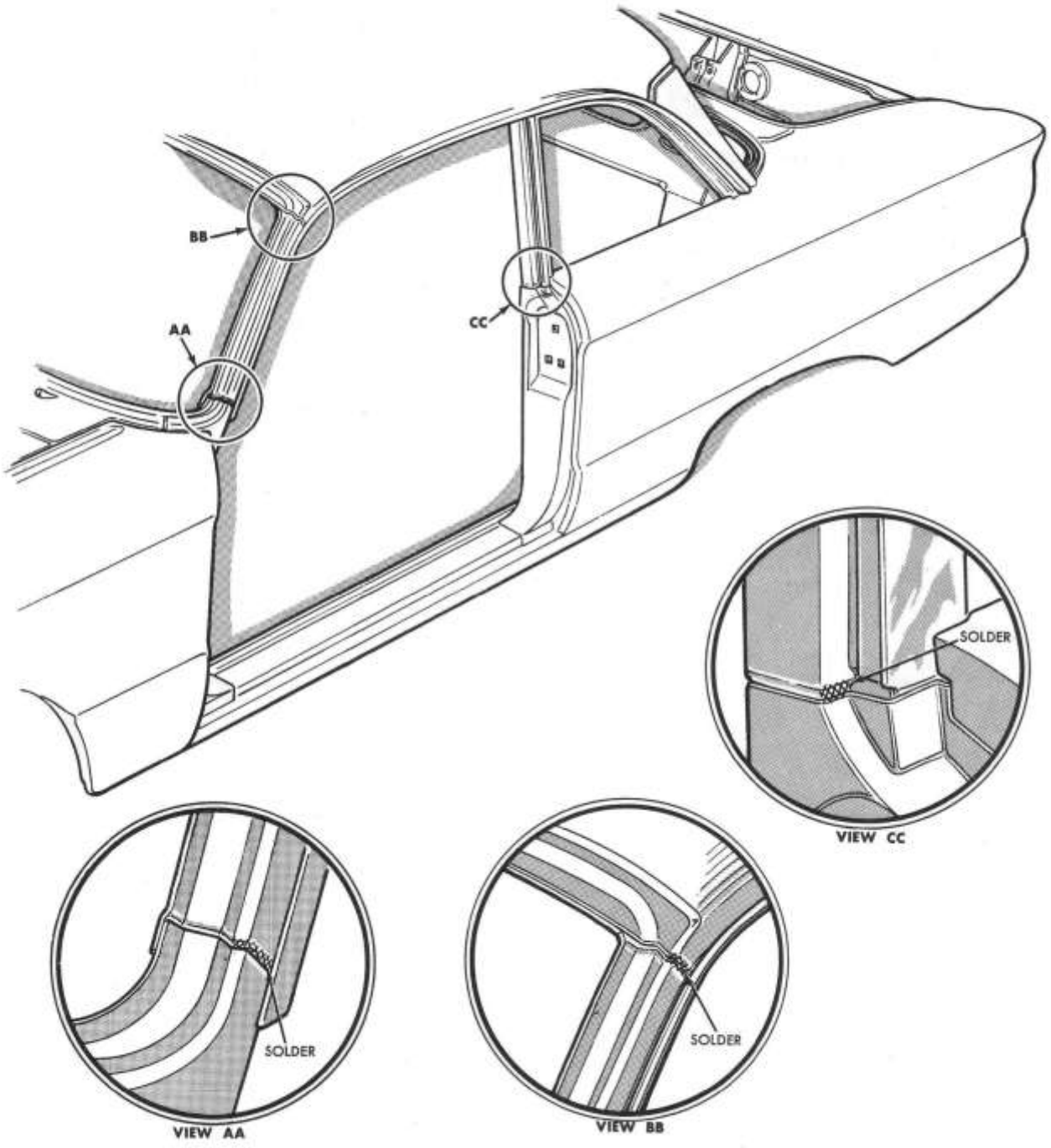


FIG. 1—Solder Application to Body—Models 58 and 64

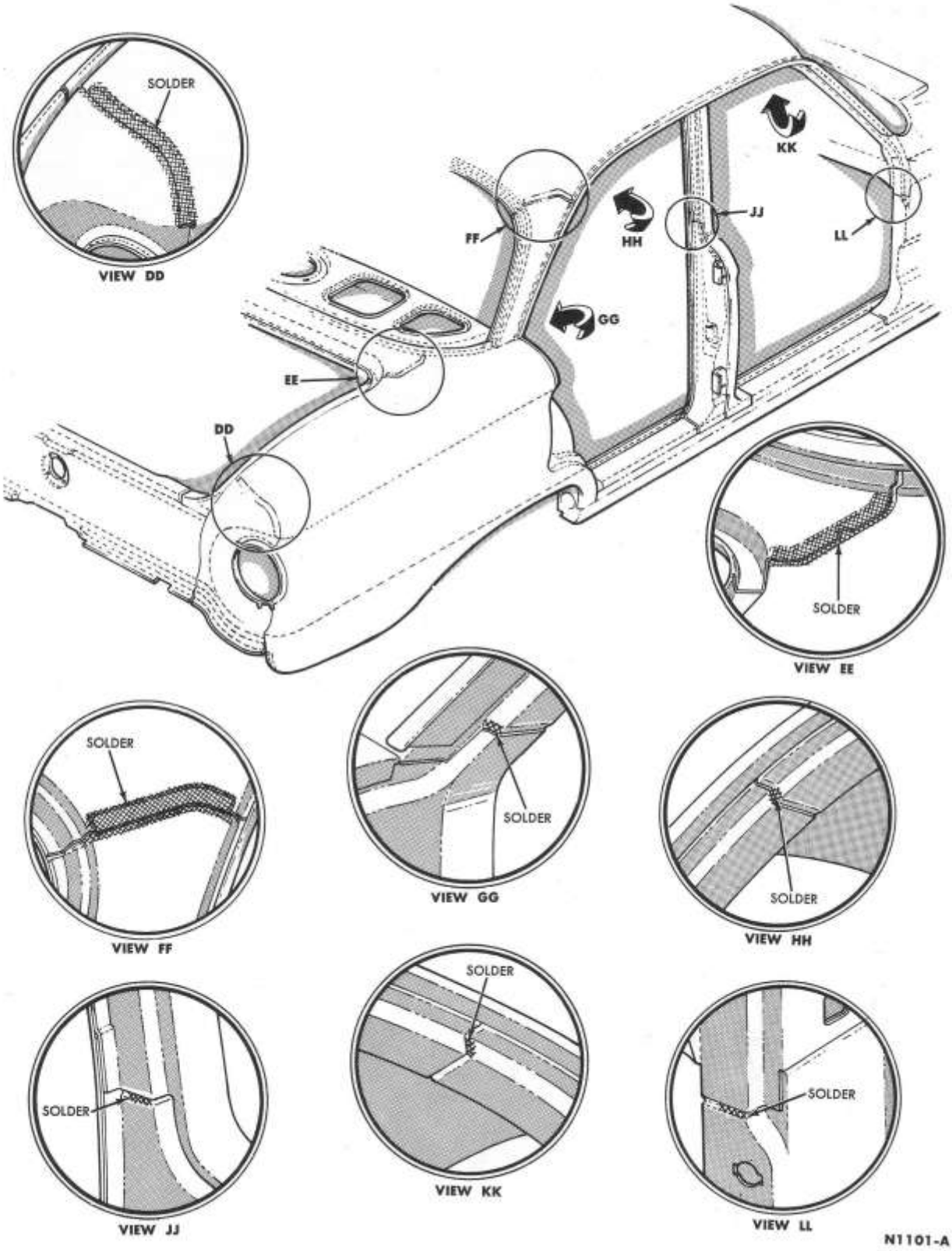


FIG. 2–Solder Application to Body

PART 15-3 WATER SHIELDS

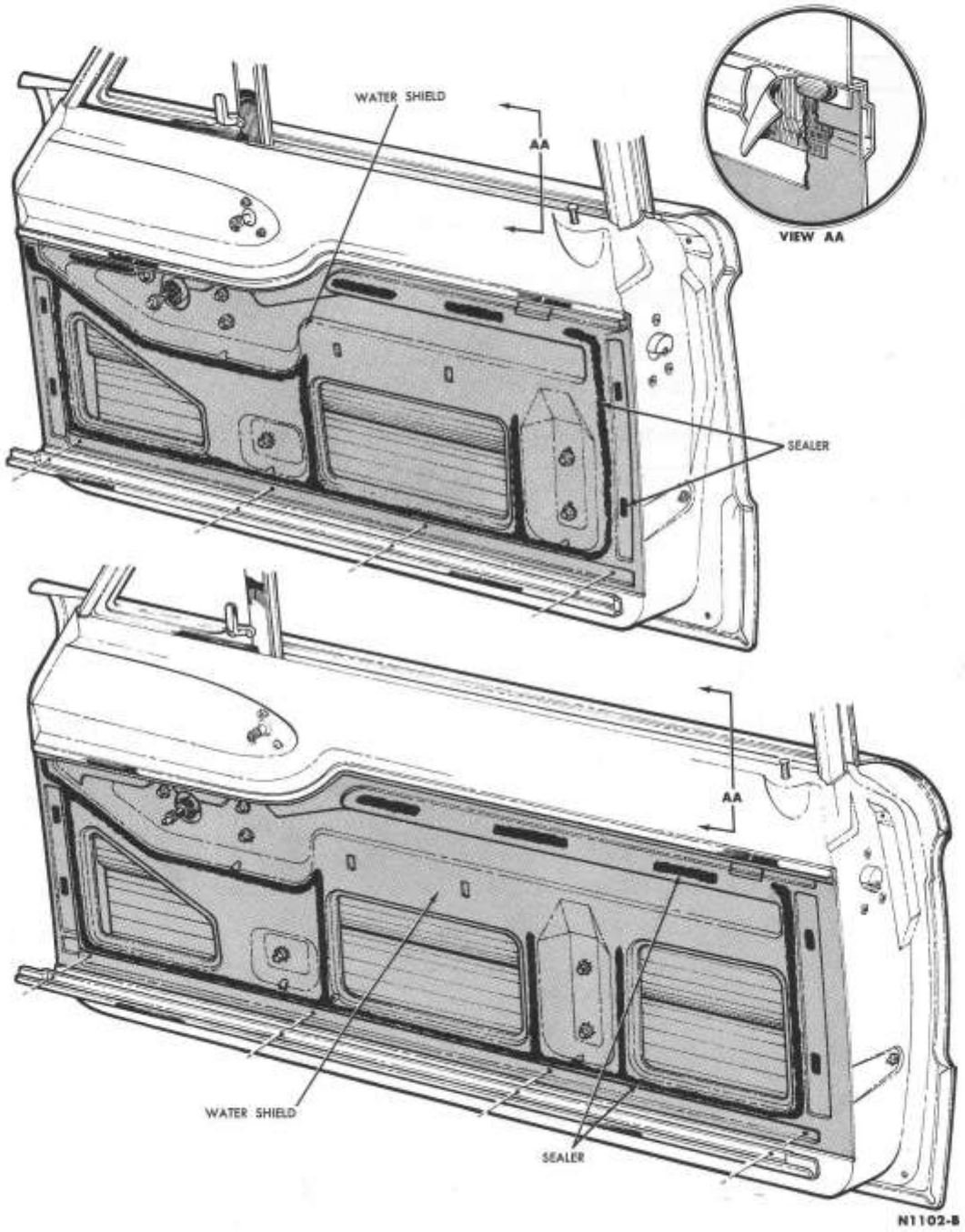
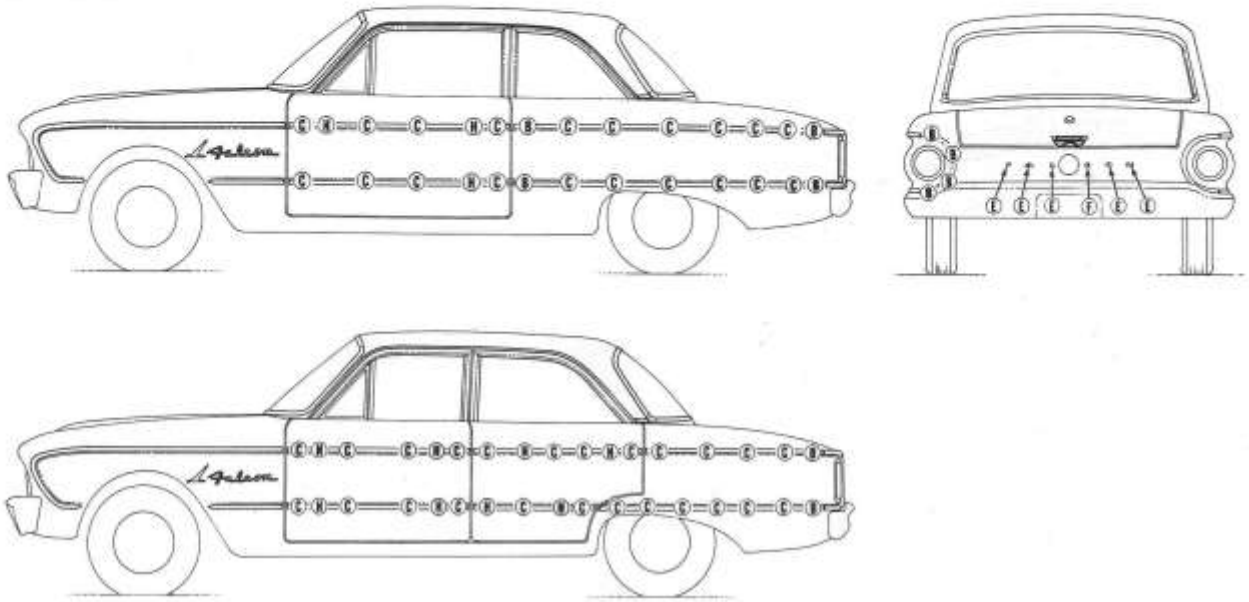


FIG. 1—Typical Door Trim Water Shields

PART 15-4 EXTERIOR MOULDINGS



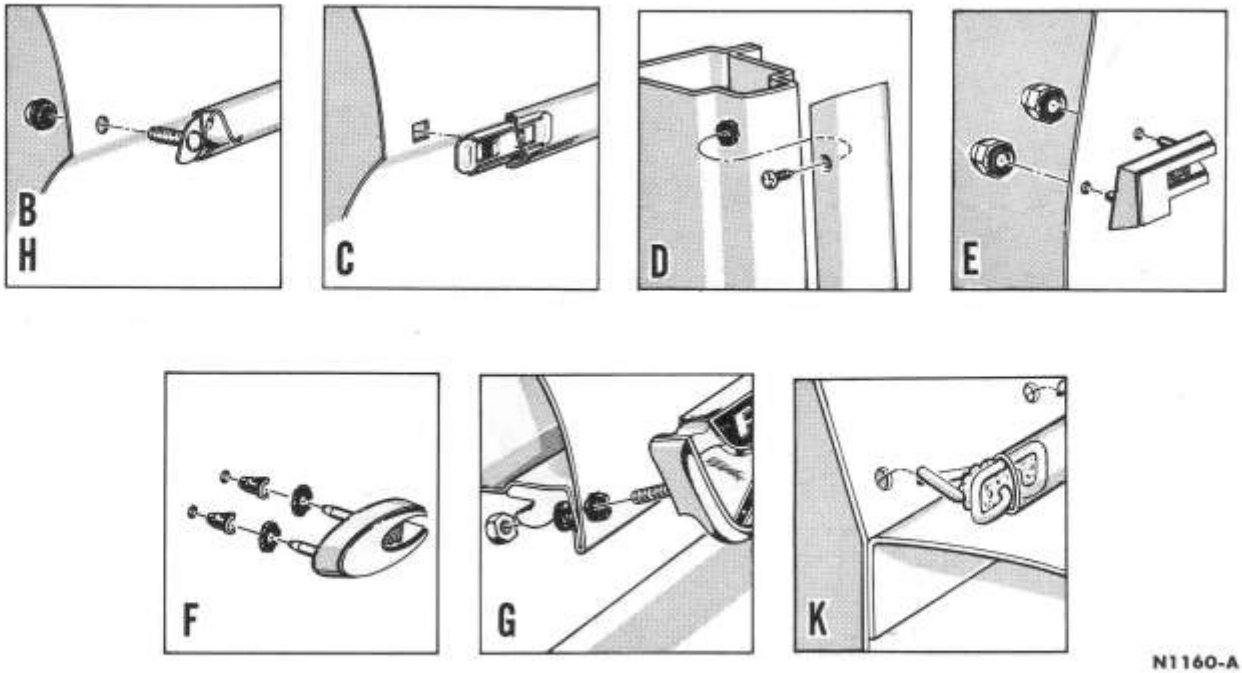


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FIG. 1—Body Exterior Mouldings—Models 64 and 58

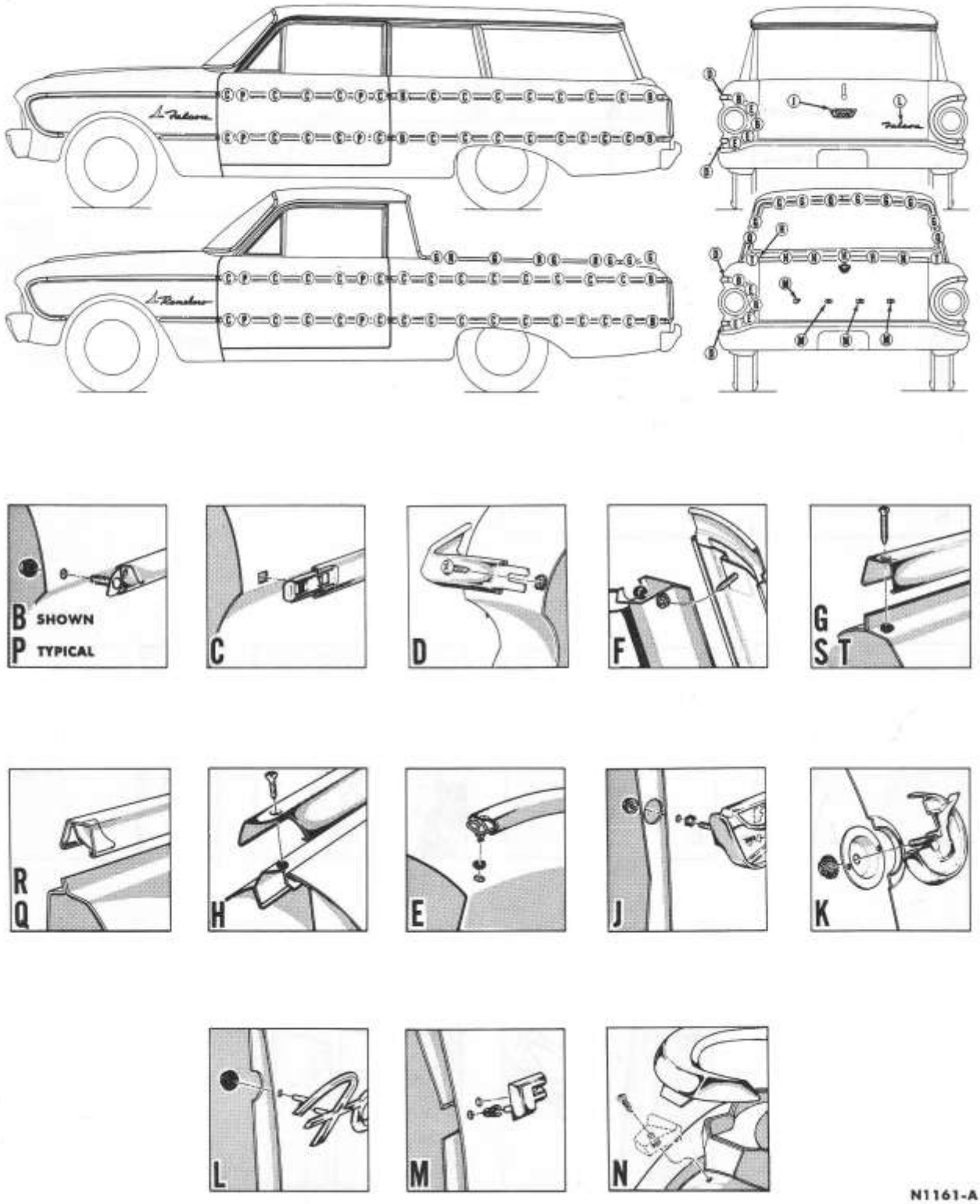

FIG. 2–Body Exterior Mouldings–Models 59 and 66

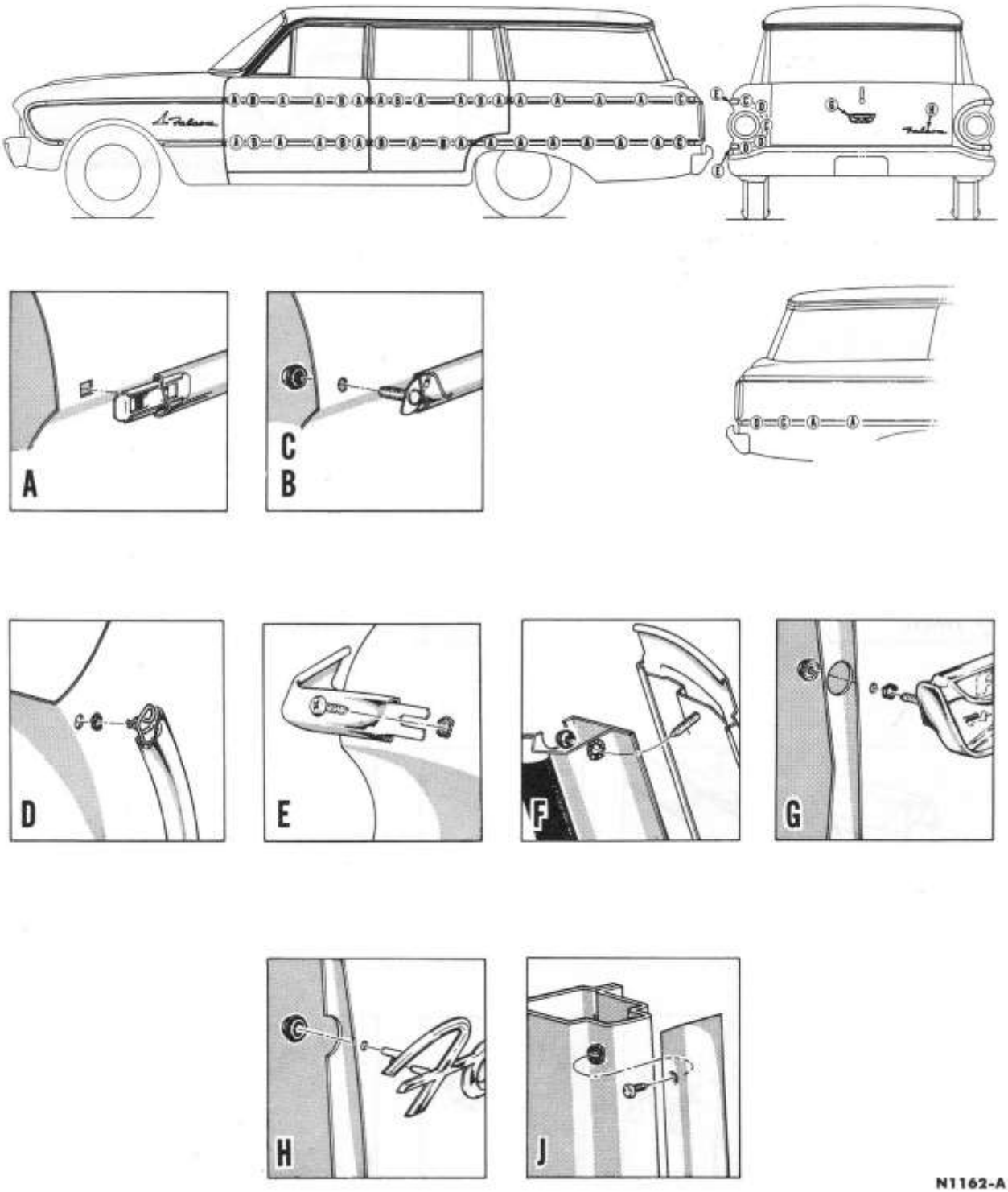

FIG. 3–Body Exterior Mouldings–Model 71

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GROUP 16

MAINTENANCE, LUBRICATION, AND SPECIAL TOOLS

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PART 16-1 MAINTENANCE SCHEDULE 16-2

PART 16-2 MAINTENANCE OPERATIONS 16-3

PART 16-3 SPECIAL TOOLS 16-6

PART 16-1 MAINTENANCE SCHEDULE

Mileage Intervals	Operations
After Each 1000 Miles	Lubricate Front Suspension, Steering Linkage, and Clutch Equalizer Bar
After Each 4000-8000 Miles*	Cross-Switch Tires

*More frequently under severe operating conditions.

Odometer Reading (Miles)	Operations
1000	1000-Mile Inspection
5000	Maintenance Operations A
9000	Maintenance Operations A and B
13,000	Maintenance Operations A and C
17,000	Maintenance Operations A and B
21,000	Maintenance Operations A
25,000	Maintenance Operations A, B, and C
	Replace Carburetor Air Cleaner Element*
	Lubricate Fordomatic Transmission Slip Yoke
	Lubricate Universal Joints
29,000	Maintenance Operations A
33,000	Maintenance Operations A and B
37,000	Maintenance Operations A and C
41,000	Maintenance Operations A and B
45,000	Maintenance Operations A
49,000	Maintenance Operations A, B, and C
	Replace Carburetor Air Cleaner Element*
	Lubricate Fordomatic Transmission Slip Yoke
	Lubricate Universal Joints
53,000	Maintenance Operations A
57,000	Maintenance Operations A and B
61,000	Maintenance Operations A and C
65,000	Maintenance Operations A and B
69,000	Maintenance Operations A
73,000	Maintenance Operations A, B, and C
	Replace Carburetor Air Cleaner Element*
	Lubricate Fordomatic Transmission Slip Yoke
	Lubricate Universal Joints

*Replace more frequently (after each 12,000-18,000 miles) in extremely dusty or sandy areas.

PART 16-2 MAINTENANCE OPERATIONS

MAINTENANCE OPERATIONS A

CHANGE ENGINE OIL	Use Certified Sequence-Tested Engine Oil— SAE 30 or 10W-30 for prevailing temperatures above 90° F SAE 20, 20W, or 10W-30 between 20° F and 90° F SAE 10W or 10W-30 between —10° F and 20° F SAE 5W* or 5W-20 for prevailing temperatures below —10° F *Sustained speeds above 65 mph should be avoided when using SAE 5W engine oils.	Certified sequence-tested engine oils are described on their containers by such phrases as: **meets, excels, exceeds,** or **has proven superior** in the **test requirements, test sequences, MS Service tests, standards,** and **service requirements** of **automotive manufacturers, automakers, car makers,** or **car manufacturers** for **MS Service** or **Service MS.**
REPLACE OIL FILTER	Follow the instructions appearing on the FoMoCo cartridge when mak-	ing an oil filter replacement.
CHECK BATTERY FLUID LEVEL	The level should be maintained at the ring in the bottom of each bat-	tery cell vent well. Do not overfill the battery.
CHECK RADIATOR COOLANT LEVEL	The level should be maintained just below the bottom of the radiator	filler neck.
CHECK FORDOMATIC TRANSMISSION FLUID LEVEL	With the engine running at idle speed, the fluid at a normal operating temperature, and the transmission selector lever at P (park), the level should be maintained at the full mark on the dipstick. Use Ford Automatic	Transmission Fluid C1AZ-19582-A. Equivalent substitute transmission fluids must conform to Ford Specifications M-2C33. See Part 6-2 for complete procedures on checking and adding fluid.
CHECK MANUAL-SHIFT TRANSMISSION LUBRICANT LEVEL	The level should be maintained at the bottom of the filler hole. Use	Ford Lubricant COAZ - 19580 - A (SAE 90).
CHECK REAR AXLE LUBRICANT LEVEL	The level should be maintained at the bottom of the filler hole. Use Ford Lubricant COAZ-19580-A (SAE 90) above —25° F., COAZ-19580-B (SAE 80 below —25° F.	Equivalent substitute rear axle lubricants must conform to Ford Specifications M-2C34 (SAE 90) or M-2C42 (SAE 80).
CHECK BRAKE MASTER CYLINDER FLUID LEVEL	The level should be maintained ½ inch below the top of the filler	opening. Use Heavy-Duty Brake Fluid.
CHECK STEERING GEAR LUBRICANT LEVEL	Remove the lowest bolt in the steering gear housing cover and check the lubricant level. To add lubricant, turn the steering wheel to the left to move the ball nut below the filler	hole, remove the filler plug, and fill until lubricant comes out of the bolt hole. Use Ford Lubricant B8A-19578-A.
CHECK TIRE PRESSURES	The recommended tire pressures are given in Group 17. For considerable high-speed driving and heavy	loads, add 4 to 6 pounds to the recommended cold pressures.

CONTINUED ON NEXT PAGE

MAINTENANCE OPERATIONS A (Continued)

CHECK OPERATION OF ALL LIGHTS AND DRIVING CONTROLS	Check and replace all burned out bulbs and fuses.
LUBRICATE CLUTCH AND BRAKE PEDALS	Apply Engine Oil—SAE 10W.
LUBRICATE ACCELERATOR LINKAGE	Apply Engine Oil—SAE 10W.
LUBRICATE DOOR LATCH STRIKER PLATES	Apply Stick Wax.
LUBRICATE DOOR LOCKS	Apply Lock Lubricant B4A-19587-A.
PERFORM ENGINE TUNE-UP A	Clean and adjust the spark plugs. Adjust the distributor points. Set the initial ignition timing. Clean the air cleaner. Set the engine idle and carburetor idle mixture. Adjust the dashpot clearance (Fordomatic only). Adjust the accelerator link seasonal position.

MAINTENANCE OPERATIONS B

CLEAN BODY AND DOOR DRAIN HOLES	The drain holes are located in the underside of the body side and rocker panels and outboard of the weatherstrip at the bottom of the door. Check the drain holes for obstructions. Use a screwdriver to clear the openings.
LUBRICATE DOOR AND WINDOW WEATHERSTRIPS	Apply Ford Silicone Lubricant COAZ-19553-A or B.
CHECK AND ADJUST STEERING GEAR PRELOAD	Steering gear preload is dependent primarily upon proper steering shaft bearing and sector gear adjustments. See Part 9-1 for detailed adjusting instructions.
PERFORM ENGINE TUNE-UP B	Tighten the drive belt. Clean the distributor cap and rotor. Clean the fuel pump sediment bowl. Replace fuel filter. Clean the positive crankcase ventilation system.

MAINTENANCE OPERATIONS C

LUBRICATE DOOR LATCH ROTORS	Apply Engine Oil—SAE 10W.
LUBRICATE DECK LID LATCH	Apply Lubriplate COAZ-19584-A.
LUBRICATE STATION WAGON OR RANCHERO TAILGATE SUPPORTS	Apply Engine Oil—SAE 10W.
LUBRICATE DOOR, DECK LID, HOOD, AND FUEL FILLER DOOR HINGE PIVOTS	Apply Engine Oil—SAE 10W.
LUBRICATE GLOVE COMPARTMENT DOOR LATCH	Apply engine oil–S.A.E. 10W.
LUBRICATE HEATER AND/OR AIR CONDITIONER CONTROLS	Apply Engine Oil—SAE 10W to all control pivots.
LUBRICATE WINDSHIELD WIPER AND WASHER CONTROL	Apply Engine Oil—SAE 10W to the moveable components of the washer control.
LUBRICATE SPEEDOMETER CABLE	Disconnect the cable housing at the speedometer and remove the cable from the housing. Inspect for kinks or worn spots. Lubricate the cable with Cable Lubricant B5A-19581-A and insert it into the housing. Rotate the cable to seat it all the way into the speedometer driven gear.

CONTINUED ON NEXT PAGE

MAINTENANCE OPERATIONS C (Continued)

CLEAN, REPACK AND ADJUST FRONT WHEEL BEARINGS	Clean the inner and outer bearing cones and rollers in solvent. Remove all lubricant from the hubs and spindles. Inspect all components for	wear or damage. Replace if necessary. Repack bearings with Wheel Bearing Grease and reassemble. See Part 8-2 for detailed procedures.
CHECK HEADLIGHT ALIGNMENT	For safety and conformance to highway regulations, proper headlight alignment should be maintained at all	times. See Part 12-1 for proper headlight alignment procedure.
CHECK EXHAUST SYSTEM FOR LEAKS	Inspect the exhaust manifolds, muffler inlet pipe connections and mufflers for evidence of exhaust leak-	age. Tighten if loose and replace if burned through or cracked.
CHECK REAR AXLE U-BOLT TORQUE	Torque the rear axle U-bolt to 13-20 foot-pounds.	
CHECK SHOCK ABSORBER MOUNTING AND BUSHINGS	With the car weight off the wheels, check the shock absorber mountings for looseness at the ends of the shock absorber. If the mountings are loose,	tighten the mounting bolts. If the rubber bushings are cracked or torn, replace them. See Part 8-3 for replacement procedures.
CHECK REAR SPRING EYE BUSHINGS	With the car weight off the rear wheels, check for looseness at the front end of each rear spring. Inspect	the eye bushings and replace if squashed or crumbled. See Part 8-3 for replacement procedure.
CHECK CONDITION OF BRAKE LININGS	Remove all four drums and inspect linings. If lining thickness is less than	$\frac{1}{32}$ inch above the top of the rivets, replace the linings.
PERFORM ENGINE TUNE-UP C	Check the distributor on a stroboscope. Adjust the distributor advance. Lubricate the distributor cam with Distributor Cam Grease. Lubricate the bushing with Engine Oil—SAE 10W. Clean the cap and rotor. Replace the spark plugs. Check the cylinder compression. Clean, tighten,	and lubricate the battery cable connections. Check the spark intensity. Check the battery charge. Clean carburetor float bowl and adjust fuel lever. Check the fuel pump pressure and capacity. Adjust the valve lash. Inspect the cooling system and engine for leaks.

SPECIAL MAINTENANCE OPERATIONS

LUBRICATE FRONT SUSPENSION, STEERING LINKAGE AND CLUTCH EQUALIZER BAR	Apply chassis lubricant with a pressure gun.	
REPLACE CARBURETOR AIR CLEANER ELEMENT	Remove the air cleaner from the carburetor. Remove the old element and clean the air cleaner body. Insert	a new element and reassemble the components.
LUBRICATE UNIVERSAL JOINTS	Repack with Universal Joint Grease. See Part 7-1 for detailed	procedure.
CROSS-SWITCH TIRES	All tires, including the spare, should be cross-switched as shown in	Part 8-2. Torque the wheel stud nuts to 55-85 ft-lbs.
LUBRICATE FORDOMATIC TRANSMISSION SLIP YOKE	Apply Ford Lubricant B8A-19589-A to the splines. Inspect the rubber bellows-type seal on the end	of the transmission extension housing after removing the drive shaft. If damaged, install a new seal.

PART 16-3 SPECIAL TOOLS

ENGINE

Tool Number	Source	Tool Purpose
835	KRW	Engine Stand (Existing)
1002	KRW	Engine Stand (New)
1009	KRW	Engine Stand (New)—Requires 6005-CF Conversion Flange for Adapters
3600-E	M	Piston Pull Scale
6001-ES	M	Engine Stand
6001-FAB	M	Engine to Repair Stand Mount
6005-X	KRW	Engine to Repair Stand Mount
6110-E	M	Ring Groove Cleaner
6149-3	M	Piston Ring Expander
6149	M	Piston Ring Compressor
6331	M	Main bearing upper insert remover
6505-G	M	Valve Stem Clearance Gauge
6513-CG	M	Exhaust Valve Micrometer
6513-EE	M	Valve Spring Compressor
1011	O	3-Jaw Puller
12132	M	Distributor Shaft Bushing Burnisher
12132-A	M	Distributor Shaft Bushing Replacer
12132-H	M	Distributor Shaft Bushing Remover
12132-N	KRW	Distributor Shaft Bushing Remover
12132-P	KRW	Distributor Shaft Bushing Replacer
12132-Q	KRW	Distributor Shaft Bushing Burnisher
KD-385	KD	Valve Spring Compressor
LM-106	M	Valve Spring Tester
RC-500	S	Ring Groove Cleaner

TRANSMISSION

Tool Number	Source	Tool Purpose
82	S	Socket Type Short Screwdriver
1175-AB	M	Puller Head Adapter—Extension Housing Seal
1175-AE	M	Grease and Oil Seal Remover
3200-32	St	Transmission—High Jack (2-Stage)
7000-DD	M	Rubber Tip Assy.—Replacement Part for 7000-DE Air Nozzle
7059-N	KRW	Snap Ring Pliers
7064	M	Snap Ring Pliers
7688	M	Shift Fork Cam Oil Seal Replacer
7688-N	KRW	Shift Fork Cam Oil Seal Replacer
S-241	S	¾" Double Hex Deep Socket
S-181	S	9/16" Double Hex Deep Socket
TM-410	S	1/16" Double Square Socket

FRONT SUSPENSION

Tool Number	Source	Tool Purpose
483	W	Adjustable Face Spanner—Upper Bearing Retainer Lock Nut Removal and Replacement
2086-L	M	Brake Shoe Return Spring Remover and Replacer
3035-N	KRW	Brake Shoe Return Spring Remover and Replacer
3590-FC	M	Steering Arm Remover
3600-AA	M	Steering Wheel Remover
3600-E	M	Steering Wheel Pull Scale
3600-N	KRW	Steering Wheel Remover
3600-S	KRW	Steering Wheel Pull Scale

REAR AXLE

Tool Number	Source	Tool Purpose
951	O	Pinion Gear Bearing Cone Remover
4201-C	M	Ring Gear Backlash Indicator
4209-C	M	Pinion Tension Scale Socket
4210-P	KRW	Ring Gear Backlash Indicator
4209-C12	M	Pinion Tension Scale

GENERATOR

Tool Number	Source	Tool Purpose
10044-A	M	Generator Pole Screw Wrench

BODY

Tool Number	Source	Tool Purpose
S9538-A	S	Inside Door Handle Remover

Key: KD—K. D. Mfg. Co.
KRW—K. R. Wilson, Inc.
M—Manzel, Inc.
O—Owatonna
S—Snap-on Tool Corp.
St—Stephenson

1961 FORD FALCON SHOP MANUAL

GROUP 17

SPECIFICATIONS

GROUP 17 SPECIFICATIONS

NOTE: All specifications are given in inches unless otherwise noted.

1 ENGINE

GENERAL SPECIFICATIONS

Piston Displacement (Cubic Inches)	144 or 170
Bore and Stroke	144 cu. in.—3.50 x 2.50 170 cu. in.—3.50 x 2.94
Compression Ratio	8.7:1
Engine Fuel Requirements	Regular
Comp. Pressure—Sea Level @ Cranking Spd.	170 ± 10
Brake Horsepower @ Specified Engine rpm	144 cu. in.— 85 @ 4200 170 cu. in.—101 @ 4400
Torque—(Ft.-Lbs.) at Specified Engine rpm	144 cu. in.—134 @ 2000 170 cu. in.—156 @ 2400
Firing Order	1-5-3-6-2-4
Valve Arrangement (Front to Rear)	E-I-I-E-I-E-E-I-E-I-I-E
Taxable Horsepower (SAE)	29.4
Engine Idle rpm: Conventional Transmission	500-525
Fordomatic (Drive range)	475-500
Engine Idle Manifold Vacuum—Minimum Inches Hg. @ Specified Engine Idle rpm (Sea Level)	18
Initial Ignition Timing—B.T.D.C. Conventional Transmission	4° *
Fordomatic	10°
Allowable Range	2°-10°
Crankcase Oil Capacity—Quarts (Add 1 quart with filter change)	3½
Oil Pressure (psi) Hot @ 2000 rpm	35-55

*5000 ft. altitude or over, 10° all engines.

CAMSHAFT AND TIMING CHAIN

Journal Standard Diameter		1.8095-1.8105
Journal Maximum Out of Round		0.0005
Journal to Bearing Clearance —Wear Limit		0.001-0.003 0.006
Timing Chain Deflection		0.5
Camshaft Lobe Lift	Int.	0.2405
	Exh.	0.2395
Max. Allowable Lobe Lift Loss—Int. & Exh.		0.005
Camshaft End Play —Wear Limit		0.003-0.007 0.012

CAMSHAFT BEARINGS

Inside Diameter—Assembled	1.8115-1.8125
Location in Relation to Front Face of Block Cam Bearing Bore—No. 1 Bearing Only—Below	0.115-0.125

CYLINDER HEAD

Gasket Surface Flatness	0.002 in any 6 inches or 0.006 inch overall
Valve Guide Bore Diameter—Intake and Exhaust	0.3115-0.3125
Valve Seat Width—Intake and Exhaust	0.070-0.080
Valve Seat Angle—Intake and Exhaust	45°
Valve Seat—Maximum Runout —Wear Limit	0.002 0.0025

VALVE MECHANISM

Valve Lash—Intake & Exhaust		0.016
Valve Stem Diameter—Standard	Int.	0.3100-0.3107
	Exh.	0.3090-0.3097
Valve Stem Diameter 0.003 O.S.	Int.	0.3130-0.3137
	Exh.	0.3120-0.3127
Valve Stem Diameter 0.015 O.S.	Int.	0.3250-0.3257
	Exh.	0.3240-0.3247
Valve Stem Diameter 0.030 O.S.	Int.	0.3400-0.3407
	Exh.	0.3390-0.3397
Valve Stem to Valve Guide Clearance	Int.	0.0008-0.0025
	Exh.	0.0018-0.0035
—Wear Limit	Int.	0.0045
	Exh.	0.0055
Valve Head Diameter	Int.	144 cu. in. 1.462-1.472 170 cu. in. 1.522-1.532
	Exh.	1.261-1.271
Valve Face Angle—Int. & Exh.		44°
Valve Face Maximum Runout (Int. & Exh.) —Wear Limit		0.0015 0.002
Valve Spring Free Length (Approximate)		2.00
Valve Spring Maximum Out of Square		0.069
Valve Spring Pressure (Lbs.)—Specified Length —Wear Limit		47.75-56.25 @ 1.585 0.40 @ 1.585
Valve Spring Pressure (Lbs.)—Specified Length —Wear Limit		112-122 @ 1.222 101 @ 1.222
Valve Spring Assembled Height		1 5/16-1 3/64
Valve Push Rod Maximum Runout		0.025
Valve Tappet Diameter		0.8740-0.8745
Valve Tappet to Tappet Bore Clearance		0.0005-0.0020
Rocker Arm to Rocker Shaft Clearance —Wear Limit		0.002-0.004 0.006
Rocker Arm Shaft Outside Diameter		0.780-0.781
Rocker Shaft Bore Diameter		0.783-0.784

CRANKSHAFT

Main Bearing Journal Standard Diameter	Coded Red	2.2486-2.2490
	Coded Blue	2.2482-2.2486
Main Bearing Journal Maximum Runout —Wear Limit		0.0025 0.0035
Connecting Rod and Main Bearing Journal Maximum Out-of-Round —Wear Limit		0.0004 0.0006
Connecting Rod and Main Bearing Journal Maximum Taper —Wear Limit		0.0003 0.001
Thrust Bearing Journal Length		1.275-1.277
Main Bearing Journal Thrust Face Maximum Runout		0.001
Connecting Rod Journal Diameter	Coded Red	2.1236-2.1240
	Coded Blue	2.1232-2.1236
Crankshaft Free End Play —Wear Limit		0.004-0.008 0.012
Assembled Flywheel Clutch Face Maximum Runout		0.010
Assembled Flywheel Outside Diameter Runout		0.007

MAIN BEARINGS

Journal Clearance—Copper Lead		0.0006-0.0025
Bearing Wall Thickness—Copper Lead	Red	0.0754-0.0759
	Blue	0.0758-0.0763

CONNECTING ROD

Piston Pin Standard Inside Diameter		0.9107-0.9112
Bearing Bore Diameter	Coded Red	2.2390-2.2394
	Coded Blue	2.2394-2.2398
Bearing Bore Maximum Out-of-Round		0.0002
Bearing Bore Maximum Taper		0.0002
Connecting Rod Length (Center to Center)		4.854-4.856
Connecting Rod—Maximum Twist Total Difference		0.012
Connecting Rod—Maximum Bend Total Difference		0.004
Connecting Rod Assembly (Assembled to Crankshaft) Side Clearance —Wear Limit		0.004-0.011 0.014

CONNECTING ROD BEARINGS

Bearing to Crankshaft Clearance		0.0005-0.0027
Bearing Wall Thickness	Red	0.0569-0.0574
	Blue	0.0573-0.0578
	0.002 U.S.	0.0583-0.0588

PISTON

Standard Piston Diameter at Bottom of Skirt	Red	3.4976-3.4982
	Blue	3.4988-3.4994
Piston to Bore Clearance—Bottom of Skirt		0.0018-0.0036

PISTON PIN

Piston Pin Dia. Standard (Coded Green)	0.9120-0.9123
Piston Pin Length	3.010-3.030
Piston Pin to Piston Clearance (Loose) —Wear Limit	0.0001-0.0003 0.0008

PISTON RINGS

Ring Width—Compression—Upper Lower	0.0774-0.0781 0.0770-0.0780
Side Clearance—Compression—Upper Lower	0.0024-0.0041 0.0025-0.0045
Piston Ring Gap Width—Compression (Upper and Lower)—Standard Bore	0.010-0.020
Side Clearance—Oil	Snug
Gap Width—Oil—Standard Bore	0.015-0.055 Spacer

CYLINDER BLOCK

Cylinder Bore Std. Diameter Spread for 8 Grades		3.5000-3.5036
Minimum Cyl. Wall Thickness Std. Bore		0.170
Cylinder Bore Maximum Out-of-Round —Wear Limit		0.001 0.003
Cylinder Bore Maximum Taper —Wear Limit		0.001 0.005
Main Bearing Bore Diameter	Coded Red	2.4012-2.4016
	Coded Blue	2.4016-2.4020
Head Gasket Surface Flatness		0.002 in any 6 inches or 0.006 inch overall

OIL PUMP

Relief Valve Spring Tension (lbs.)	8.6-9.5 @ 1.078
Relief Valve Clearance	0.0015-0.0029
Drive Shaft to Housing Bearing Clearance	0.0015-0.0029
Rotor Assembly End Clearance (Pump Assembled)	0.0011-0.0041
Outer Race to Housing—Radial Clearance	0.006-0.012
Rotor Assembly Face to Drive Shaft End	2.36-2.38

TORQUE LIMITS

	Foot-Pounds
Main Bearing Cap Bolts (Oiled)	65-75
Cylinder Head Bolts (Oiled)	65-75
Oil Pan to Cylinder Block	7-9
Flywheel to Crankshaft	75-85
Exhaust Manifold to Cylinder Head	13-18
Oil Pump to Cylinder Block	12-15
Oil Pump Cover Plate	6-9
Camshaft Thrust Plate to Cylinder Block	12-15
Cylinder Front Cover	6-9
Water Outlet Housing	12-15
Oil Pan Drain Plug	15-20
Crankcase Ventilation Tube to Engine	6-9
Rocker Arm Cover	3-5
Camshaft Sprocket to Camshaft	35-45
Damper or Pulley to Crankshaft	45-55
Connecting Rod Nuts	19-24
Rocker Shaft Support to Cylinder Head	30-35
Water Pump to Cylinder Block	12-15
Oil Tube to Oil Pump	12-15
Oil Filter Adapter to Cylinder Block	50-60
Valve Rocker Arm Adjusting Screw (Self-Locking)—Minimum Torque to Rotate	3
Fuel Pump to Cylinder Block	12-15
Engine Front Support—Insulator Assembly to Engine Bolts	18-24
Insulator Assembly to Attaching Bracket Lock Nut	11-15
Engine Rear Support—Support Retainer to Insulator Lock Nuts	11-15
Support Assembly to Body Lock Nuts	10-15
Bracket and No. 2 Crossmember to Body Lock Nut	20-28
Insulator to Transmission Extension Bolts	18-24
Insulator Assembly Nuts	18-24
Support to Transmission Extension Bolts	
Conventional Transmission	37-42
Fordomatic Transmission	18-24
Fan and Pulley Assembly to Engine	10-15

2 IGNITION SYSTEM

DISTRIBUTOR

Initial Advance Crankshaft Degrees (BTC)	Min.	Max.	Breaker Arm Spring Tension (Ounces)	Contact Spacing	Dwell Contact at Idle Speed
Conventional Drive	2°	10°	17-20	0.024-0.026	35°-38°
Fordomatic	4°	10°	17-20	0.024-0.026	35°-38°

VACUUM ADVANCE CHARACTERISTICS

144 Cu. In. Engine

Distributor CODF–12127-A

Standard Transmission

Set test stand to 0° @ 1000 rpm and 0 inches of Mercury

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
400	0	0.33
600	½-1½	0.78
800	3½-4½	1.30
1400	10 -11¼	3.45
1800	12½-13¾	5.00
2000	12¾-14	5.35
Maximum Advance Limit		15¼°

Distributor CODF–12127-B

Automatic Transmission

Set test stand to 0° @ 60° rpm and 0.48 inches of Mercury

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
700	0	0.65
1000	1¼-2¼	1.27
1600	4¼-5¼	2.93
2000	5¾-7	3.94
Maximum Advance Limit		15¾°

170 Cu. In. Engine

Distributor CIDF–12127-B

Standard Transmission

Set test stand to 0° @ 45° rpm and 0 inches of Mercury

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
700	1½-2½	0.43
1000	5¼-6¼	0.92
1300	7½-8¾	1.50
1700	10 -11¼	2.40
2000	11 -12¼	3.00
Maximum Advance Limit		16½°

Distributor CIDF–12127-C

Automatic Transmission

Set test standard to 0° @ 600 rpm and 0.27 inches of Mercury

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
700	0	0.43
900	¾-1¾	0.76
1300	4½-5½	1.50
1700	7-8¼	2.40
2000	8½-9¾	3.00
Maximum Advance Limit		16½°

DISTRIBUTOR DIMENSIONS

Distributor Shaft	Inches
Diameter (at bushing)	0.4675-0.4680
End clearance (to gear)	0.028
Gear Location (from bottom of gear to bottom of mounting rib)	2.510-2.515

CONDENSER

Capacity Microfarads	Min. Leakage Megohms	Max. Series Resistance Ohms
0.21-0.25	5	1

COIL

Amperage Draw	
Engine Stopped	Engine Idling
4.5	2.5
Primary Resistance Ohms	Secondary Resistance Ohms
1.40-1.54 (75°F.)	8000-8800 (75°F.)

*Primary Ignition Circuit Resistor–1.30-1.40 (75°F.)

SPARK PLUGS

Commercial Equivalent	Size	Gap (Inches)	Torque (Ft.-Lbs.)
Champion No. F-14-Y	18 mm	0.032-0.036	15-20
Champion No. 870	18 mm	0.032-0.036	15-20

3 FUEL SYSTEM

CARBURETOR

144 CU. IN. ENGINE

The following carburetors are used on engines that are equipped with the positive crankcase ventilation system.

- CIDE–9510-A ..... Manual-shift transmission
- CIDE–9510-B ..... Automatic transmission

The following carburetors are used on engines that are not equipped with the positive crankcase ventilation system.

- CODE–9510-C ..... Manual-shift transmission
- CODE–9510-D ..... Automatic transmission

Main Metering Jet Identification No.	
0-5,000 Feet	
CIDE–9510-A	53
CIDE–9510-B	53
CODE–9510-C	52
CODE–9510-D	52
5,000-10,000 Feet	
CIDE–9510-A	52
CIDE–9510-B	52
CODE–9510-C	52
CODE–9510-D	52
10,000-15,000 Feet	
CIDE–9510-A	51
CIDE–9510-B	51
CODE–9510-C	51
CODE–9510-D	51

Float Setting ..... 11/64 ± 1/64 inch from the roof of the float chamber to the lowest point of the float, carburetor inverted.

Fuel Level Setting	23/32 ± 1/32 inch below the economizer piston mounting surface.
Venturi Size	1¼ inches
SPARK CONTROL VALVE IDENTIFICATION NO.	
CODE—9510-C and CIDE—9510-A	50
CODE—9510-D and CIDE—9510-B	35
Anti-Stall Dashpot Clearance	0.120-0.150 inch
Initial Idle Mixture Adjustment	1-1½ turns open
Power Valve Opens at	4-7 inches of mercury

170 CU. IN. ENGINE	
The following carburetors are used on engines equipped with the positive crankcase ventilation system.	
CIDE—9510-C	Manual-shift transmission
CIDE—9510-D	Automatic transmission
The following carburetors are used on engines not equipped with the positive crankcase ventilation system.	
CIDE—9510-E	Manual-shift transmission
CIDE—9510-F	Automatic transmission

Main Metering Jet Identification No.	
0-5,000 Feet	
CIDE—9510-C	60
CIDE—9510-D	60
CIDE—9510-E	61
CIDE—9510-F	61
5,000-10,000 Feet	
CIDE—9510-C	59
CIDE—9510-D	59
CIDE—9510-E	59
CIDE—9510-F	59
10,000-15,000 Feet	
CIDE—9510-C	58
CIDE—9510-D	58
CIDE—9510-E	58
CIDE—9510-F	58

Float Setting	11/64 ± 1/64 inch from the roof of the float chamber to the lowest point of the float, carburetor inverted.

Fuel Level Setting	23/32 ± 1/32 inch below the economizer piston mounting surface.
Venturi Size	1¼ inches
Spark Control Identification No.	35
Anti-Stall Dashpot Clearance	0.120-0.150 inch
Initial Idle Mixture Adjustment	1-1½ turns open
Power Valve Opens at	4-7 inches of mercury

FUEL PUMP

Minimum Intake Vacuum (Hg.) @ 600 Engine rpm	6
Eccentric Total Lift	0.290-0.310
Minimum Booster Pump Vacuum (Hg.) @ 500 Engine rpm	10
Fuel Pump Static Pressure psi @ 500 Engine rpm	3.5-5.5
Min. Fuel Pump Volume (Flow) @ 500 Engine rpm	1 pint in 30 seconds

CARBURETOR TORQUE LIMITS

Description	Inch-Pounds
Accelerating Pump—Discharge Nozzle Screw	20-25
Accelerating Pump Inlet and Outlet—Check Valve Plugs	10-15
Choke Cable Clamp Screw	15-20
Choke Cable Bracket Screw	20-25
Choke Plate Screw	7-10
Dashpot Assembly	30-40
Main Metering Jet	25-30
Throttle Plate Screw	7-10
Fuel Inlet Needle Seat Screw	50-75
Fuel Inlet Fitting	75-100
Power Jet and Mainwell Assembly Screw	7-10
Economizer Diaphragm Cover Screw	13-17
Dashpot Operating Lever Screw	15-20
Fuel Bowl Screw	10-15
Throttle Lever Ball Stud Nut	20-25
Throttle Body Screw	20-25
Spark Control Valve	90-100

FUEL TANK

Capacity—Gallons	14.8

4 COOLING SYSTEM

Cooling System Pressure	13-15 psi
Water Pump Impeller to Housing Clearance	0.005-0.025
Pump Pulley or Pulley Hub to Pump Housing Mounting Face Alignment	3.94 inches from front face of pulley hub
Drive Belt Deflection Generator and Water Pump Pulley	½ inch

Cooling System Capacity*		8.7 quarts
Thermostats		
Low Temp	Opens °F	157°-162°
	Fully Open at °F	182°
High Temp	Opens °F	173°-183°
	Fully Open at °F	200°

*Add 1 qt. for heater

5 CLUTCH, CONVENTIONAL TRANSMISSION, AND REAR AXLE

CLUTCH IDENTIFICATION

Engine	Pressure Plate			Disc	
	Diameter (Inches)	Number of Springs	Spring Color	Number of Springs	Spring Color
144	8½	6	Unpainted	6	(4) Orange (2) Green
170	8½	6	Unpainted	6	(3) Green (3) Unpainted

ADJUSTMENTS

CLUTCH	Inches
Clutch Pedal Free Travel	⅛-1⅛
Clutch Pedal Total Travel	6-6½
Assist Spring Retainer—See Fig. 2 (C-1151-A)	1 5/16
Maximum Variation of Finger Height	0.031
TRANSMISSION	
Cam Ramp to Interlock Shift Sleeve—Clearance	0.001-0.013
End Play—Cluster Gear	0.0045-0.0185

REAR AXLE	
Backlash Between Drive Gear and Pinion	0.003-0.008
Backlash Variation between Teeth	Max. 0.002
Runout of Backface of Ring Gear as Assembled	Max. 0.002
Thickness: Differential Side Gear Thrust Washers	0.030-0.032
Differential Pinion Gear Thrust Washers	0.030-0.032
Pinion Retainer to Carrier Housing Nominal Shim	0.001-0.008
Shims Available:	0.008-0.024

TORQUE LIMITS

CLUTCH	Ft.-Lbs.
Clutch Cover to Flywheel Bolts	12-20
Flywheel Housing to Engine Bolts	23-28
Flywheel Housing Dust Cover Bolts	12-15
Clutch Release Equalizer Underbody Bracket Bolts	15-24
Clutch Pedal Assist Spring Link to Brake Pedal Support Bracket	13-20
Clutch Pedal Bumper Bracket to Brake Pedal Support Bracket	8-12

TRANSMISSION	Ft.-Lbs.
Extension Housing Bolts—5/16-14	37-42
—3/8-16	28-38
Input Shaft Bearing Retainer to Transmission Case Bolts	12-15
Transmission to Flywheel Housing Bolts	32-36
Transmission Cover to Transmission Case Bolts	10-13
Engine Rear Support to Extension Housing Bolt	18-24
Engine Rear Support to Extension Housing Bracket Nut	18-24
Universal Joint U-Bolt Nut	7-10
Gear Shift Levers to Cam and Shaft Assembly Lock Nuts	12-15
REAR AXLE	
Rear Cover Bolts	15-25
Differential Bearing Cap Screws	40-50
Differential Bearing Adjusting Nut Lock Bolts	12-20
Rear Shock Absorber to Rear Spring Clip Plate Assembly Nuts	15-25
Universal Joint Flange Axle End to Universal Joint Bearing Assembly Nuts	10-14
Drive Gear Attaching Cap Screws	40-50
Rear Axle Shaft Bearing Retaining Nuts	30-35
Spring Clip Nuts (Rear Springs to Axle Housing)	13-20
Minimum Torque Required to Tighten Pinion Flange Lock Nut to Obtain Correct Pinion Bearing Preload	140
Pinion Bearing Preload (Inch-Pounds) New Bearings	17-27
Used Bearings	10-16
Differential Bearing Preload	½-1 notch tight

DRIVE PINION ADJUSTING SHIM THICKNESS CHANGES—INCHES

Old Pinion Marking	New Pinion Marking								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

REAR AXLE RATIOS AND GEAR IDENTIFICATION

Axle Ratio	No. of Teeth	
	Driven Gear	Pinion
3.10:1	31	10
3.50:1	35	10
3.89:1	35	9
4.00:1	36	9

GEAR RATIOS—CONVENTIONAL 3-SPEED TRANSMISSION

Engine	Gear			
	Low	2nd	High	Reverse
144 Cu. In.	3.29	1.75	1.00	4.46
170 Cu. In.	3.29	1.83	1.00	4.46

LUBRICANT CAPACITIES—APPROXIMATE

Application	Pints
Conventional Transmission	2½
Rear Axle	2

6 FORDOMATIC TRANSMISSION

FORDOMATIC TRANSMISSION

Engine Cubic Inch Displacement	Gear Ratios			Stall Ratio	Stall Speed Engine rpm
	Low	Direct	Reverse		
144	1.75	1.00	1.50	2.4	1645-1845
177	1.75	1.00	1.50	2.4	1840-2040

FLUID PRESSURE LIMITS

Engine Speed	Selector Lever Position	Gauge Reading (psi)	
		TRANSMISSION MODEL PCF—A or B (170 ENGINE)	TRANSMISSION MODEL PBZ—H or J (144 ENGINE)
Idle	All	46-56	40-48
1200 rpm	D	78-82	53-57
Stall	D, L, and R	170-192	135-155

APPROXIMATE LUBRICANT REFILL CAPACITY

Approximate Capacity (Quarts)	6¼

CHECKS AND ADJUSTMENTS

Operation	Specification
Transmission End Play Check	0.020-0.039 inch Selective Thrust Washers Available: 0.067-0.069 inch, 0.0076-0.74 inch 00.085-0.83 inch, 00.094-.092 inch
Turbine and Stator End Play Check	0.060 inch (maximum)
Front Band Adjustment	Adjust screw to 10 foot-pounds torque, and back off two full turns. Lock nut to 35-40 foot-pounds.
Rear Band Adjustment	Adjust screw to 45-50 inch-pounds torque, and back off two turns. Lock jam nut to 15-18 foot-pounds.
Accelerator Pedal Height Adjustment	4¼ inches above floor pan
Anti-Stall Dashpot Clearance	0.130-0.150 inch

CONTROL PRESSURE VARIATION—WITH ROAD SPEED

Engine Model	Axle Ratio	Throttle Position	Average Control Pressure (PSI)		
			10 mph	15 mph	30 mph
144	3.10:1	Wide Open	118	95	74
144	3.50:1	Wide Open	112	82	74
144	3.89:1	Wide Open	108	74	74
170	3.10:1	Wide Open	156	136	74
170	3.50:1	Wide Open	151	124	74
170	3.89:1	Wide Open	148	115	74

ASSEMBLY TORQUE LIMITS

Screws or Bolts		Ft.-Lbs.
Control Valve Body	Screws (10-24)	20-30*
	Bolts—Upper to Lower Body (¼-20)	70-85*
	Bolts—Body to Transfer Case (¼-20)	8-10
Cover—Governor Body		20-30*
Planet Gear Shaft Retainer to Output Shaft Carrier		20-30*
Cover—Rear Pump to Body		50-60*
Oil Pan to Case		10-13
Cover—Front or Rear Servo to Case		12-15
Support—Converter Stator to Front Pump		12-17
Pump to Case—Front		18-22
Pump to Case—Rear		12-15
Extension to Case		28-38
Nuts		
Lever—Manual Control Shaft to Case		17-20
Lever—Throttle to Case—Outer		17-20
Seat—Rear Band Servo Piston Rod		15-18
Stop—Front Band Lock		35-40
Fitting—Oil Filler Tube to Case		40-50
Plugs		
Drain—Oil Pan		10-15
Drain—Converter Cover		20-28
Front Servo Mfg. Holes		10-15
Gauge Hole in Case		10-15
Fitting		
By-Pass Tube or Tube Connector		9-12

*Inch-pounds

FORDOMATIC SHIFT POINTS—APPROXIMATE

Engine Model	Transmission Model	Rear Axle Ratio	Automatic Shift Speeds (mph) Selector Lever at D			
			1-2 Minimum Throttle	1-2 Thru Detent	2-1 Thru Detent	2-1 Closed Throttle
144 Six	PBZ-H	3.10 to 1	12-18	48-55	46-54	8-14
		3.50 to 1	11-16	43-49	41-48	7-12
	PBZ-J	3.89 to 1	10-14	40-44	38-43	7-11
170 Six	PCF-A	3.10 to 1	13-18	47-55	46-54	6-15
		3.50 to 1	12-16	42-49	41-47	6-13
	PCF-B	3.89 to 1	11-15	38-44	37-43	5-12

7 FRONT AND REAR SUSPENSION

CASTER

Degrees	+½° ±½°
Difference between shim stack thicknesses at two bolts should not exceed	1/32 inch
1/32" change in shim thickness at either bolt will change caster angle	½°

CAMBER*

Degrees	+½° ±½°
Maximum shim stack thickness at each bolt	1/16 inch
1/16" change in shim thickness at both bolts will change camber angle	⅓°

*Maximum difference between both front wheel camber angles—½° (¼° preferred).

TREAD AND TOE-IN

Tread (Inches)	Front	55
	Rear	54½
Toe-In (Inches)		3/32 ±1/32
Toe-Out on Turns (Degrees)†		20¾°

†Angle of inside wheel when outside wheel is turned 20°.

TORQUE LIMITS—FRONT SUSPENSION

Description	Ft.-Lbs.
Lower Arm Ball Joint Assembly to Spindle Slotted Nut	35-65
Upper Arm Ball Joint Assembly to Spindle Slotted Nut	35-65
Bumper Assembly—Suspension Compression to Body Bracket Stud Nut	12-17
Arm and Inner Shaft Assembly—Upper Suspension to Body Bolt	65-90
Lower Arm Assembly to Underbody Lock Nut	60-75
Lower Arm Strut to Underbody Lock Nut	40-55
Shock Absorber Assembly to Spring Seat Bolt	12-17

*Inch-Pounds

Description	Ft.-Lbs.
Shock Absorber to Upper Mounting Bracket Stud Nut	15-25
Brake Assembly to Front Spindle Lock Nut	25-35
Front Stabilizer to Lower Arm Stud Nut	12-17
Front Strut to Lower Arm Bolt	40-55
Shock Absorber Upper Bracket to Body Nut	8-13
Front Stabilizer to Body Lock Nut	11-16
Upper Arm Shaft to Upper Arm Bolt	40-55
Shaft—Upper Arm Spring Seat to Upper Arm Lock Nut	13-18
Lower Arm Ball Joint Preload	20-30*
Wheel Nut Torque Limits (Ft.-Lbs.)	55-85

COIL SPRINGS—FRONT

Body Style	Design Load (Pounds)	Deflection Rate (Pounds per Inch)	Free Height (Inches)
Sedan	1210 ± 20	170 ± 7	16.48
Station Wagon	1140 ± 20	170 ± 7	16.03

TORQUE LIMITS—REAR SUSPENSION

Description	Ft.-Lbs.
Spring Assembly to Rear Spring Front Hanger Lock Nut	30-40
Spring Shackle Bars to Body Lock Nut	13-20
Spring Shackle Bar to Rear Spring Assembly Lock Nut	13-20
Spring Assembly to Rear Axle "U" Bolt Lock Nut	13-20
Universal Joint Flange—Axle End to Bearing Ass'y Nut	9-10
Rear Shock Absorber to Upper Mounting Bracket Stud Nut	15-25
Rear Shock Absorber to Spring Clip	15-25
Hanger Bracket to Underbody Nut	20-27

TIRE PRESSURES

Model	Load Conditions	Tire Size and Ply	Tire* Pressures (Psi)	
			Front	Rear
Car	All Loads	6.00 x 13-4	24	24
		6.50 x 13-4	24	24
Station Wagon	Normal Passenger Load	6.50 x 13-4	22	26
	Passenger and Cargo Loads	6.50 x 13-4	22	30
	All Loads and Snow Tires	6.50 x 13-4	22	30
Ranchero	All Loads	6.50 x 13-4	24	30
		6.50 x 13-6	24	30

*Cold pressures. For considerable high-speed driving, add 4 to 6 pounds to the recommended cold pressures.

SEMI-ELLIPTIC LEAF SPRINGS—REAR

Body Style	No. of Leaves	Capacity at Normal Loaded Height (Pounds)	Deflection Rate (Pounds per Inch)	Length (Inches)	Width (Inches)
Sedan	5	620-650	75-85	50.0	2.0
Station Wagon	5	860-900	112-122	50.0	2.0

8 STEERING

STEERING GEAR AND LINKAGE ADJUSTMENTS

Sector Shaft End Play—Steering Linkage Disconnected	No Perceptible
Worm Bearing Pre-Load (Pull to keep steering wheel moving)	3-6 in.-lbs.
Total Pre-Load— Mesh Load plus Worm Bearing Pre-Load (Pull to rotate worm past center high spot)	8-13 in.-lbs.
Backlash permissible at 30° on either side of straight-ahead steering position	No Perceptible

DIMENSION

Sector Adjusting Screw Head to End of Sector Shaft Maximum Clearance	0.002 inch

TORQUE LIMITS

Description	Ft.-Lbs.
Sector Arm and Idler Arm to Cross Link Slotted Nut	25-35
Spindle Connecting Rod and End Assembly to Idler and Sector Arms Slotted Nut	25-35
Spindle Connecting Rod and End Assembly to Spindle Arm Slotted Nut	25-35
Spindle Connecting Rod Clamp to Adjusting Sleeve Lock Nut	10-15
Idler Arm Mounting Bracket to Underbody Assembly Lock Nut	13-20
Idler Arm Assembly to Idler Arm Mounting Bracket Bolt	45-60
Steering Wheel to Steering Gear Assembly Nut	25-35
Cover Assembly to Steering Gear Housing Assembly Bolt	12-20
Sector Arm to Sector Shaft Assembly Nut	85-110
Steering Gear to Underbody Assemblies Bolt	25-35
Steering Column Bracket to Instrument Panel Nut	9-13

9 BRAKES

TORQUE LIMITS—BRAKES

Description	Ft.-Lbs.
Brake Cylinder to Brake Backing Plate Bolt	8-12
Hand Brake Control Assembly to Instrument Panel Bolt	8-14
Master Cylinder to Dash Panel Bolt	12-18
Hand Brake Control Assembly to Dash Bolt	8-12
Brake Hose Bolt	12-18
Brake Pedal Support Bracket to Dash Panel Bolt	12-18
Brake Pedal Support Bracket to Instrument Panel Nut	10-15
FRONT BRAKES ONLY	
Wheel Assembly to Wheel Hub and Drum Assembly Bolt	55-85
Wheel, Hub and Drum Assembly to Wheel Spindle Nut	10-15
Brake to Spindle Lock Nut	25-35
REAR BRAKES ONLY	
Axle Housing to Brake Assembly Lock Nut	30-35
Drum to Axle Shaft Assembly Speednut	Hand Push Fit
Wheel Assembly to Axle Shaft to Drum Assembly Nut	55-85
Brake Line Connection to Axle Housing Bolt	12-18
Bleeder Screw to Brake Backing Plate	8-12
Master Cylinder Cover	Finger Tight
Eccentric Bolt to Brake Pedal	20-27

BRAKE CHECKS AND ADJUSTMENTS

Type or Check or Adjustment	Specification
Brake Pedal	Pedal Free Play ¼-5/16 inch
Brake Shoe Repair	Brake Lining Clearance (Midway between Rivets)
	Maximum 0.005 inch Lining Wear Limit (From Top of Rivets) Maximum 1/32 inch
	Top of Rivets) Maximum 1/32 inch
Master Cylinder	Hydraulic Master Cylinder Bore, Honed Diameter,
	Maximum 1.003 inch
Drum Out of Round	Refinish if Total Indicator Runout Exceeds 0.005 inch

DIMENSIONS

All Dimensions are given in inches.

		Front	Rear
Drum Inside Diameter		9.000	
Drum Maximum Boring Limit		9.060	
Lining Width	Primary	2.25	1.50
	Secondary	2.25	1.50
Wheel Cylinder Bore Diameter		1.062	0.8125
Master Cylinder Bore Diameter		1.000	

10 GENERATING AND STARTING SYSTEM

REGULATOR

Current Rating (Amperes)	25	30*
Current Regulation (Amperes)	23-27	28-32*
Cut-In Voltage	12.4—13.2	12.0—12.8*
Maximum Reverse Current to Open (Amperes)	8	8
Voltage Regulation @ 75°F.	14.6—15.4	

*R.P.O.

STARTER MOTOR

Normal Engine Cranking rpm	Min. Torque @ 5 Volts		Maximum Commutator Runout (Inches)	No Load Amperage @ 12 v
	Ft.-Pounds (Min.)	Amp. Load (Max.)		
250-290	15.5	670	0.002	70

Current Draw under load (Engine at normal operating temperatures) 100-150 Amperes.

STARTER MOTOR BRUSHES

Mfg. Length (Min.) (Inches)	Wear Limit (Inches)	Brush Spring Tension (Ounces)	No. Used
0.43-0.46	5/16	48-56	4

GENERATOR

Part Number	Field Current Draw Amperes @ 12 v		Watts	Gen. rpm Charge Starts*	Maximum Rate		Pulley			Brushes		
	Hot	Cold			Amps.	Gen. rpm*	Drive Ratio	Belt Width (In.)	Pitch Diameter (Inches)	No.	Original Length (Inches)	Spring Tension (Oz.)
CODF-10000-C	1.2-1.8	1.7-2.0	375	1400	25	2450	2.00:1	3/8	2.7	2	0.86	32-40
CODF-10000-D	1.2-1.8	1.7-2.0	450	1300	30	2550	2.00:1	3/8	2.7	2	0.86	32-40

External Circuit Resistance (generator armature terminal to battery positive terminal: 0.6 Volt Maximum @ 25 Amperes).
Maximum Commutator Runout: 0.002 inch.
*To find equivalent engine rpm, divide by drive ratio of generator pulley.

VOLTAGE REGULATION SETTING VERSUS AMBIENT AIR TEMPERATURE

Ambient Temperature °F.	Voltage Regulation Setting (Volts)
25	15.1-15.9
35	15.0-15.8
45	14.9-15.7
55	14.8-15.6
65	14.7-15.5
75	14.6-15.4
85	14.5-15.3

Ambient Temperature °F.	Voltage Regulation Setting (Volts)
95	14.3-15.1
105	14.2-15.0
115	14.1-14.9
125	13.9-14.7
135	13.8-14.6
145	13.6-14.4

BATTERIES—12 VOLT

Plates	Amp. Hours	Specific Gravity
54	40	Domestic 1.270-1.290 Tropical 1.200-1.220
54	55*	

*R.P.O.

ALLOWABLE BATTERY FAST CHARGE TIME—DOMESTIC ONLY

Specific Gravity	Maximum Fast Charge Time
1.150 or less	1 hour
1.150 to 1.75	¾ hour
1.175 to 1.200	½ hour
1.200 to 1.225	¼ hour
Above 1.225	Slow Charge Only

11 LIGHTS, INSTRUMENTS, AND ACCESSORIES

BULB CHART

	Candle Power or Wattage	Trade No.
Headlamps	50/40w	6012
Front Turn Signal and Parking	32/4 c.p.	1034
Rear Turn Signal, Stop and Tail	32/4 c.p.	1034
License Plate	4 c.p.	67
Instrument Panel Indicators:		
Hi Beam	2 c.p.	57
Oil Pressure	1.5 c.p.	1445
Generator	1.5 c.p.	1445
Turn Signal	2 c.p.	57
Illumination:		
Cluster	2 c.p.	57
Radio Dial	1.5 c.p.	1445
Dome Lamp	15 c.p.	1003

HORN

Horn Current Draw at 12 v	10-11 Amperes

INSTRUMENTS

Fuel and Temperature Gauges—Average Voltage at Gauge Terminals	5 v

STOP LIGHT SWITCH

Operating Pressure	60-110 psi

TURN INDICATOR

Current Draw at 12 v	0-4 Amperes

HEATER MOTOR CURRENT DRAW

At Low Speed	4-5 Amperes at 12 volts
At High Speed	5-6 Amperes at 12 volts

FUSE AND CIRCUIT BREAKER CHART

Circuit	Protective Device	Location
Headlamps	Circuit Breaker	Integral with Headlight Switch
Instrument Panel, Dome, and All Exterior Lamps, except Headlamps	Circuit Breaker	Incorporated in Lighting Switch
Turn Signals	SFE-14 Fuse	Fuse Panel on Lighting Switch
Radio	SFE-7.5 Fuse	
Heater Blower	SFE-14 Fuse	
Electric Windshield Wiper	Circuit Breaker	Right Side of Instrument Panel
Cigar Lighter	Sulphur Disc	On Back of Cigar Lighter
Tailgate Control Circuit	Circuit Breaker	On Starter Relay
Tailgate Motor Ground	Circuit Breaker	Right Taillight Vicinity

12 BODY

BODY STYLES

Model	Description
58A	4-Door Sedan
59A	2-Door Station Wagon
64A	2-Door Sedan
66A	2-Door Ranchero
71A	4-Door Station Wagon

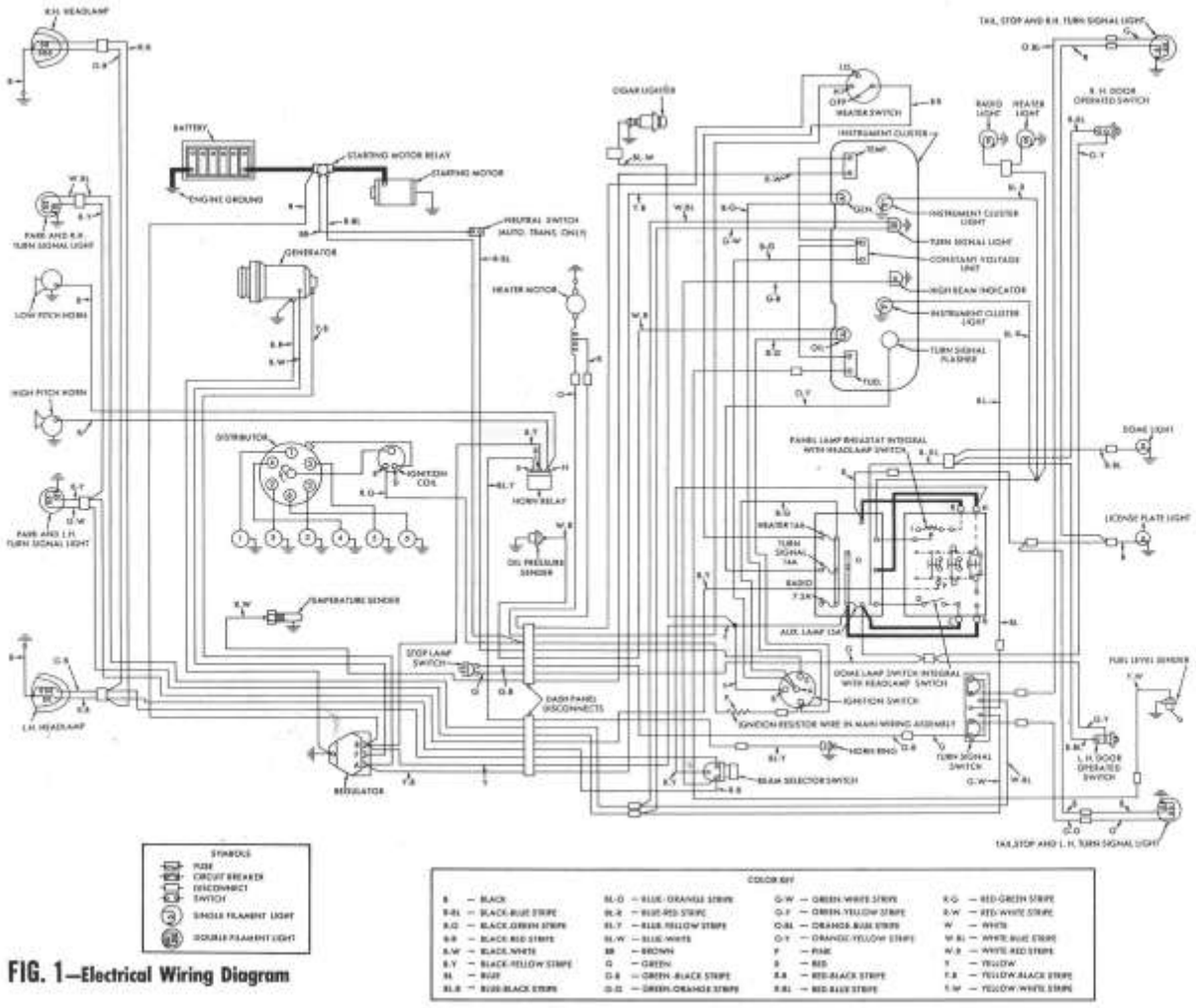
GENERAL DIMENSIONS

	58A	59A	64A	66A	71A
Overall Length (Inches)	181.19	189.00	181.19	189.00	189.00
Overall Width (Inches) Including Bumper	70.00	69.96	69.96	69.96	69.96
Overall Height (Inches) Loaded	54.50	55.05	54.50	55.16	55.08
Unloaded	56.36	56.91	56.36	56.96	56.88
Estimated Curb Weight (Lbs.)*	2424	2646	2389	2450	2679

*Add 55 Lbs. for Automatic Transmission

EXTERIOR COLORS

Code	Basic Spec. No.	Color
A	M30J-1724	Raven Black
C	M30J-1139	Light Turquoise
D	M30J-1361	Light Blue
E	M30J-1364	Medium Green Metallic
F	M30J-1366	Yellow
H	M30J-1367	Dark Blue Metallic
J	M30J-1232	Red
K	M30J-1369	Bronze Metallic
M	M30J-1238	White
Q	M30J-1371	Light Gray Metallic
R	M30J-1372	Medium Blue Metallic
S	M30J-1373	Light Green
W	M30J-1274	Turquoise Metallic



SYMBOLS
FUSE
CIRCUIT BREAKER
DISCONNECT SWITCH
SINGLE FILAMENT LIGHT
DOUBLE FILAMENT LIGHT

COLOR KEY

B — BLACK	BL-O — BLUE-ORANGE STRIPE	G-W — GREEN-WHITE STRIPE	R-G — RED-GREEN STRIPE
B-BL — BLACK-BLUE STRIPE	BL-R — BLUE-RED STRIPE	G-Y — GREEN-YELLOW STRIPE	R-W — RED-WHITE STRIPE
B-G — BLACK-GREEN STRIPE	BL-Y — BLUE-YELLOW STRIPE	O-BL — ORANGE-BLUE STRIPE	W — WHITE
B-R — BLACK-RED STRIPE	BL-W — BLUE-WHITE	O-Y — ORANGE-YELLOW STRIPE	W-BL — WHITE-BLUE STRIPE
B-W — BLACK-WHITE	BR — BROWN	P — PINK	W-R — WHITE-RED STRIPE
B-Y — BLACK-YELLOW STRIPE	G — GREEN	R — RED	Y — YELLOW
BL — BLUE	G-B — GREEN-BLACK STRIPE	R-B — RED-BLACK STRIPE	Y-B — YELLOW-BLACK STRIPE
BL-B — BLUE-BLACK STRIPE	G-O — GREEN-ORANGE STRIPE	R-BL — RED-BLUE STRIPE	Y-W — YELLOW-WHITE STRIPE

FIG. 1—Electrical Wiring Diagram

K1217-A

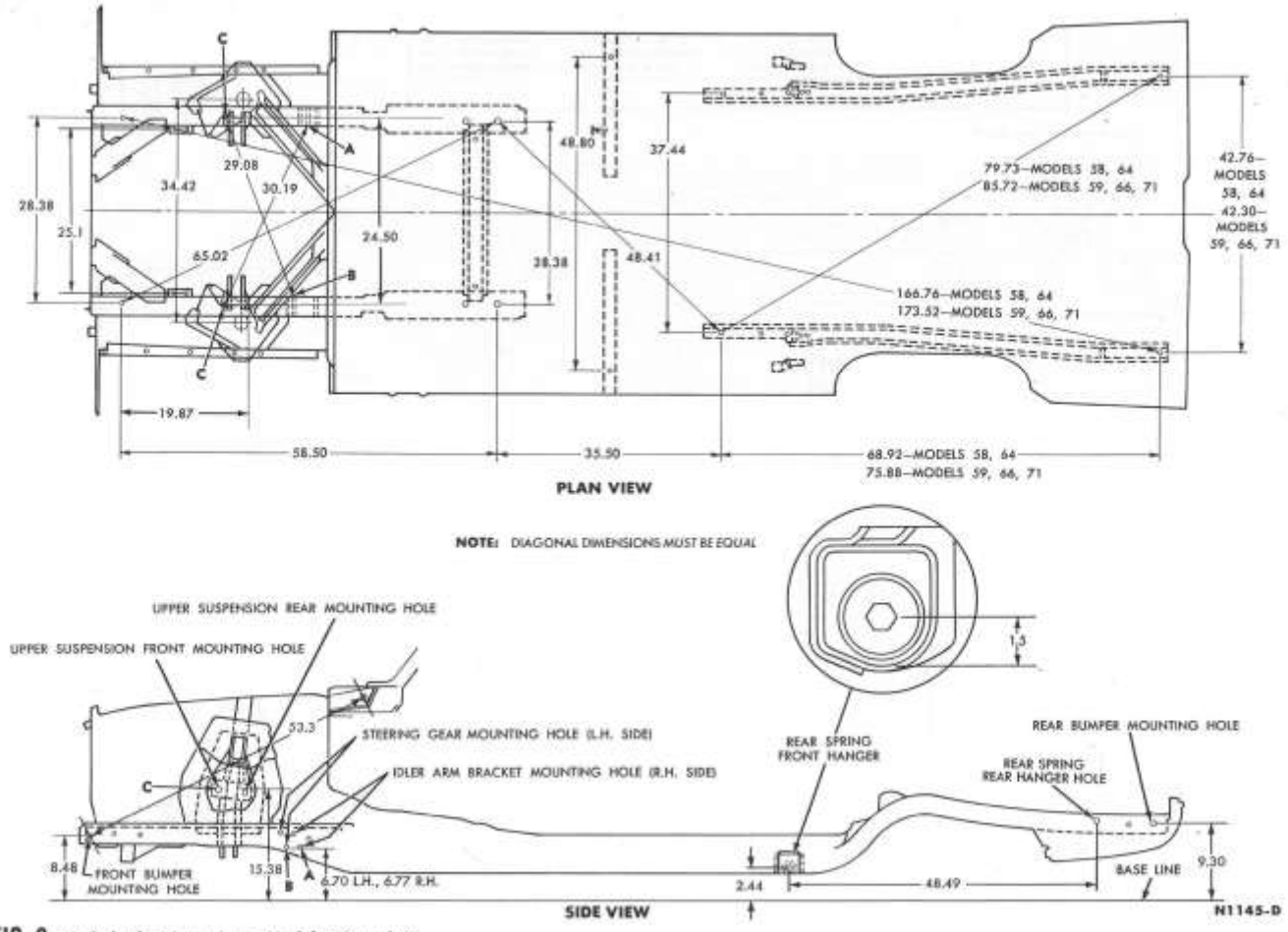


FIG. 2—Underbody Dimensions—Models 58 and 64

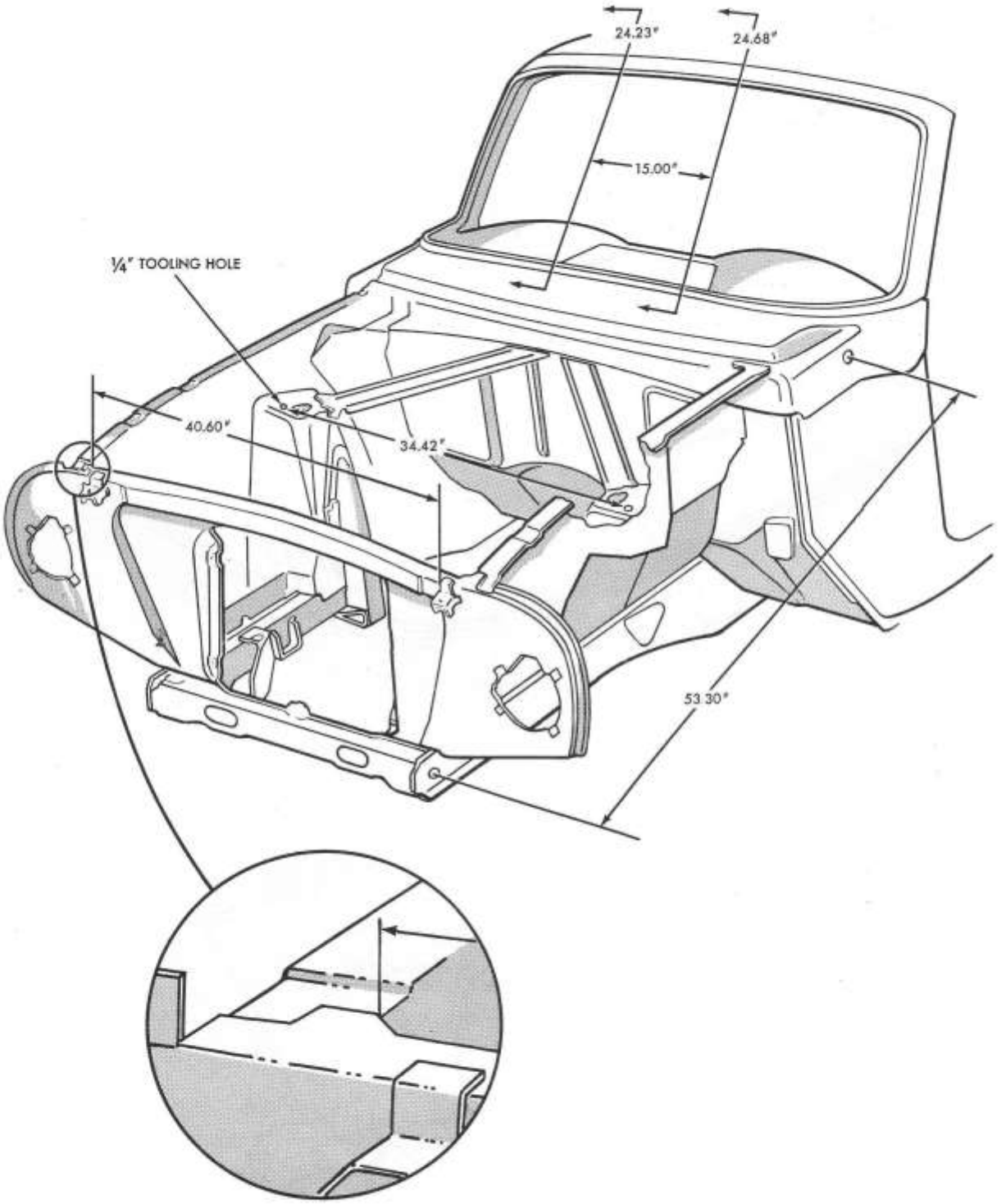


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FIG. 3—Upper Body Dimensions

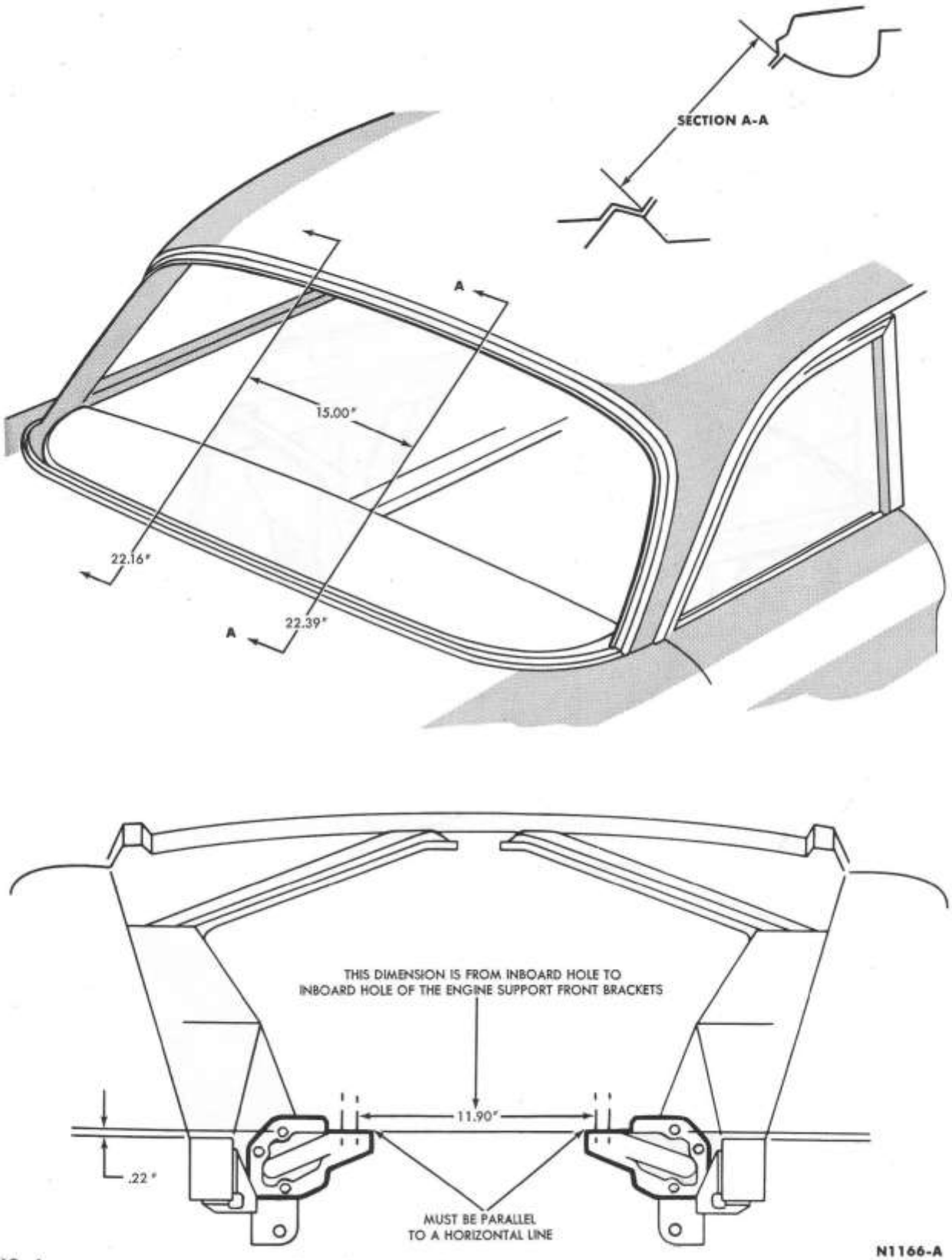

FIG. 4—Engine Compartment and Back Window Dimensions

1961 FORD FALCON SHOP MANUAL

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