1965 FORD

Thunderbird

SHOP MANUAL

1965

THUNDERBIRD

SHOP MANUAL

SERVICE DEPARTMENT
FORD DIVISION
FORD MOTOR COMPANY

FIRST PRINTING—SEPTEMBER, 1964

GROUP INDEX

SPECIFICATIONS AND SPECIAL SERVICE TOOLS AT END OF EACH GROUP

FOREWORD

This shop manual provides the Service-Technician with complete information for the proper servicing of the 1965 Thunderbird.

The information is grouped according to the type of work being performed, such as diagnosis and testing, frequently performed adjustments and repairs, in-vehicle adjustments, overhaul, etc. Specifications and recommended special tools are included.

Refer to the opposite page for important vehicle identification data.

The descriptions and specifications in this manual were in effect at the time this manual was approved for printing. The Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

SERVICE DEPARTMENT

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VEHICLE IDENTIFICATION

GROUP 1

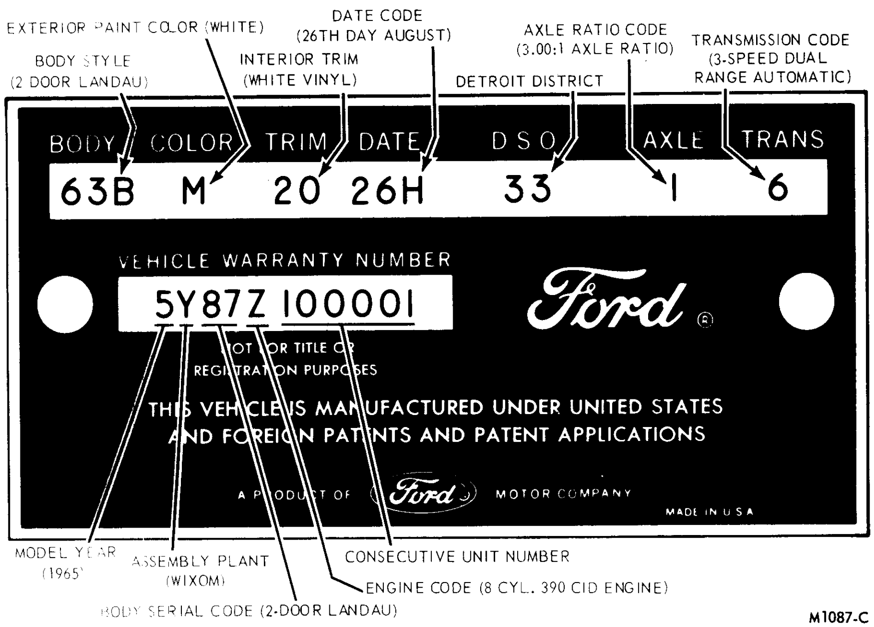

Fig. 1—Thunderbird Warranty Plate

Figure 1 illustrates a Thunderbird Warranty plate. The warranty plate is attached to the rear (lock) face of the left door.
The official Vehicle Identification Number for title and registration purposes is stamped on the hood support top surface to the right of the hood lock plate (Fig. 2). Do not use the Vehicle Warranty Number which appears on the warranty plate for title or registration purposes.

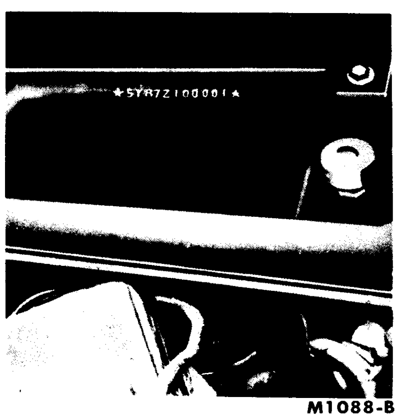

Fig. 2—Vehicle Identification Number Location

VEHICLE DATA

The vehicle data appears in a line across the top of the warranty plate (Fig. 1). The first two letters and a number identify the Body Style. The following one or two letters identify the Exterior Paint Color. The next code consisting of two numbers, or a letter and a number, identifies the Interior Trim. The Date Code showing the date the car was manufactured, follows the Trim Code and consists of two numbers and a letter. The next code gives the district in which the car was ordered and consists of two numbers. The next to the last code is the Axle Ratio Code and is designated by a number for a conventional axle or a letter for an Equa-Lock axle. The last code in the vehicle data is the Transmission Code and consists of one number. The charts that follow, list in detail the various vehicle data codes.

VEHICLE WARRANTY NUMBER

The vehicle warranty number is the second line of numbers and letters appearing on the Warranty Plate (Fig. 1). The first number indicates the model year. The letter following the model year indicates the assembly plant at which the car was manufactured. The next two numbers designate the Body Serial Code. The letter following the Body Serial Code designates the Engine Code. The remaining numbers indicate the Consecutive Unit Number. The charts that follow, list the various Vehicle Warranty Number codes.

BODY SERIAL AND STYLE CODES

The two-digit numeral which follows the assembly plant code identifies the body series. This two-digit number is used in conjunction with the Body Style Code in the Vehicle Data, which consists of a two-digit number with a letter suffix. The following chart lists the Body Serial codes, Body Style codes and the body type.

Body Serial Code	Body Style Code	Body Type
81	63D	2-Door Landau Special
83	63A	2-Door Hardtop
85	76A	Convertible
87	63B	2-Door Landau

EXTERIOR PAINT COLOR CODES

Code	M-32-J Number	Color
A	1724-A	Black
B	1450-A	Dk. Turq. Met.
C	1736-A	Med. Ivy Gold Met.
E	1446-A	Med. Silver Mink Met.
F	1226-A	Lt. Blue
G	1743-A	Lt. Ivy Gold

EXTERIOR PAINT COLOR CODES (Continued)

H	1544-A	Dk. Blue Met.
J	1515-A	Red
M	1619-A	White
N	921-A	Platinum
P	1738-A	Palomino Met.
Q	1624-A	Med. Blue Met.
R	1879-A	Dk. Ivy Green Met.
S	1744-A	Dk. Grey Met.
T	1631-A	Lt. Beige
U	1070-A	Med. Turq. Met.
W	1555-A	Rose Beige Met.
X	1632-A	Maroon Met.
Z	1630-A	Med. Beige Met.
4	1734-A	Lt. Aqua

INTERIOR TRIM CODES

Code	Trim Schemes
11	Silver Mink Cloth and Vinyl
41	Silver Mink (W/Headrest) Cloth and Vinyl
12	Blue Cloth and Vinyl
42	Blue (W/Headrest) Cloth and Vinyl
16	Black Cloth and Vinyl
46	Black (W/Headrest) Cloth and Vinyl
19	Palomino Cloth and Vinyl
49	Palomino (W/Headrest) Cloth and Vinyl
20	White Vinyl
50	White (W/Headrest) Vinyl
21	Lt. Silver Mink Met. Vinyl
51	Lt. Silver Mink Met. (W/Headrest) Vinyl
22	Lt. Blue Met. Vinyl
52	Lt. Blue Met. (W/Headrest) Vinyl
24	Lt. Beige Met. Vinyl
54	Lt. Beige Met. (W/Headrest) Vinyl
25	Red Vinyl
55	Red (W/Headrest) Vinyl
26	Black Vinyl
56	Black (W/Headrest) Vinyl
27	Lt. Aqua Metallic Vinyl
57	Lt. Aqua Metallic (W/Headrest) Vinyl
28	Lt. Gold Metallic (W/Headrest) Vinyl
29	Med. Palomino Vinyl
59	Med. Palomino (W/Headrest) Vinyl
30	White Pearl Leather
60	White Pearl (W/Headrest) Leather
32	Lt. Blue (Low Met.) Leather
62	Lt. Blue (Low Met.) (W/Headrest) Leather
33	Burgundy Leather
63	Burgundy (W/Headrest) Leather
35	Red Leather
65	Red (W/Headrest) Leather
36	Black Leather
66	Black (W/Headrest) Leather
39	Med. Palomino (Leather Print) Leather
69	Med. Palomino (Leather Print) (W/Headrest) Leather

DATE CODES

The code letters for the month are preceded by a numeral to show the day of the month when the Thunderbird was completed. The second year code letters are to be used if model production exceeds 12 months.

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

DISTRICT CODES (DSO)

Thunderbirds built to a Domestic Special Order, Foreign Special Order, or Pre-Approved Order have the complete order number recorded in this space. Also appearing in this space is the two digit code number of the District which ordered the unit. If the unit is regular production, only the District code number will appear.

Code	District	Code	District
11	Boston	45	Davenport
12	Buffalo	51	Denver
13	New York	52	Des Moines
14	Pittsburgh	53	Kansas City
15	Newark	54	Omaha
21	Atlanta	55	St. Louis
22	Charlotte	61	Dallas
23	Philadelphia	62	Houston
24	Jacksonville	63	Memphis
25	Richmond	64	New Orleans
26	Washington	65	Oklahoma City
31	Cincinnati	71	Los Angeles
32	Cleveland	72	San Jose
33	Detroit	73	Salt Lake City
34	Indianapolis	74	Seattle
35	Lansing	81	Ford of Canada
36	Louisville	83	Government
41	Chicago	84	Home Office Reserve
42	Fargo	85	American Red Cross
43	Rockford	89	Transportation Services
44	Twin Cities	90-99	Export

REAR AXLE RATIO CODE

Code	Ratio
1	3.00:1

TRANSMISSION CODE

Code	Type
6	3-Speed Dual Range Automatic

MODEL YEAR

The number 5 designates 1965

ASSEMBLY PLANT CODES

Code Letter	Assembly Plant	Code Letter	Assembly Plant
A	Atlanta	N	Norfolk
D	Dallas	P	Twin Cities
E	Mahwah	R	San Jose
G	Chicago	S	Pilot Plant
H	Lorain	T	Metuchen
J	Los Angeles	U	Louisville
K	Kansas City	W	Wayne
L	Michigan Truck	Y	Wixom
		Z	St. Louis

ENGINE CODES

Code	Type
Z	8 Cylinder 390 Cubic Inch (4 barrel)
9	8 Cylinder 390 Cubic Inch (4 barrel Low Compression)

CONSECUTIVE UNIT NUMBER

The assembly plant, with each model year, begins with consecutive unit number 100001 and continues on for each unit built.

BRAKES

GROUP 2

PART 2-1 GENERAL BRAKE SERVICE

1 DIAGNOSIS AND TESTING

PRELIMINARY TESTING

1. Check the fluid level in the master cylinder, and add SAE 70R3-Wagner 21B(301) brake fluid if required.

2. Push the brake pedal down as far as it will go while the engine is running or vacuum is in the system and the car is standing still. If the pedal travels more than halfway between the released position and the floor, check the brake adjustment and the automatic adjusters.

To check rear brake adjuster operation, check the shoes and the adjuster components for binding or improper installation and follow the procedure described under "Brake Shoe Adjustments" in Part 2-2, Section 2.

Make several reverse brake stops to ensure uniform adjustment at the rear wheels.

On front disc brakes, the automatic adjustment is a permanent built-in feature.

3. With the transmission in neutral, stop the engine and apply the parking brake. Depress the service brake pedal several times to exhaust all vacuum in the system. Then, depress the pedal and hold it in the applied position. Start the engine. If the vacuum system is operating, the pedal will tend to fall away under foot pressure and less pressure will be required to hold the pedal in the applied position. If no action is felt, the vacuum booster system is not functioning. Follow the procedures in the "Booster Diagnosis Guide."

4. With the engine shut off, exhaust all vacuum in the system. Depress the brake pedal and hold it in the applied position. If the pedal gradually falls away under this pressure, the hydraulic system is leaking. Check all tubing, hoses, calipers, wheel cylinders, and connections for leaks.

If the brake pedal movement feels spongy, bleed the hydraulic system to remove air from the lines and cylinder. See "Hydraulic System Bleeding," Section 2. Also, check for leaks or insufficient fluid.

5. Should one of the brakes be locked and the car must be moved, open the 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

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 check for the existence of the trouble symptoms listed in Table 1, with the exception of brake chatter and those symptoms resolved in the preliminary tests. For each of the symptoms encountered, check and eliminate the causes which are also listed in Table 1. To check for brake chatter or surge, apply the brakes lightly at approximately 50 mph. Chatter or surge will apply almost entirely to rear brakes only.

For booster removal and installation procedures, refer to Part 2-2, Section 3. For disassembly and assembly procedures, refer to Part 2-2, Section 4. For cleaning and inspection refer to Part 2-1, Section 3.

TABLE 1—Front (Disc) Brake Trouble Symptoms and Possible Causes

POSSIBLE CAUSES OF TROUBLE	TROUBLE SYMPTOMS	Excessive Pedal Travel	Brake Roughness or Chatter (Pedal Pumping)	Excessive Pedal Effort	Pull	Groan	Rattle	Brakes Heat Up During Driving and Fail to Release	Leaky Wheel Cylinder	Grabbing or Uneven Braking Action	No Braking Effect When Pedal is Depressed
Shoe and Lining Knock-back after Violent Cornering or Rough Road Travel		X									
Piston and Shoe and Lining Assembly not Properly Seated or Positioned		X									X
Air Leak or Insufficient Fluid in System or Caliper		X									X
Loose Wheel Bearing Adjustment		X									
Damaged or Worn Caliper Piston Seal		X							X		X
Improper Booster Push Rod Adjustment		X									
Excessive Lateral Run-Out of Rotor			X								
Rotor Excessively out of Parallel			X								
Frozen or Seized Pistons				X	X			X		X	
Brake Fluid, Oil or Grease on Linings				X	X					X	
Shoe and Lining Worn Below Specifications				X							
Proportioning Valve Malfunction				X						X	
Booster Inoperative				X							
Caliper Out of Alignment with Rotor					X					X	
Loose Caliper Attachment					X					X	
Need to Slightly Increase or Decrease Pedal Effort						X					
Excessive Clearance Between Shoe and Caliper or Between Shoe and Splash Shield							X				
Shoe Hold Down Clips Missing or Improperly Positioned							X				
Operator Riding Brake Pedal								X			
Scores in the Cylinder Bore									X		
Corrosion Build-Up in the Cylinder Bore or on the Piston Surface									X		
Bleeder Screw Still Open											X
Caliper Out of Parallel with Rotor					X						

TABLE 2—Rear (Drum) Brake and General System Trouble Symptoms and Possible Causes

POSSIBLE CAUSES OF TROUBLE	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	Shoe Click After Release	Noisy or Grabbing Brakes	Brakes Do Not Apply
Mechanical Resistance at Pedal or Shoes			X	X										
Brake Line Restricted		X	X	X		X								
Leaks or Insufficient Fluid					X				X	X				X
Improper Tire Pressure						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						
Lining 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	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				X
Air in Hydraulic System		X			X				X					X
Self Adjusters Not Operating						X			X					
Insufficient Shoe-to-Carrier Plate Lubrication		X										X	X	
Tire Tread Worn							X							
Poor Lining to Drum Contact								X						
Loose Front Suspension								X						
"Threads" Left by Drum Turning Tool Pulls Shoes Sideways												X		
Cracked Drum									X					

BOOSTER DIAGNOSIS GUIDE

BOOSTER INOPERATIVE—HARD PEDAL	If the preliminary tests show that the booster is inoperative or if a hard pedal condition still exists after eliminating the causes of "Excessive Pedal Effort" or "Hard Pedal" listed in Tables 1 and 2 the trouble may be caused by vacuum leakage. Disconnect the vacuum line at the booster, remove the vacuum manifold and check valve assembly, and look for a sticking or faulty check valve. Check all vacuum connections for leakage or obstruction. Check all hoses for a leaking or collapsed condition. Repair or replace parts as necessary. If the foregoing procedure does not eliminate the trouble, remove the booster from the car. Separate the front shell from the rear shell, and check the valve and rod assembly reaction disc, diaphragm plates and diaphragm assemblies for damage that would cause leaks. When assembling, be sure that the diaphragm assemblies are properly positioned. Improper location could cause leakage between the vacuum and atmospheric sides of the diaphragms.
BRAKES DRAG OR GRAB	If the brakes still drag or grab after eliminating the causes listed in Tables 1 and 2, the condition is probably caused by a sticking valve plunger assembly. Remove and disassemble the booster. Clean, inspect, and replace parts as necessary.
SELF APPLICATION OF BRAKES WHEN ENGINE STARTS	Remove and disassemble the booster. Check for a leak in the rear shell. Check the diaphragms for being out of locating radii in the housing. Check for a sticking or unseated valve poppet. Clean, inspect and replace parts as necessary. Be sure that the diaphragms are properly located when assembling.

2 COMMON ADJUSTMENTS AND REPAIRS

PARKING BRAKE LINKAGE ADJUSTMENT

Check the parking brake cables when the brakes are fully released. If the cables are loose, adjust them as follows:

1. Fully release the parking brake pedal by pushing down the manual release lever.
2. Raise the car.
3. Adjust the equalizer lever against the cable spring on the pedal cable to the dimension shown in Fig. 1.
4. Loosen the adjusting nut on the equalizer rod, and then turn the lock nut in front of the equalizer several turns forward.
5. Depress the parking brake pedal 1¾ inches from its normal released position.
6. While turning the rear wheels in a rearward direction, turn the adjusting nut against the equalizer until a moderate drag is felt (Fig. 1).
7. When the cables are properly adjusted, tighten the locknut against the equalizer.
8. Release the parking brake, and check to make sure that the brake shoes return to the fully released position.
9. Depress the parking brake pedal two inches. Under normal conditions, this will satisfactorily hold the car.
10. Release the parking brake again, and then depress the pedal ½ inch. The brakes should not drag with the pedal depressed ½ inch.

If the rear brakes do not fully release, check the cables for kinks or binds. Free the cables as required.

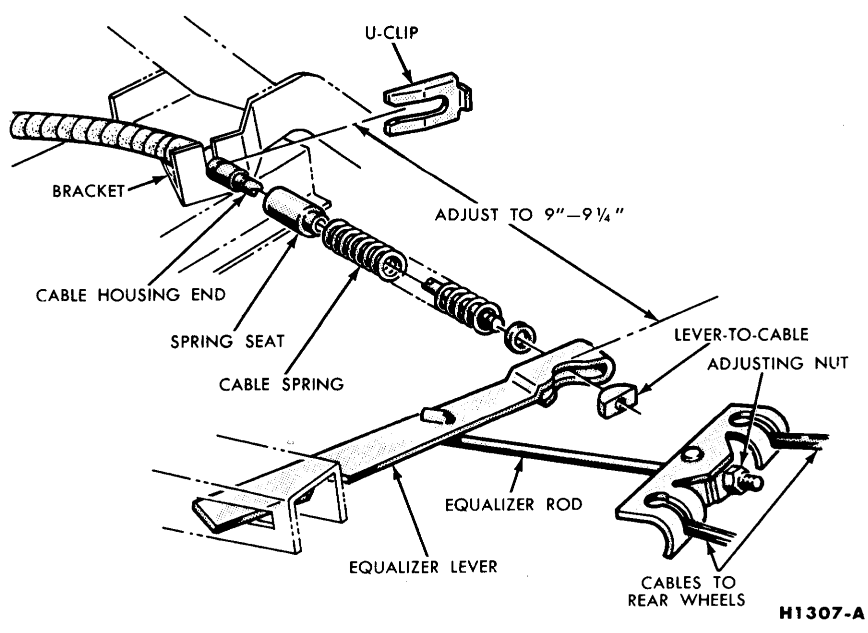

FIG. 1—Parking Brake Adjustments

MASTER CYLINDER PUSH ROD ADJUSTMENT

The push rod is designed with a self-locking adjustment screw to provide the correct relationship between the booster piston and the master cylinder piston. The adjustment screw is set to the correct height at the time of original assembly of the power unit. **Under normal service the adjustment screw does not require any further attention providing the push rod assembly remains in the original unit.** However, when a new push rod is used or the push rod assembly is transferred to another unit, the distance from the end of the adjustment screw to the mounting surface of the booster body should be rechecked either with a micrometer depth gauge to a dimension of 0.990-0.995 inch, or with a height gauge as shown in Fig. 2. The details for making a height gauge are given in Fig. 3.

To adjust the push rod, hold the serrated end of the rod with cross-milled pliers and turn the adjustment screw **in** to shorten, or **out** to lengthen.

After assembly of the master cylinder to the power section, the piston cup in the hydraulic cylinder should just clear the compensating port hole when the unit is in the fully released position. This can be checked by placing a few drops of brake fluid over the compensating port and applying light air pressure to the output port of the master cylinder. If air bubbles appear, the port is open. If the primary piston cup overlaps the compensating port, there will be no flow of air through the compensating port. If this condition exists, the adjustment screw should be turned into the push rod a slight amount or until the compensating port is open.

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

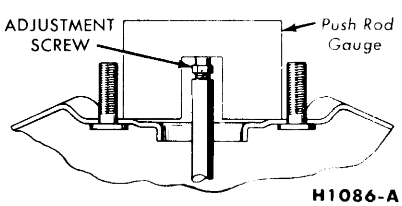

FIG. 2—Push Rod Adjustment

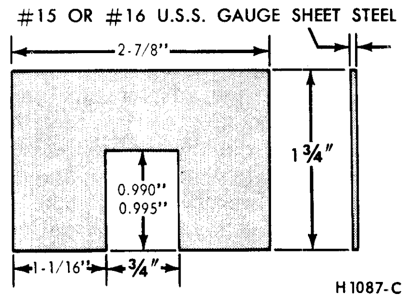

FIG. 3—Push Rod Guage Dimensions

to be sure that all air is expelled from the brake cylinders, disc brake calipers, and lines.

The hydraulic system can be bled manually or with pressure bleeding equipment.

With disc brakes, more pumping of the pedal is required and more frequent checking of the master cylinder may be necessary while bleeding.

Remove the front wheel and tire assemblies in order to gain access to the bleeder fittings on the disc brake calipers.

MANUAL BLEEDING

Bleed the longest lines first. Keep the master cylinder reservoir filled with new SAE 70R3-Wagner 21B (301)brake fluid during the bleeding operation.

Never use brake fluid which has been drained from the hydraulic system.

1. Position a bent ⅜-inch box wrench on the bleeder fitting on the right rear brake wheel cylinder (Fig. 4). Attach a rubber drain tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**
2. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting approximately ¾ turn.
3. Push the brake pedal down slowly thru its full travel. Close the bleeder fitting, then return the pedal 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 fitting and remove the drain tube.
5. Repeat this procedure on the brake cylinders or disc calipers at each wheel in order: left rear, right front, and left front. Refill the master cylinder reservoir after each brake cylinder is bled and when the bleeding operation is completed. The fluid level should be within ⅜ inch of the top of the reservoir. The diaphragm-type gasket should be properly positioned in the reservoir cap before the cap is installed.
6. Be sure that the front brake pistons are returned to their normal positions and that the shoe and lining assemblies are properly seated.
7. Before driving the car, check the operation of the brakes and be sure that a firm pedal is obtained.

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 the master cylinder reservoir cap.
2. Remove the master cylinder reservoir cap, install an adapter cap to the reservoir, and attach the bleeder tank hose to the fitting on the adapter cap.

An adapter cap can be fabricated by cutting a hole in the center of a reservoir cap and soldering a fitting at the hole. The adapter cap must be securely seated and completely sealed on the master cylinder or leakage will occur.

3. Position a ⅜-inch box wrench on the bleeder fitting on the right rear brake wheel cylinder (Fig. 4). Attach a rubber drain tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**
4. Open the valve on the bleeder tank to admit pressurized brake fluid to the master cylinder reservoir.
5. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting.
6. When air bubbles cease to appear in the fluid at the submerged

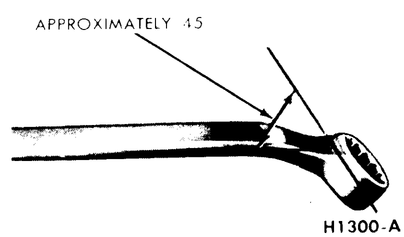

FIG. 4—Brake Bleeder Wrench

end of the drain tube, close the bleeder fitting and remove the tube.

7. Repeat this procedure on the brake cylinder or disc caliper at each wheel in order: left rear, right front, and left front. Refill the master cylinder reservoir after each brake cylinder is bled.

8. When the bleeding operation is completed, close the bleeder tank valve and remove the tank hose from the adapter fitting.

9. Remove the adapter cap, refill the master cylinder reservoir to within ⅜ inch from the top of the reservoir. Be sure that the diaphragm-type gasket is properly positioned in the reservoir cap, and then install the cap.

10. Be sure that the front brake pistons are returned to their normal positions and that the shoe and lining assemblies are properly seated.

11. Before driving the car, check the operation of the brakes and be sure that a firm pedal is obtained.

3 CLEANING AND INSPECTION

FRONT BRAKES

1. Remove the wheel and tire assembly, caliper splash shield, and the shoe and lining assemblies as outlined in Part 2-2, Section 2.

2. Make three thickness measurements with a micrometer across the middle section of the shoe and lining. Take one reading at each side and one in the center. If the assembly has worn to a thickness of 0.195 inch (shoe and lining together) or 0.030 inch (lining material only) at any one of the three measuring locations, replace all (4) shoe and lining assemblies on both front wheels.

3. With the shoe and lining assemblies installed, insert a feeler gauge between the lining and rotor. If the clearance is not within 0.002-0.010 inch, check for shoe and lining assemblies not being properly seated on the caliper bridges, for a piston pushed back in the cylinder bore, for a seized piston, or for malfunction of a piston seal.

Ordinarily, the clearance should be 0.002-0.010 inch. However, if the vehicle was stopped by a brake application just prior to checking the clearance, the brakes may drag slightly.

4. To check rotor runout, first eliminate the wheel bearing end play by tightening the adjusting nut. After tightening the nut check to see that the rotor can still be rotated.

5. Clamp a dial indicator to the caliper housing so that the stylus contacts the rotor at a point approximately 1 inch from the outer edge. Rotate the rotor and take an indicator reading. If the reading exceeds 0.002 inch total indicator runout, replace the rotor. **Do not attempt to refinish a rotor that indicates runout in excess of specification.**

When the runout check is finished be sure to adjust the bearings as outlined in Group 3, in order to prevent bearing failure.

6. Check the rotor for scoring. Minor scores can be removed with a fine emery cloth. If the rotor is excessively scored replace it.

7. Visually check the caliper. If it is cracked or if excess leakage is evident, it should be replaced. Slight leakage or seized pistons indicate removal and disassembly.

8. If upon disassembly the caliper is found to be distorted or damaged, or if the cylinder bores are scored or excessively worn, replace the assembly.

The two halves of the caliper assembly should never be separated. Damage or failure of one requires replacement of both as a unit.

REAR BRAKES

1. Remove the wheel from the drum, and remove the drum as outlined in Part 2-2, Section 2. Wash all the parts except the brake shoes in a cleaning fluid and dry with compressed air.

2. Brush all dust from the carrier plate and interior of the brake drum.

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. Replace the lining in axle sets. Prior to replacement of the lining, the drum diameter should be checked to determine if oversize linings must be installed.

4. Check the condition of the brake shoes, retracting springs, and drum for signs of overheating. If the shoes have a slight blue coloring, or if the springs show a change in free length, indicating overheating, replacement of the retracting and hold down springs is necessary. **Overheated springs lose their pull and could cause the new lining to wear prematurely if they are not replaced.**

5. If the car has 30,000 or more miles of operation on the brake linings, or signs of overheating are present when relining brakes, the wheel cylinders should be disassembled and inspected for wear and dirt in the cylinder. The cylinder cups and other parts contained in the overhaul kit should be replaced, thus avoiding future problems.

6. Inspect all other brake parts and replace any that are worn or damaged.

7. Inspect the brake drums and, if necessary, refinish. Refer to Part 2-2, Section 4 for refinishing.

BOOSTER UNIT

Clean all metal parts in a suitable solvent. After the metal parts have been thoroughly cleaned, those parts which came in contact with brake fluid should be re-washed in alcohol. Wash all plastic parts and the rubber center plate seal in alcohol. Blow out dirt and cleaning solvent from all recesses and internal passages. When overhauling the booster, use all parts furnished in the repair kit. **Discard all old rubber parts except the center plate seal which is not replaceable.**

Inspect all parts and replace those parts that are damaged, worn or chipped. If the hydraulic cylinder bore is scored, rusted, pitted or etched, replace it. If the center plate or seal is defective or damaged, replace the plate and seal assembly.

PART 2-2 BRAKE SYSTEM

1 DESCRIPTION AND OPERATION

The 1965 Thunderbird brake system employs disc brakes on the front wheels and single anchor, internal expanding and self-adjusting brake assemblies on the rear wheels. The system is powered by a vacuum booster as standard equipment.

The master cylinder converts physical force from the brake pedal and booster into hydraulic pressure against the pistons in the calipers (front wheels) or in the wheel cylinders (rear wheels). The pistons in turn convert hydraulic pressure back into physical force at the discs and brake shoes.

DISC BRAKE ASSEMBLIES – FRONT WHEELS

RELATION AND FUNCTION OF COMPONENT PARTS

The disc brake is a fixed caliper, opposed piston, non-energized, ventilated disc type, actuated by a hydraulic system (Fig.1). There is no lateral movement of either the disc (rotor) or the caliper. The caliper assembly consists of two caliper housings bolted together with each half containing two cylinder bores of $1\frac{15}{16}$" diameter. Each cylinder bore contains a piston with an attached molded rubber dust boot to seal the cylinder bore from contamination (Fig. 2). Square-section rubber piston seals are positioned in grooves in the cylinder bores.

The piston seals perform three important tasks:

1. They provide hydraulic sealing between the cylinders and pistons.

2. They return the pistons to released position, when hydraulic pressure is released.

3. They maintain the shoes in correct adjustment at all times (comparable to the automatic adjusters in drum-type brakes.

The cylinders are connected hydraulically by means of internal passages in the caliper housings and an external transfer tube between the two halves of the caliper assembly. One bleeder screw and fluid inlet fitting is provided on each caliper assembly.

The shoe and lining assemblies are located in between parallel machined abutments within the caliper, and are supported radially by tabs on the outer ends of the shoe assemblies (Fig. 25). The shoes slide axially in the caliper abutments by means of the tabs which ride on machined ledges (bridges) when hydraulic pressure is applied to the piston (Fig. 11). A shoe and lining assembly consists of friction material bonded to a metal plate called the shoe. It is replaced as a unit. Brake torque is absorbed by the mating of the shoe end against the caliper abutments (Fig. 25). A splash shield is attached to the top of the caliper to retain the shoe and lining assemblies and reduce contamination. The caliper assembly is mounted on the front wheel spindle to the rear of the wheel vertical centerline.

The cast iron disc is of the ventilated rotor type incorporating forty fins and is staked to, and rotates with, the wheel hub. The outside diameter of the rotor is 11.87 inches and the inside diameter is 7.875 inches. This type of design increases cooling area and permits circulation of air through the rotor resulting in more rapid cooling of the brake. A splash shield bolted to the spindle is used primarily to prevent road contaminants from contacting the inboard rotor and lining surfaces (Fig. 12). The wheel provides protection for the outboard surface of the rotor.

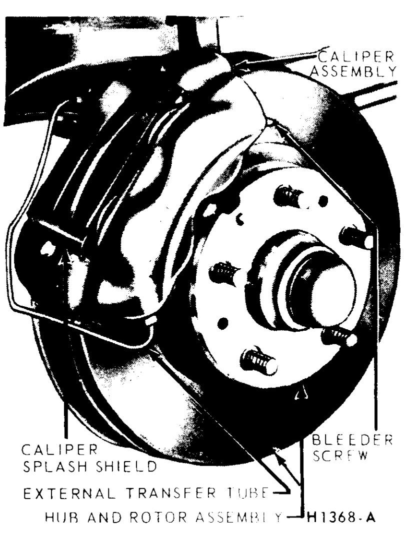

FIG. 1–Disc Brake Assembly

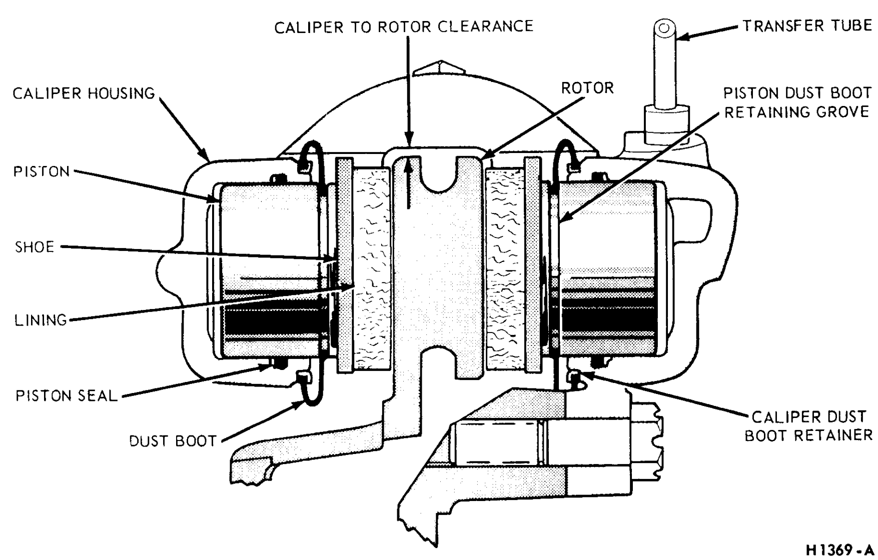

FIG. 2–Caliper Assembly–Sectional View

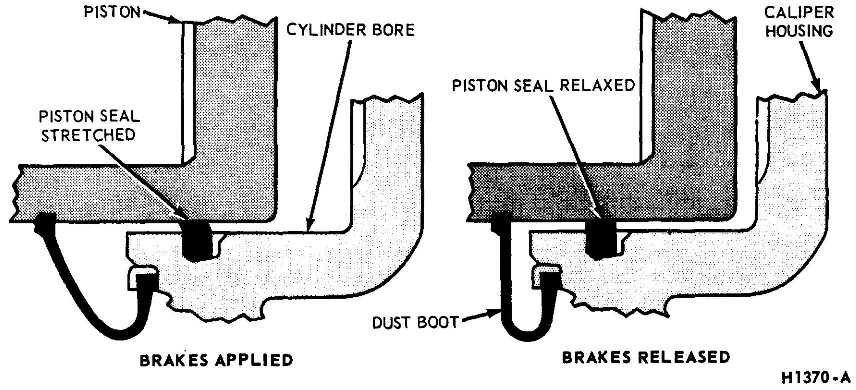

FIG. 3—Function of Piston Seal

OPERATION

As the brake pedal is depressed, hydraulic pressure from the master cylinder forces the pistons out of the caliper bores against their respective shoe and lining assemblies. The force of the pistons against the shoes moves the linings against both sides of the revolving rotor to effect braking action.

During brake application, the rubber seal in each piston stretches as the piston moves against the shoe (Fig. 3). When the hydraulic pressure against the piston is released, the seal relaxes or rolls back. This roll-back action pulls the piston away from the shoe approximately 0.005 inch to relieve the force of the lining against the rotor and, thereby, provide the required running clearance. Also, inherent rotor runout contributes to the maintenance of running clearance. Automatic adjustment is achieved by the pistons sliding in the seals outward from the cylinder bores. The piston gradually changes its position relative to the seal as the lining wears and, thus, maintains the correct adjustment location at all times.

When the brakes are in the unapplied position, there is no hydraulic pressure to the calipers because the fluid source at the master cylinder by-passes the residual check valve.

A warning sound feature is incorporated in the design of the brake shoes. Metal tabs on the ends of the shoes create an audible, metallic, scraping noise, when the linings become worn enough to allow the tabs to contact the rotor. This metal-to-metal contact warns the driver that the shoes need replacing and is not detrimental to the function of the disc brake.

A proportioning valve located between the master cylinder and the rear brake wheel cylinder provides balanced braking action between the front and the rear brakes under a wide range of braking conditions (Fig. 20). By regulating the hydraulic pressure applied to the rear wheel cylinders, the valve limits rear braking action when high pressures are required at the front brakes. In this manner, premature rear wheel skid is prevented. The proportioning valve is serviced as an assembly and is never adjusted or overhauled.

SELF-ADJUSTING BRAKE ASSEMBLIES—REAR WHEELS

The self-adjusting brake mechanism consists of a cable, cable guide, adjusting lever, adjusting screw assembly, and adjuster spring (Fig. 4). The cable is hooked over the anchor pin at the top and is connected to the lever at the bottom. The cable is connected to the secondary brake shoe by means of the cable guide. The adjuster spring is hooked to the primary brake shoe and to the lever. The automatic adjuster operates only when the brakes are applied while the car is moving rearward and only when the secondary shoe is free to move toward the drum beyond a predetermined point.

With the car moving rearward and

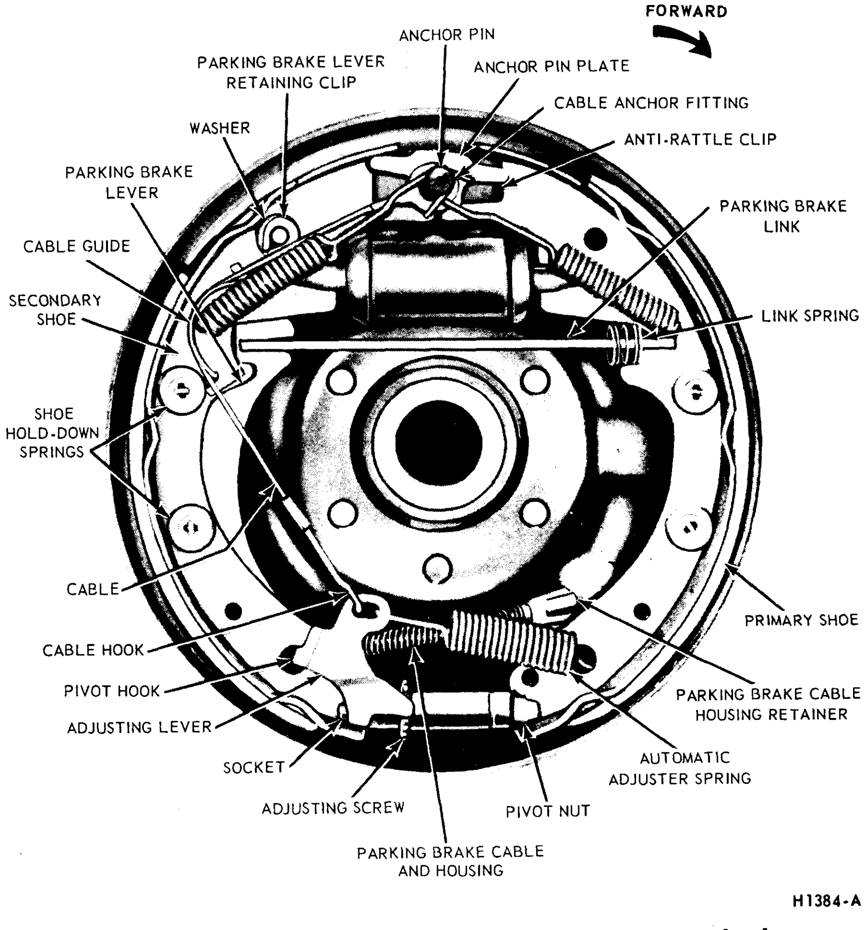

FIG. 4—Thunderbird Self Adjusting Brake Assembly—Rear Wheel

the brakes applied, the "wrap-around" action of the shoes following the drum forces the upper end of the primary shoe against the anchor pin. The action of the wheel cylinder moves the upper end of the secondary shoe away from the anchor pin. The movement of the secondary shoe causes the cable to pull the adjusting lever upward and against the end of a tooth on the adjusting screw star-wheel. The upward travel of the lever increases as lining wear increases. When the lever can move upward far enough, it passes over the end of the tooth and engages the tooth. When the brakes are released, the adjuster spring pulls the lever downward causing the star-wheel to turn and expand the shoes. The star-wheel is turned one tooth at a time as the linings progressively wear.

With the car moving forward and the brakes applied, the secondary shoe is against the anchor pin and the primary shoe is moved toward the drum. Therefore, the adjuster does not operate.

The conventional parking brake lever, link, and spring are used in the rear brake. The anchor pins are fixed and non-adjustable.

BOOSTER SYSTEM

DESCRIPTION

The tandem diaphragm type Master Vac is a self-contained vacuum hydraulic power braking unit. It is of the vacuum suspended type which utilizes engine intake manifold vacuum and atmospheric pressure for its power. It consists of three basic elements combined into a single unit (Fig. 5).

The three basic elements are:

1. A vacuum power chamber which consists of a front and a rear shell, a center plate, a front and a rear diaphragm, a hydraulic push rod and a vacuum diaphragm return spring.

2. A mechanically actuated control valve integral with the vacuum power diaphragms that controls the degree of power brake application or release in accordance with the foot pressure applied to the valve operating rod through the brake pedal linkage. The control valve consists of a single poppet with an atmospheric port and a vacuum port. The vacuum port seat is a part of the valve body attached to the diaphragm assembly. The atmospheric port seat is a part of the valve plunger which moves within the valve housing and vacuum power diaphragm assembly.

3. A hydraulic cylinder which contains all of the elements of the conventional brake master cylinder except for the hydraulic push rod which has a self locking adjustment screw at one end with a piston head at the other end.

The vacuum power diaphragms and the components which make up the valve assembly are connected to the brake pedal through the valve operating rod and pedal linkage. The valve operating rod is connected to the valve plunger which moves within the power diaphragm assembly. A valve return spring returns the valve plunger and valve rod to the released position when pressure is released from the brake pedal. The valve poppet is of flexible rubber type and is supported by the valve body. In the released position the poppet return spring holds the poppet against the atmospheric port seat. A special type of seal is used to seal the opening between valve body sleeve and the rear end plate. Vacuum is supplied to the Master Vac through a vacuum check valve located in the front housing. Air for operation is admitted through a silencer within the valve housing. A rubber valve rod guard keeps dust and dirt from getting into the valve mechanism. A seal located in the front vacuum chamber seals the opening between the vacuum chamber and the hydraulic push rod. The hydraulic push rod forms the link between the vacuum power diaphragms assembly and the hydraulic piston of the hydraulic cylinder. The center plate located between the two diaphragms divides the power unit into four chambers. A long, threaded hub on the front plate attaches to the hub of the rear plate and maintains a set separation between the two vacuum power diaphragms, moving backward and forward through a seal in the stationary center plate.

OPERATION

Released Position. With the engine running and the brakes released, vacuum from the intake manifold is admitted through the vacuum check valve to the front (left) vacuum chamber and to the vacuum chamber to the front (left) of the rear diaphragm (Fig. 6). In the released position (no pressure applied to the brake pedal), the valve operating rod and valve plunger are held to the right in the valve housing by the valve return

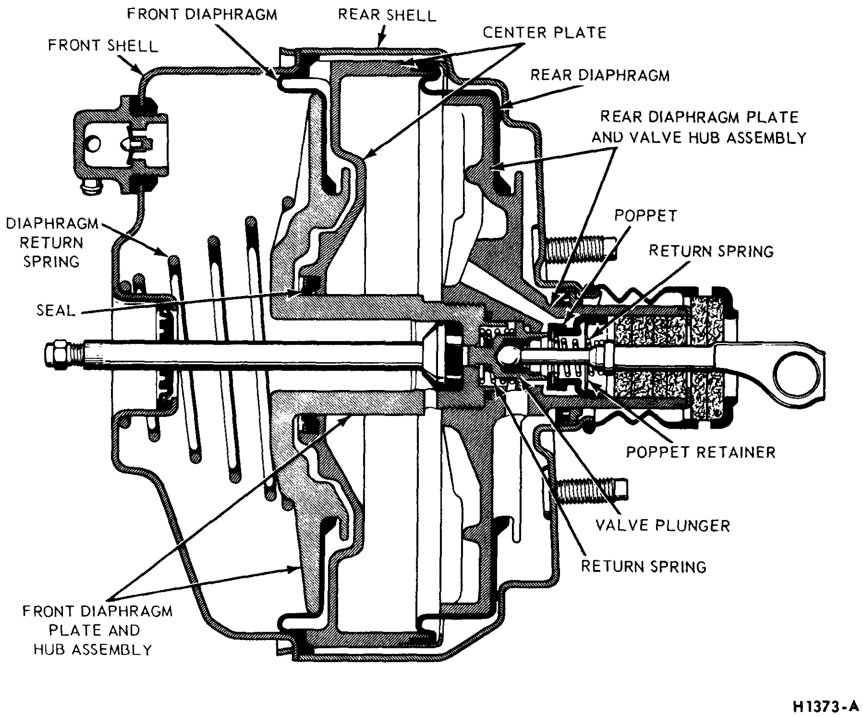

FIG. 5—Booster Unit—Sectional View

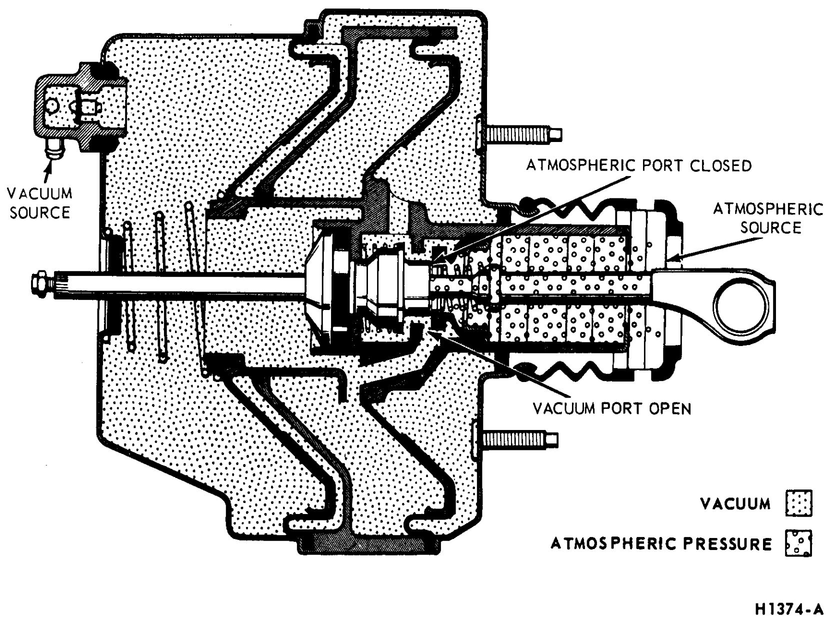

FIG. 6—Booster in Released Position

spring to CLOSE the atmospheric port and OPEN the vacuum port. With the valve in this position, the chambers to the rear of both the front and rear diaphragm are open to vacuum through the portings around the edge of the center plate and through the hub of the valve housing. The vacuum power diaphragms are then balanced or suspended in vacuum, since vacuum is present on both sides of both diaphragms. The vacuum power diaphragm return spring is then free to return the diaphragm assembly with the hydraulic push rod to the fully released position. With the hydraulic push rod in the released position, the hydraulic compensating port in the hydraulic master cylinder is open to permit brake fluid to either return from the brake system to the fluid reservoir or enter the brake system from the fluid reservoir to compensate for expansion of/or loss of fluid from the brake system.

Applied Position. As the brakes are applied by the driver, the valve operating rod and valve plunger move to the left in the power diaphragms assembly to compress the valve return spring and bring the poppet valve into contact with the vacuum valve seat in the valve housing to "CLOSE" the vacuum port (Fig. 7). Any additional movement of the valve operating rod in the applied direction, moves the valve plunger away from the poppet valve to "OPEN" the atmospheric port and admit atmosphere through the air filter and passages to the chambers at the right sides of both the front and rear vacuum power diaphragms. With vacuum on the left side of the front and rear diaphragms and atmospheric pressure on the right side of the front and rear diaphragms, a force is developed to move the vacuum power diaphragm assembly, hydraulic push rod and hydraulic piston to the left to close the compensating port and force hydraulic fluid under pressure through the residual check valve and brake tubes into the brake wheel cylinders. As hydraulic pressure is developed in the hydraulic cylinder, a counter force (to the right) acting through the hydraulic push rod sets up a reaction force against the vacuum power diaphragm and valve plunger through the rubber reaction disc at the end of the hydraulic push rod piston. The rubber disc reacts similar to a column of fluid to distribute the pressure between the vacuum power diaphragm assembly and the valve plunger in proportion to their respective contact areas.

The pressures acting against the valve plunger and valve operating rod tend to move the valve plunger slightly to the right in relation to the diaphragm and valve housing assembly to close off the atmospheric port. Since part of the counter force (to the right) reacts through the valve plunger and valve operating rod against the driver's foot, a "feel" of the braking effort is provided. The amount of reaction transmitted to the valve plunger is designed into the Master Vac to assure maximum power consistent with the assurance that the driver always maintains a "feel" of the amount of brake that is being applied. This reaction force is in direct proportion to the hydraulic pressure developed within the brake systems.

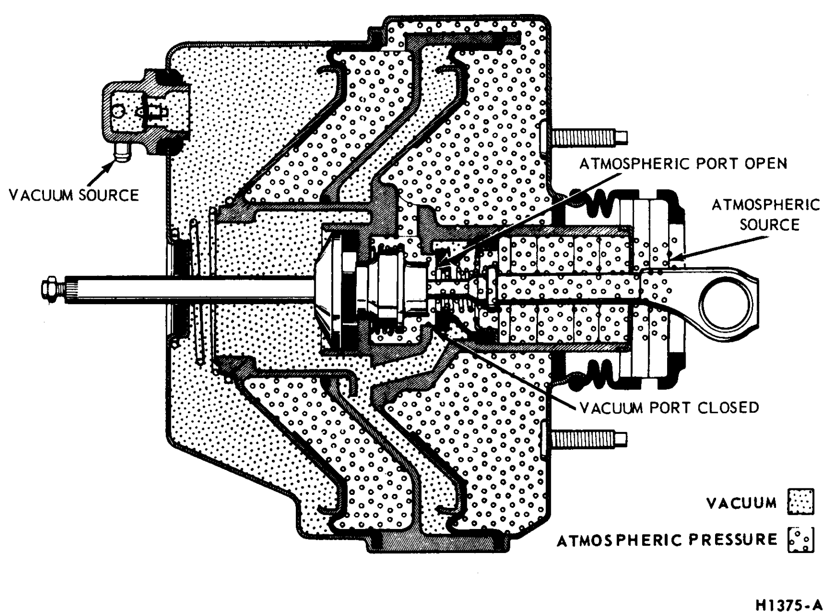

FIG. 7—Booster in Applied Position

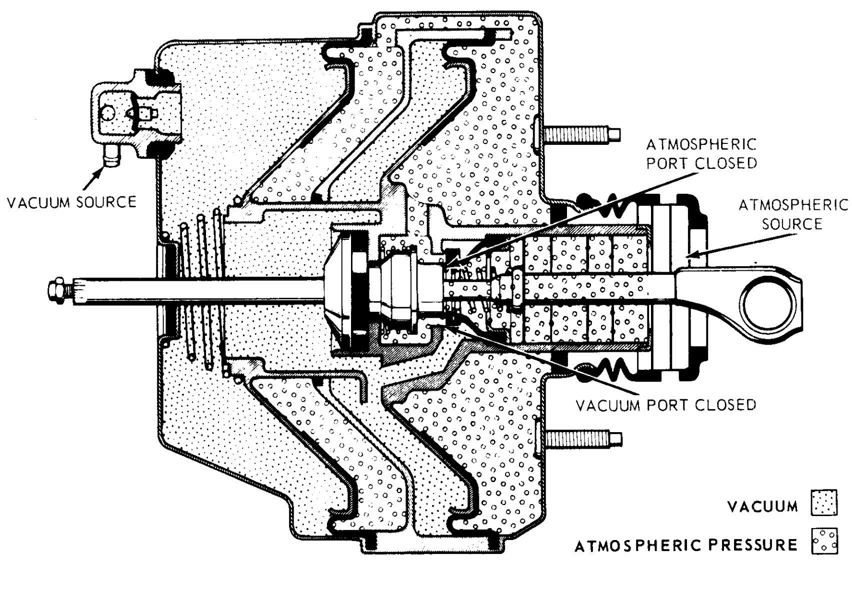

FIG. 8—Booster in Lap or Holding Position

Lap or Holding Position. During application of the brakes the "re-action" against the valve plunger is working against the driver to close the atmospheric port. With both atmospheric and vacuum ports closed, the Master Vac is said to be in the "lap" or holding position (Fig. 8). When both valves are closed or "lapped off", any degree of braking application attained will be held until either the atmospheric port is reopened by an increase in pedal pressure to further increase the brake application or by a decrease in pedal pressure to reopen the vacuum port to decrease the brake application. Whenever the pressure applied to the brake pedal is held constant for a moment, the valve returns to its "lap" or holding position. However, upon reaching the fully applied position, the valve plunger is held away from the valve poppet atmospheric valve seat to admit maximum atmospheric pressure to the chambers to the right of the front and rear diaphragms.

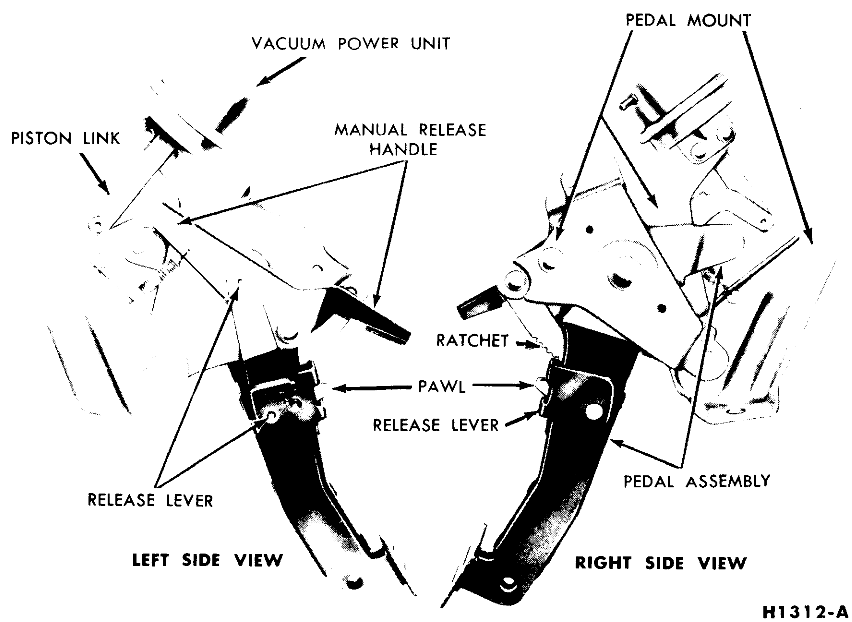

FIG. 9—Parking Brake Control Assembly

With the chambers to the left of the diaphragms open to manifold vacuum, full power application is attained which is referred to as the "run out" point of the power unit. Any increase in hydraulic pressure beyond this point would have to be supplied entirely by physical effort of the driver.

PARKING BRAKES

An independent foot-operated parking brake control (Fig. 9) actuates the rear wheel brake shoes through a cable linkage. The operating cable is routed from the parking brake control assembly to the equalizer lever which is attached to the equalizer assembly. The rear brake cables connect the equalizer assembly to the parking brake lever at each rear secondary shoe (Fig. 1, Part 2-1 and Fig. 22).

When the pedal is depressed the secondary brake shoes are forced against the rear brake drums. The pedal is held in the applied position by the engagement of a spring-loaded pawl with a ratchet in the control assembly.

A vacuum power unit will release the parking brakes automatically when the transmission selector lever is moved into any drive position with the engine running. The brakes will not release automatically, however, when the selector lever is in the neutral or park position with the engine running, or in any position with the engine off.

The parking brake control assembly is mounted to the left cowl side panel (Fig. 22). The pedal assembly pivots on a stationary pedal mount (Fig. 9). A spring-loaded pawl and a release lever are assembled to the pedal. A ratchet is as-

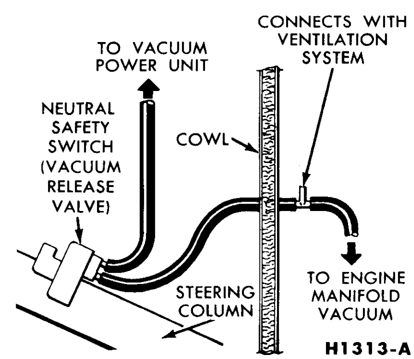

FIG. 10—Connections for Automatic Parking Brake Release

sembled to the stationary mount. The pawl contacts the ratchet at such an angle that it will slide over the ratchet teeth as the pedal is depressed; however, when the applying motion stops and the pedal starts to release, the pawl engages the ratchet and thus locks the brakes in the applied position. Since the release lever pivots against the pawl, a slight movement of the release lever will disengage the pawl from the ratchet allowing the brakes to release. The release lever is actuated by a manual release handle which is connected to the lever through a slot and rivet pin (Fig. 9).

The vacuum power unit with mounting bracket is riveted to the control assembly. The vacuum actuated piston within the unit is connected by a link to the upper end of the release handle which actuates the release lever to move the pawl out of engagement with the ratchet (Fig. 9). The lower end of the release handle extends out for alternate manual release in the event of vacuum power failure or for optional manual release at any time.

Hoses connect the power unit and the engine manifold to a vacuum release valve in the transmission neutral safety switch (Figs. 9 and 10). Moving the transmission selector lever into any drive position with the engine running will open the release valve to connect engine manifold vacuum to one side of the actuating piston in the power unit. The pressure differential thus created will cause the piston and link to pull the manual release handle which, in turn, actuates the release lever.

2 IN-CAR ADJUSTMENTS AND REPAIRS

After any brake service work, obtain a firm brake pedal before moving the car. Riding the brake pedal (common on left foot applications) should be avoided when driving the car.

FRONT (DISC) BRAKE SHOE AND LINING REPLACEMENT

REMOVAL

1. Remove the wheel and tire assembly from the hub and rotor assembly. **Be careful to avoid damage or interference with the caliper splash shield, bleeder screw fitting or transfer tube.**

2. Remove the two bolts that retain the caliper splash shield, and remove the shield (Fig. 1).

3. To facilitate removal and installation of the shoe and lining assemblies, the pistons must be pushed into their bores. Apply a steady inward pressure against each shoe and lining assembly toward its respective caliper housing on each side of the rotor (Fig. 2). Maintain the pressure for at least a minute. If the pistons will not go in easily, force them in with water pump pliers.

4. Grasp the metal flange on the outer end of the shoe with two pairs of pliers and pull the shoe out of the caliper (Fig. 11).

CLEANING AND INSPECTION

When the shoe and lining assemblies are replaced, remove the dust boots from the pistons. Check the condition of the boots, and inspect each piston surface for damage or corrosion. Thoroughly clean each dust boot and surrounding area before installing.

INSTALLATION

1. Position a new shoe and lining assembly on each side of the rotor so that the lining faces the rotor. Be sure that the tabs on the shoe flanges seat fully against the caliper bridges (Fig. 11).

2. Install the caliper splash shield and secure the shield to the caliper with two retaining bolts (Fig. 1).

3. Pump the brake pedal several times until a firm pedal is obtained and the shoe and lining assemblies are properly seated.

4. Install the wheel and tire assembly on the hub and rotor assembly.

5. Check and refill the master cylinder reservoir with specified brake fluid as required.

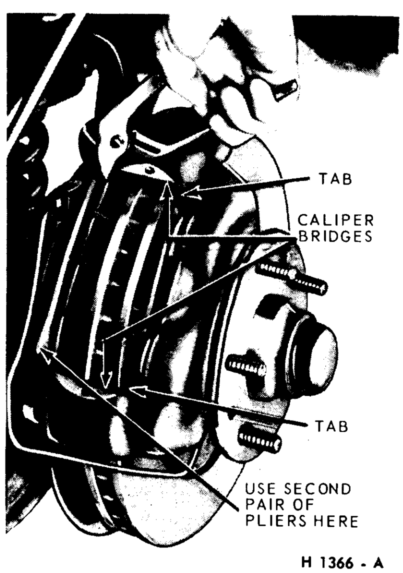

FIG. 11—Removing Disc Brake Shoe and Lining Assembly

6. Road test the car.

It should not be necessary to bleed the system after a shoe and lining replacement.

DISC BRAKE CALIPER ASSEMBLY

REMOVAL

1. Remove the wheel and tire assembly from the hub and rotor assembly. **Be careful to avoid damage or interference with the caliper splash shield, bleeder screw fitting or transfer tube.**

2. Disconnect the front brake flexible hose from the brake tube at the bracket on the frame (Fig. 20).

3. Remove the two bolts that retain the caliper to the spindle.

Take care to avoid loosening the bridge bolts that hold the two halves of the caliper together.

4. Lift the caliper assembly off the rotor.

INSTALLATION

1. Position the caliper assembly on the rotor, and mate the mounting bolt holes in the caliper with those in the spindle. It may be necessary to push the caliper pistons into the cylinder bores to obtain clearance between the shoe and lining assemblies and the rotor. The shoe and lining assemblies should be seated properly on the bridges.

2. Install the caliper to spindle retaining bolts and torque to specification. Note the difference in bolt lengths. Check to insure that the rotor runs squarely and centrally between the two halves of the caliper. There should be approximately 0.090-0.120 inch clearance between the caliper and the rotor outside diameter (Fig. 2).

3. Connect the front wheel brake flexible hose to the brake tube at the bracket on the frame (Fig. 20). The hose should be checked for correct routing.

4. Bleed the brake system as outlined in Section 2-1. Check the master cylinder fluid level, and the specified brake fluid as required.

5. **Pump the brake pedal several times to actuate the piston seals and to position the shoe and lining assemblies.**

6. Install the wheel and tire assembly.

7. Road test the car.

FRONT WHEEL HUB AND ROTOR ASSEMBLY

REMOVAL

1. Remove the wheel and tire assembly from the hub and rotor assembly (Fig. 12). **Be careful to avoid damage or interference with the caliper splash shield, bleeder screw fitting or transfer tube.**

2. Remove the caliper assembly from the spindle and the rotor. If the caliper does not require servicing, it is not necessary to disconnect the brake hose or remove the caliper from the car. Position the caliper out of the way, and support it with a wire to avoid damaging the caliper or stretching the hose. Insert a **clean** cardboard spacer between the linings to prevent the pistons from coming out of the cylinder bores while the caliper is removed.

Handle the rotor and caliper assemblies in such a way as to avoid deformation of the rotor and nicking or scratching of the brake linings.

3. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone and roller assembly.

4. Remove the hub and rotor assembly from the spindle.

INSTALLATION

1. If the rotor is being replaced, remove the protective coating from the new rotor with carburetor degreaser. Pack a new set of bearings with specified grease, and install the inner bearing cone and roller assembly in the inner cup. Pack grease lightly between the lips of a new grease retainer and install the retainer (Fig. 12).

If the original rotor is being installed, make sure that the grease in the hub is clean and adequate, that the inner bearing and grease retainer are lubricated and in good condition, and that the rotor braking surfaces are clean.

2. Install the hub and rotor assembly on the spindle.

3. Lubricate and install the outer wheel bearing, washer and adjusting nut.

4. Adjust the wheel bearings to specification, and then install the nut lock, cotter pin, and grease cap. **The wheel bearing adjustment is especially important with disc brakes.**

5. Mount the caliper assembly on the spindle and torque the two mounting bolts to specification. If necessary, push the caliper pistons into the cylinder bores to obtain clearance between the shoe and lining assemblies and the rotor. Be sure that the shoe and lining assemblies are seated on the bridges. Check the flexible hose for correct routing.

6. Install the wheel and tire on the hub and rotor assembly.

DISC BRAKE ROTOR SPLASH SHIELD

REMOVAL

1. Remove the caliper and the hub and rotor assembly as outlined under "Removal" in the foregoing procedure.

2. Remove the three bolts that retain the splash shield to the spindle, and remove the shield (Fig. 12).

3. Remove the gasket.

INSTALLATION

1. Install the gasket.

2. If the shield is bent, straighten it out before installation. Position the shield to the spindle, install the retaining bolts, and torque to specification (Fig. 12).

3. Install the hub and rotor assembly and the caliper as outlined under "Installation" in the foregoing procedure.

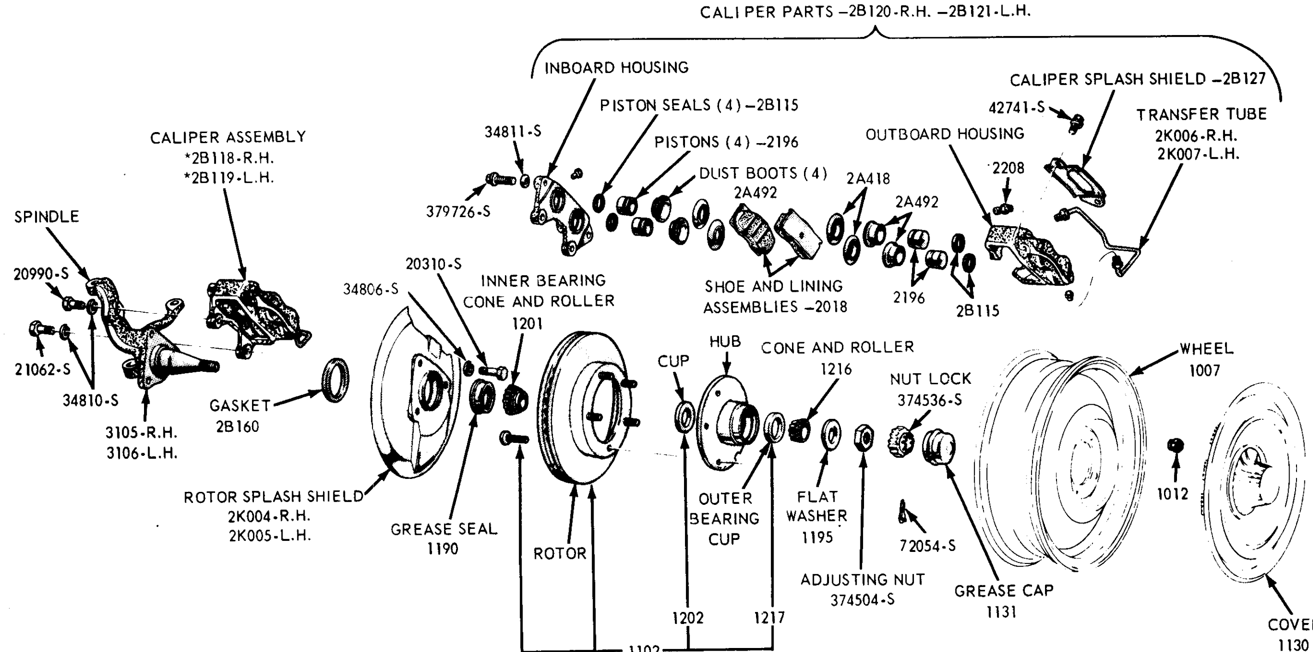

FIG. 12—Disc Brake Disassembled

H1371-A

PROPORTIONING VALVE

REMOVAL

1. Disconnect and remove the master cylinder - to - proportioning valve brake tube (Fig. 20).

2. Disconnect the front - to - rear brake tube from the proportioning valve.

3. Working underneath the left fender, remove the bolt that retains the proportioning valve to the fender apron and remove the valve through the access hole (Fig. 13).

INSTALLATION

1. From underneath the left fender, install the proportioning valve through the access hole in the fender apron. Position the valve to the apron so that the mounting tang extends through the hole in the fender apron as shown in Fig. 13. Install the retaining bolt.

2. Connect the front-to-rear brake tube to the valve (Fig. 20).

3. Position and connect the master cylinder - to - proportioning valve brake tube.

4. Bleed the brake system.

BRAKE SHOE ADJUSTMENTS — REAR WHEELS

The car should be raised with the wheels off the floor.

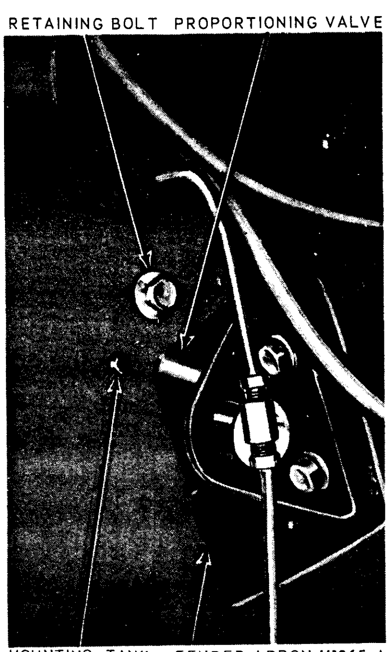

FIG. 13—Removing or Installing the Proportioning Valve

FIG. 14—Expanding Brake Shoes

The rear hydraulic service brakes are self-adjusting and require a manual adjustment only after the brake shoes have been relined, replaced, or when the length of the adjusting screw has been changed while performing some other service operation.

The brake drums should be at normal room temperature when adjusting the brake shoes. If the shoes are adjusted when the drums are hot and expanded, the shoes may drag when the drums are cool and contracted.

1. After the shoes have been installed or the adjusting screw has been turned, install the drum. Be sure that all excess grease, oil, and other foreign material are wiped off the carrier plate and drum.

2. Remove the adjusting hole cover from the carrier plate and, from the carrier plate side, turn the adjusting screw upward to expand the shoes (Fig. 14). Expand the shoes until a drag is felt when the drum is rotated.

3. Remove the drum. Mark the tooth on the star wheel where the lever contacts the adjusting screw. While holding the adjusting lever out of engagement with the adjusting screw, back off the adjusting screw ¾ of a turn with the fingers. If finger movement will not turn the screw, free it up; otherwise, the self-adjusting lever will not turn the screw. Lubricate the screw with a thin uniform coating of high-temperature grease (see Specifications). **Any other adjustment procedure may cause damage to the adjusting screw with consequent self adjuster problems.**

4. Apply a small quantity of high-temperature grease to the points where the shoes contact the carrier plate, being careful not to get the lubricant on the linings. Install the drum. Secure the drum with three Tinnerman nuts.

5. Install the wheel and tire. Tighten the mounting nuts to specification.

6. Install the adjusting hole cover on the brake carrier plate.

7. Check the parking brake cables for proper adjustment. Make sure that the equalizer lever operates freely.

8. After the brake shoes have been properly adjusted, check the operation of the brakes.

REAR BRAKE DRUM

REMOVAL

1. Raise the car until the wheel and tire clear the floor.

2. Remove the hub cap and wheel. Remove the three Tinnerman nuts and remove the brake drum. If the brake drum will not come off easily, insert a narrow screwdriver through the brake adjusting hole in the carrier plate, and disengage the adjusting lever from the adjusting screw. While holding the adjusting lever away from the adjusting screw, back off the adjusting screw with the brake adjusting tool (Fig. 15). **Back off the adjustment only if the drum cannot be removed. Be very careful not to burr, chip, or damage the notches in the adjusting screw; otherwise, the self-adjusting mechanism will not function properly.** If the adjustment was changed, make certain that the adjuster lever is properly seated in the shoe web.

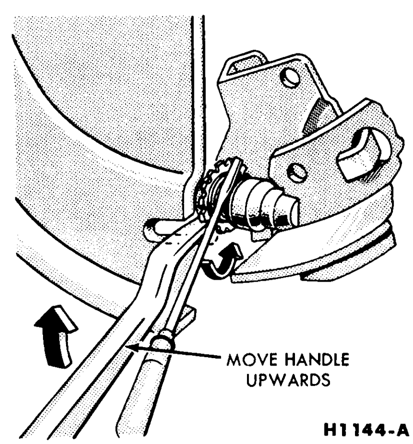

FIG. 15—Backing off Brake Adjustment

INSTALLATION

1. Remove the protective coating from a new drum with carburetor degreaser.

2. Place the drum over the brake assembly and into position. If required, adjust the brakes as outlined under "Brake Shoe Adjustments" in this section. Make sure the adjusting lever is properly seated in the shoe web.

3. Install the three Tinnerman nuts and tighten securely. Install the wheel on the axle shaft flange studs against the drum, and tighten the retaining nuts to specifications. Install the hub cap.

REAR BRAKE SHOE REPLACEMENT

REMOVAL

1. Remove the wheel and the brake drum.

2. Contact the shoes as follows:

a. Disengage the adjusting lever from the adjusting screw by pulling backward on the adjusting lever (Fig. 4).

b. Move the outboard side of the adjusting screw upward and back off the pivot nut as far as it will go.

3. Pull the adjusting lever, cable and automatic adjuster spring down and toward the rear to unhook the pivot hook from the large hole in the secondary shoe web. **Do not attempt to pry the pivot hook out of the hole.**

4. Remove the automatic adjuster spring and adjusting lever (Fig. 4).

5. Remove the primary shoe to anchor spring with the tool shown in Fig. 16. With the same tool, remove the secondary shoe to anchor spring and unhook the cable eye from the anchor pin.

6. Remove the anchor pin plate and the anti-rattle clip.

7. Remove the cable guide from the secondary shoe (Fig. 4).

8. Remove the shoe hold-down springs, shoes, adjusting screw, pivot nut, and socket.

9. Remove the parking brake link and spring. Disconnect the parking brake cable from the parking brake lever.

10. After removing the secondary shoe, disassemble the parking brake lever from the shoe by removing the retaining clip and spring washer (Fig. 4).

INSTALLATION

1. Before installing the brake shoes, back off the parking brake adjustment. Then assemble the parking brake lever to the secondary shoe and secure with the spring washer and retaining clip.

2. Apply a light coating of high-temperature grease at the points where the brake shoes contact the carrier plate.

3. Position the brake shoes on the carrier plate and secure the assembly with the hold-down springs. Install the parking brake link and spring. Connect the parking brake cable to the parking brake lever (Fig. 4).

4. Install the anti-rattle clip and the anchor pin plate on the anchor pin.

5. Place the cable eye over the anchor pin with the crimped side toward the carrier plate.

6. Install the cable guide on the secondary shoe web with the flanged hole properly fitted into the hole in the secondary shoe web. Thread the cable around the cable guide groove (Fig. 4).

It is imperative that the cable be positioned in this groove and not between the guide and the shoe web.

7. Install the secondary shoe to anchor spring (Fig. 17).

8. Install the primary shoe to anchor spring with the tool shown in Fig. 4.

Be certain that the cable eye is not cocked or binding on the anchor pin when installed. All parts should be flat on the anchor pin.

9. Apply high-temperature grease to the threads and the socket end of the adjusting screw. Turn the adjusting screw into the adjusting pivot nut to the limit of the threads and then back off ½ turn.

Interchanging the brake shoe adjusting screw assemblies from one side of the car to the other would cause the brake shoes to retract rather than expand each time the automatic adjusting mechanism operated. To prevent installation on the wrong side of the car, the socket end of the adjusting screw is stamped with an R or L (Fig. 18). The adjusting pivot nuts can be distinguished by the number of grooves machined around the body of the nut. Two grooves indicate a right hand nut; one groove indicates a left hand nut.

10. Place the adjusting socket on the screw and install this assembly between the shoe ends with the adjusting screw toothed wheel nearest the secondary shoe.

11. Hook the cable hook into the hole in the adjusting lever. The adjusting levers are stamped with an R or L to indicate their installation on a right or left hand brake assembly (Fig. 18).

12. Position the hooked end of the adjuster spring completely into the large hole in the primary shoe web. The last coil of the spring should be at the edge of the hole. Connect the loop end of the spring to the adjuster lever hole.

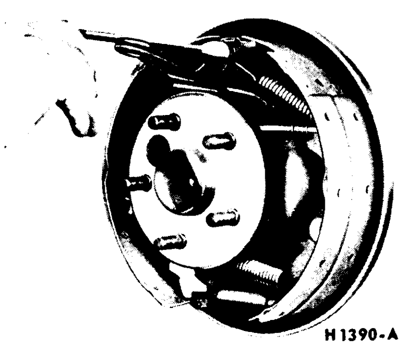

FIG. 16—Retracting Spring Removal

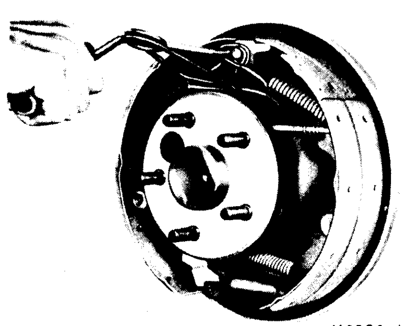

FIG. 17—Retracting Spring Installation

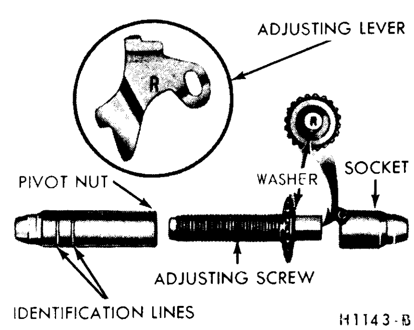

FIG. 18—Adjusting Screw and Lever Identification

13. Pull the adjuster lever, cable and automatic adjuster spring down and toward the rear to engage the pivot hook in the large hole in the secondary shoe web (Fig. 4).

14. After installation, check the action of the adjuster by pulling the section of the cable between the cable guide and the adjusting lever toward the secondary shoe web far enough to lift the lever past a tooth on the adjusting screw wheel. The lever should snap into position behind the next tooth, and release of the cable should cause the adjuster spring to return the lever to its original position. This return action of the lever will turn the adjusting screw one tooth.

If pulling the cable does not produce the action described, or if the lever action is sluggish instead of positive and sharp, check the position of the lever on the adjusting screw toothed wheel. With the brake in a vertical position (anchor at the top), the lever should contact the adjusting wheel 3/16 inch (plus or minus 1/32 inch) above the centerline of the screw. If the contact point is below this centerline, the lever will not lock on the teeth in the adjusting screw wheel, and the screw will not be turned as the lever is actuated by the cable.

To determine the cause of this condition:

a. Check the cable end fittings. The cable should completely fill or extend slightly beyond the crimped section of the fittings. If it does not meet this specification, possible damage is indicated and the cable assembly should be replaced.

b. Check the cable length. The cable should measure 11 1/8 inches (plus or minus 1/64 inch) from the end of the cable anchor to the end of the cable hook.

c. Check the cable guide for damage. The cable groove should be parallel to the shoe web, and the body of the guide should lie flat against the web. Replace the guide if it shows damage.

d. Check the pivot hook on the lever. The hook surfaces should be square with the body of the lever for proper pivoting. Replace the lever if the hook shows damage.

e. See that the adjusting screw socket is properly seated in the notch in the shoe web.

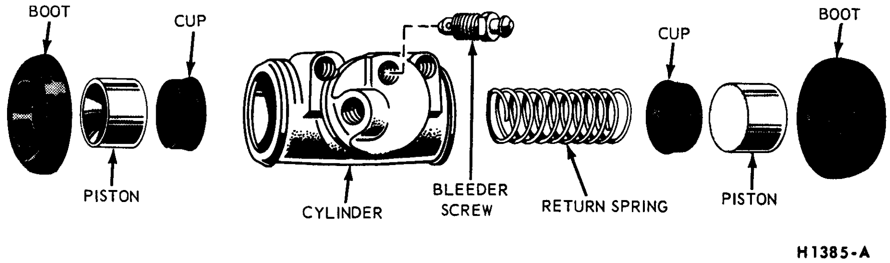

FIG. 19—Rear Brake Wheel Cylinder

REAR WHEEL CYLINDER REPAIR

It is not necessary to remove the brake cylinder from the carrier plate to disassemble, inspect, or hone and overhaul. Removal is necessary only when the cylinder is damaged or scored beyond repair.

DISASSEMBLY

1. Remove the links and the rubber boots from the ends of the brake cylinder. Remove the pistons, cups, and return spring from the cylinder bore (Fig. 19).
2. Remove the bleeder screw from the cylinder.

INSPECTION

1. Wash all parts in clean denatured alcohol. If alcohol is not available, use specified brake fluid. Dry with compressed air.
2. Check all internal parts for excessive wear or damage. **If any of the internal parts require replacing, all should be replaced.**
3. Inspect the cylinder bore for score marks or rust. If either condition is present, the cylinder bore must be honed. **However, the cylinder should not be honed more than 0.003 inch beyond its original diameter.**
4. Check the bleed hole to be sure that it 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 into their respective positions in the cylinder bore (Fig. 19). Place a boot over each end of the cylinder.

REAR WHEEL CYLINDER REPLACEMENT

REMOVAL

1. With the wheel in a raised position, remove the wheel and the drum.
2. Remove the brake shoe assemblies, following procedures outlined in this section.
3. Disconnect the brake line from the brake cylinder. **Be sure the engine is stopped and there is no vacuum in the booster system before disconnecting the hydraulic lines.**

Unscrew the tube fitting that connects the tube to the cylinder. **Do not pull the metal tube away from the cylinder. Pulling the tube out of the cylinder connection will bend the metal tube and make installation difficult.** The tube will separate from the cylinder when the cylinder is removed from the carrier plate.

4. Remove the brake cylinder retaining bolts and lock washers and remove the cylinder.

INSTALLATION

Wipe the end(s) of the hydraulic line to remove any foreign matter before making connections.

1. Place the rear wheel cylinder into position. Enter the tubing into the cylinder, and start the tube fitting nut into the threads of the cylinder.
2. Secure the cylinder to the carrier plate by installing the retaining bolts and lock washers.
3. Tighten the tube fitting nut to specification with Milbar tool 1112-144 or its equivalent.
4. Bleed the brake hydraulic system as detailed in Section 2.

REAR 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 and adjuster assemblies and the wheel

cylinder as outlined in this section. On the rear wheel, disconnect the parking brake lever from the cable.

3. Rotate the axle shaft so that the hole in the axle shaft flange line up with the carrier plate retaining nuts and remove the nuts. Pull the axle shaft assembly out of the housing with tool 4235C and a slide hammer (Part 4-2), and then remove the carrier 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.

2. Install the wheel cylinder and connect the brake line as outlined in this section.

3. Install the brake shoe and adjuster assemblies as outlined in this section. Connect the parking brake cable to the lever. Install the brake drum and wheel.

4. Adjust the brake shoes (Section 2), and bleed the brake system as outlined in Part 2-1, Section 2.

HYDRAULIC LINES

Steel tubing is used throughout the brake system with the exception of the flexible hoses at the front wheels and at the rear axle housing brake tube connector (Fig. 20).

Always bleed the entire system after any hose or line replacement.

BRAKE TUBE REPLACEMENT

If a section of the brake tubing becomes damaged, the entire section should be replaced with tubing of the same type, size, shape, and length. **Copper tubing should not be used in a hydraulic system.** When bending brake tubing to fit underbody or rear axle contours, be careful not to kink or crack the tube.

All brake tubing should be flared properly to provide good leak-proof connections. Clean the brake tubing by flushing with clean denatured alcohol, before installation.

When connecting a tube to a hose, tube connector, disc caliper, or brake cylinder, tighten the tube fitting nut to the specified torque with Milbar tool 1112-144 or equivalent.

BRAKE HOSE REPLACEMENT

A flexible brake hose should be replaced if it shows signs of softening, cracking, or other damage.

When installing a new front brake hose, position the hose to avoid contact with other chassis parts. Place a new copper gasket over the hose fitting and screw the hose assembly into the front disc brake caliper. Place the opposite end of the hose at the bracket on the frame. Install the horseshoe-type retaining

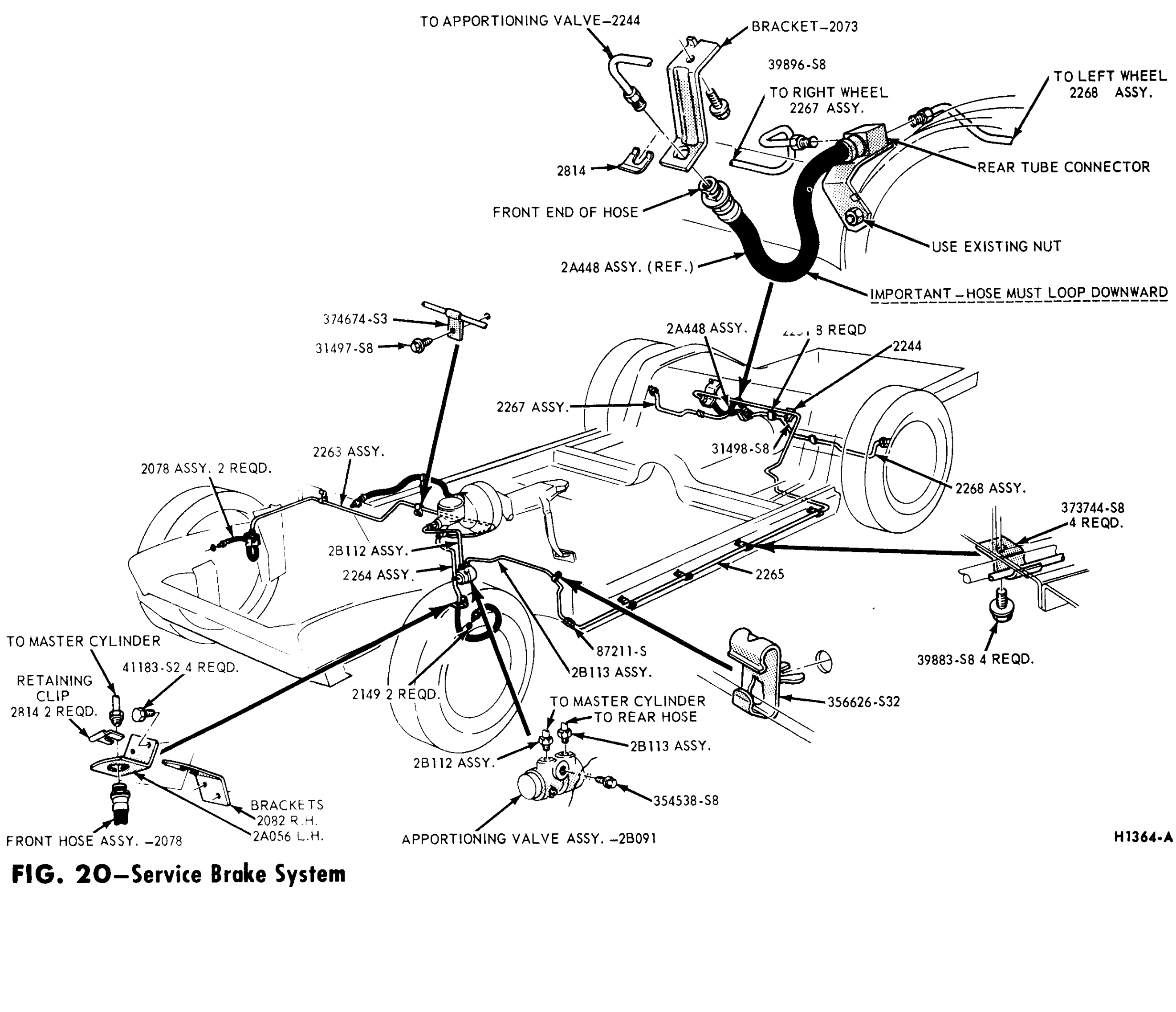

FIG. 20—Service Brake System

clip, and connect the tube to the hose with the tube fitting nut. (Fig. 20).

A rear brake hose should be installed so that it does not touch the muffler outlet pipe or shock absorber.

Place a new gasket over the rear hose fitting and screw the hose assembly into the rear brake tube connector. Place the front end of the hose at the bracket on the frame. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut.

3 REMOVAL AND INSTALLATION

MASTER CYLINDER

REMOVAL

1. Disconnect the brake lines from the outlet fittings (Fig. 20).
2. Remove the two nuts and lock washers that secure the master cylinder to the booster unit. Separate the master cylinder from the booster unit and make sure that the master cylinder does not rest on the push rod.
3. Remove and discard the rubber seal from the outer groove at the end of the master cylinder.
4. Remove the push rod from the power unit. **Do not disturb the adjusting screw.**

INSTALLATION

1. Apply a light coating of lubricant COAZ-19584-A to the piston end of the hydraulic push rod and guide the piston end of the push rod into the center bore of the booster piston.
2. Twist the push rod to make certain the end of the piston is bottomed against the reaction disc and there is no air pocket between the end of the push rod and the reaction disc.
3. Before proceeding with the installation, check the distance from the outer end of the push rod to the master cylinder mounting surface at the end of the vacuum cylinder (Part 2-1, Fig. 2). This dimension should be from 0.990 to 0.995 inch measured metal to metal. If the push rod dimension is not correct, see "Master Cylinder Push Rod Adjustment", Part 2-1, Section 2.
4. When the push rod adjustment is correct, install a new rubber seal in the groove at the end of the master cylinder.
5. Position the master cylinder over the push rod onto the two studs that are integral with the booster body.
6. Install the attaching nuts and lock washers and torque the nuts to specifications.
7. Connect the brake lines to the outlet fittings (Fig. 20).
8. Bleed the brake system. Fill the master cylinder to ⅜-inch from the top of the filler opening. Be sure that the gasket is properly seated in the filler cap, and install the cap.

BRAKE BOOSTER

REMOVAL

1. Disconnect the vacuum hose from the booster.
2. Remove three bolts and loosen one to allow the brace between the cowl and spring tower to be positioned inboard for obtaining clearance.
3. Remove the retaining nuts and lock washers, and remove the master cylinder from the booster. It is not necessary to disconnect the brake lines.
4. Working inside the car below the instrument panel, disconnect the booster push rod link from the brake pedal assembly. To do this, proceed as follows:

Disconnect the stop light switch wires at the connector. Remove the hairpin retainer. Slide the stop light switch off from the brake pedal **just far enough for the switch outer hole to clear the pin,** and then lift switch straight **upward** from the pin. Slide the master cylinder push rod and the nylon washer and bushing off from the brake pedal pin (Fig. 21).

5. Remove the four bracket-to-dash panel retaining nuts and washers.
6. Remove the booster and bracket assembly from the dash panel, sliding the push rod link out from the

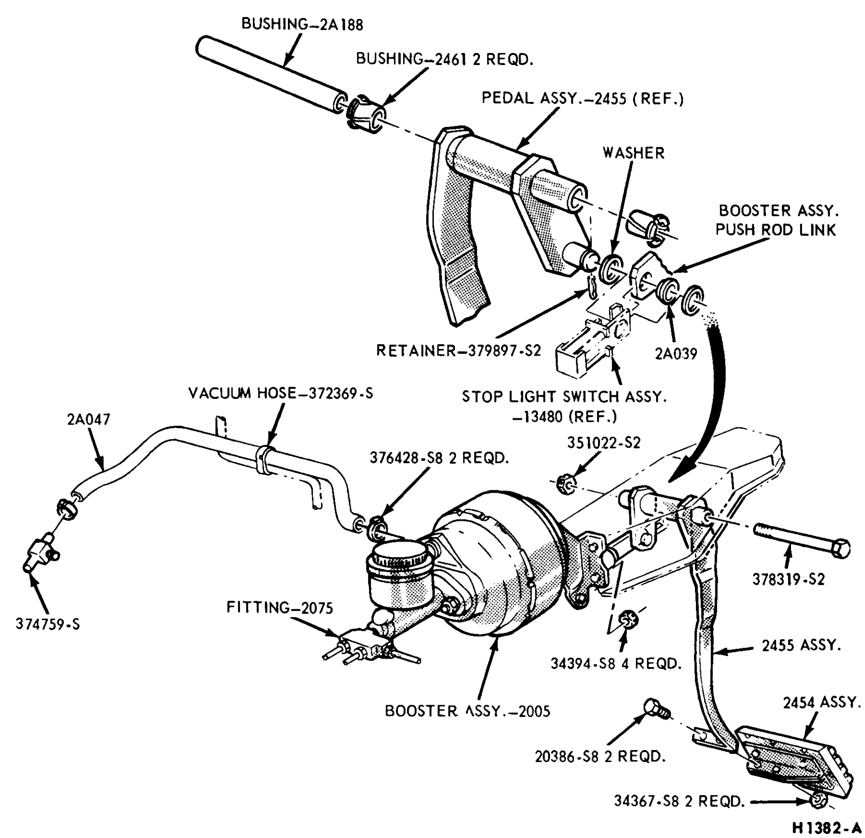

FIG. 21—Brake Booster and Pedal Installation

engine side of the dash panel (Fig. 21).

7. Remove the dust seal from the booster push rod link and position it in the slot in the dash panel fo installation.

INSTALLATION

1. Mount the booster and bracket assembly to the dash panel by sliding the bracket mounting studs and the push rod link in through the holes in the dash panel (Fig. 21).

2. Working inside the car below the instrument panel, install the mounting bracket-to-dash panel retaining nuts and washers. Leave the nuts loose until after the pedal assembly has been connected.

3. Working inside the car below the instrument panel, connect the booster push rod link to the brake pedal assembly. To do this, proceed as follows:

Install the inner nylon washer, the master cylinder push rod, and the bushing on the brake pedal pin. Position the switch so that it straddles the push rod with the switch slot on the pedal pin and the switch outer hole just clearing the pin. Slide the switch completely onto the pin. Install the outer nylon washer as shown in Fig. 21. Secure these parts to the pin with the hairpin retainer. Connect the stop light switch wires to the connector, and install the wires in the retaining clip.

4. Tighten and torque the booster retaining nuts to specification.

5. Position the master cylinder to the booster, install the lock washers and retaining nuts, and torque to specification.

6. Position the cowl to spring tower brace, install the bolts and nuts, and torque to specification.

7. Connect the vacuum hoses to the booster.

BRAKE PEDAL

REMOVAL

1. Loosen the booster mounting nuts.

2. Disconnect the stop light switch wires at the connector.

3. Remove the hairpin retainer. Slide the stop light switch off from the brake pedal pin **just far enough for the switch outer hole to clear the pin,** and then lift the switch straight **upward** from the pin. Slide the master cylinder push rod and the nylon washers and bushing off from the brake pedal pin (Fig. 21).

4. Remove the pivot bolt and nut that holds the pedal to the pedal support bracket. Remove the brake pedal assembly from the pedal support bracket, and remove the bushings.

INSTALLATION

1. Apply a coating of Lubriplate to the bushings and locate all the bushings in their proper places on the pedal assembly (Fig. 21).

2. Install the brake pedal assembly and bushings to the support bracket, and then install the pivot bolt through the support bracket and brake pedal assembly. Install the pivot bolt nut and torque to specification.

3. Install the inner nylon washer, the master cylinder push rod, and

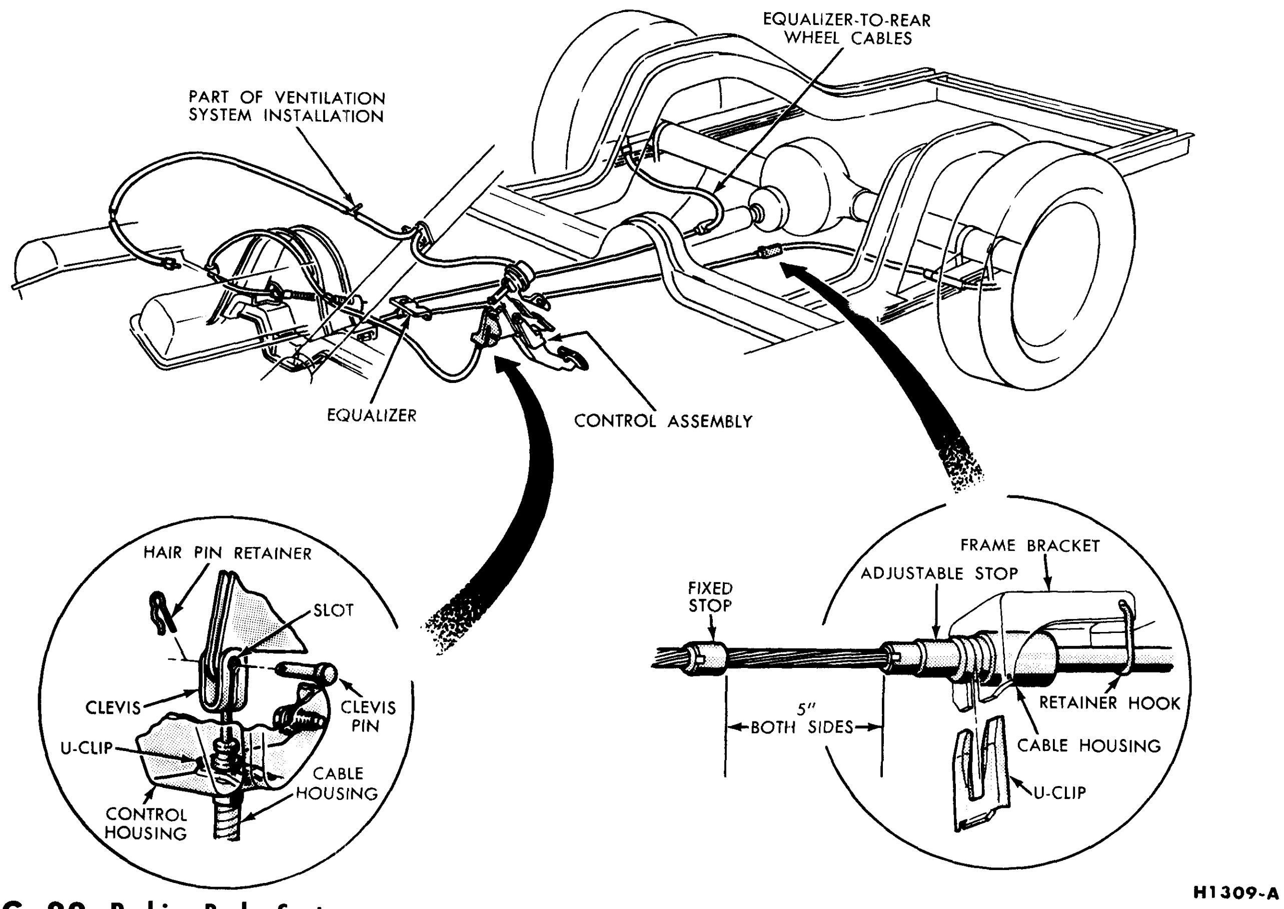

FIG. 22—Parking Brake System

the bushing on the brake pedal pin. Position the switch so that it straddles the push rod with the switch slot on the pedal pin and the switch outer hole just clearing the pin. Slide the switch completely onto the pin, install the outer nylon washer as shown in Fig. 21. Secure these parts to the pin with the hairpin retainer.

4. Connect the stop light switch wires to the connector, and install the wires in the retaining clip.

5. Torque the booster mounting nuts to specification.

PARKING BRAKE CONTROL ASSEMBLY

REMOVAL

1. Raise the car on a hoist and disconnect the pedal cable from the equalizer lever by removing the adjusting nut (Fig. 1, Part 2-1). Remove the U-clip and disengage the cable housing from the bracket.

2. Lower the car. In the passenger compartment, remove the retaining screws and the left kick pad. Remove the four screws that retain the air duct to the inner cowl panel, and then remove the air duct to obtain access to the brake control assembly. Remove the control cable from the air duct.

3. Disconnect the hose from the vacuum power unit.

4. Remove the control assembly-to-mounting bracket bolts.

5. Remove the U-clip that retains the cable housing to the parking brake control housing (Fig. 22).

6. Remove the hairpin retainer and clevis pin from the clevis. Disengage the clevis from the ball end of the cable, then remove the control assembly from the cable and cable housing.

INSTALLATION

1. Position the cable through the hole in the parking brake control housing. Install the clevis on the ball end of the cable and connect the clevis to the actuating arm with the clevis pin (Fig. 22). Secure the clevis pin with the hairpin retainer.

2. Secure the cable housing to the parking brake control housing with the U-clip.

3. Position the parking brake control assembly to the mounting bracket and install the three retaining bolts.

4. Connect the vacuum hose to the vacuum power unit.

5. Position the air duct to the inner cowl panel, and secure with four retaining screws. Connect the air duct control cable to the air duct. Position the left kick pad to the side panel and secure with two retaining screws.

6. Raise the car on a hoist. Engage the cable housing to the frame bracket with a U-clip (Fig. 1, Part 2-1). Install the spring seat, cable spring and washer on the rear end of the cable. Assemble the cable to the equalizer lever and install the half-moon type adjusting nut on the end of the cable.

7. Adjust the parking brake linkage as outlined in Part 2-1, Section 2, and then check the operation of the parking brake.

PARKING BRAKE VACUUM POWER UNIT

REMOVAL

1. Remove the parking brake control assembly from the car as described under "Removal" in the foregoing procedure.

2. Drill out or grind off the two rivets that retain the vacuum power unit to the parking brake control assembly.

3. Drill out or grind off the rivet that connects the vacuum piston link to the release lever, and remove the power unit.

INSTALLATION

1. Position the vacuum power unit on the parking brake control assembly and secure with two round head bolts and nuts.

2. Connect the vacuum piston link to the release lever with a shoulder bolt nut and wave washer. The wave washer is to be positioned on the shoulder bolt between the vacuum piston link and the release lever. The link and release lever must pivot freely.

3. Install the parking brake control assembly in the car as described under "Installation" in the foregoing procedure.

4. Test the lock and automatic release operations of the parking brake control assembly with the engine running in all the transmission selector lever positions. With the engine running, the parking brake should remain engaged in "neutral" or "park" and should release in any drive position.

PARKING BRAKE EQUALIZER-TO-CONTROL ASSEMBLY CABLE

REMOVAL

1. Raise the car on a hoist and disconnect the pedal cable from the equalizer lever by removing the adjusting nut (Fig. 1, Part 2-1). Remove the cable washer, spring, and spring seat. Remove the U-clip and disengage the cable housing from the bracket.

2. Lower the car. In the passenger compartment, remove the retaining screws and the left kick pad. Remove the four screws that retain the air duct to the inner cowl panel, and then remove the air duct to obtain access to the brake control assembly. Remove the control cable from the air duct.

3. Disconnect the hose from the vacuum power unit.

4. Remove the control assembly-to-mounting bracket bolts.

5. Remove the U-clip that retains the cable housing to the parking brake control housing (Fig. 22).

6. Remove the hairpin retainer and clevis pin from the clevis. Disengage the clevis from the ball end of the cable. Remove the control assembly from the cable and cable housing.

7. Push the cable and housing down through the hole in the floor pan and remove it from under the car.

INSTALLATION

1. From the underside of the car, guide the upper end of the replacement cable into the hole in the floor pan.

2. From the inside, pull the new cable and housing up through the hole in the floor pan.

3. Position the cable through the hole in the parking brake control housing. Install the clevis on the ball end of the cable and connect the clevis to the actuating arm with the clevis pin (Fig. 22). Secure the clevis pin with the hairpin retainer.

4. Secure the cable housing to the parking brake control housing with the U-clip.

5. Position the parking brake control assembly to the mounting bracket and install the three retaining bolts.

6. Connect the vacuum hose to the vacuum power unit.

7. Position the air duct to the inner cowl panel, and secure with four retaining screws. Connect the air duct control cable to the air

duct. Position the left kick pad to the side panel and secure with two retaining screws.

8. Raise the car on a hoist. Engage the cable housing to the frame bracket with a U-clip (Fig. 1, Part 2-1). Install the spring seat, cable spring and washer on the rear end of the cable. Assemble the cable to the equalizer lever and install the half-moon type adjusting nut on the end of the cable.

9. Adjust the parking brake linkage as outlined in Part 2-1, Section 2, and then check the operation of the parking brake.

PARKING BRAKE EQUALIZER TO REAR WHEEL CABLE

REMOVAL

1. Raise the car and remove the hub cap. Remove the wheel and tire assembly from the drum.

2. Remove the three Tinnerman nuts that retain the brake drum, then remove the drum.

3. Loosen the adjusting nut on the equalizer rod and disengage the ball end of the cable from the equalizer (Fig. 1, Part 2-1).

4. Remove the U-clip that retains the cable housing to the frame bracket. Disengage the housing from the bracket and slip off the retainer hook (Fig. 22).

5. Working on the wheel side of the carrier plate (Fig. 4), compress the prongs on the cable retainer so that they can pass through the hole in the carrier plate. Draw the cable retainer out of the hole.

6. With the spring tension off the parking brake lever, lift the cable out of the slot in the lever and remove through the carrier plate hole.

INSTALLATION

1. Pull enough of the cable through the housing so that the end of the cable may be inserted through the carrier plate access hole from the inner side and engaged with the slot in the parking brake lever.

2. Pulling the excess slack from the cable, insert the cable housing into the carrier plate access hole so that the retainer prongs expand.

3. Thread the front end of the cable through the frame bracket, and engage the cable housing to the bracket. Install the U-clip and retainer hook (Fig. 22).

4. While holding the adjustable cable stop against the cable housing end, pull the cable through the housing until there is a distance of five inches between the two stops as shown in Fig. 22. Crimp the adjustable stop against the cable to hold this dimension.

5. Insert the ball end of the cable into the equalizer and tighten the adjusting nut slightly.

6. Install the rear drum. Tighten the three Tinnerman nuts that retain the drum, and install the wheel and hub cap.

7. Adjust the parking brake linkage as outlined in Part 2-1, Section 2.

4 MAJOR REPAIR OPERATIONS

REAR 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 or over 0.007 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 (11.150 inches).

If the drum diameter is less than 0.030 inch oversize (11.120 inches) after refinishing, standard lining may be installed. If the drum diameter is 11.120-11.150 inches, oversize linings must be installed.

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.

REAR BRAKE SHOE RELINING

Brake linings that are worn to within 1/32 inch of the rivet or have been saturated with grease or oil should be replaced. Failure to replace worn linings will result in a scored drum. **When it is necessary to replace linings, they must also be replaced on the wheel on the opposite side of the car.**

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 shoes.

2. Check the inside diameter of the brake drum. If the diameter is less than 11.120 inches, standard linings may be installed. If the diameter is 11.120-11.150 inches, oversize lining should be installed.

3. Position the new lining on the shoe. Starting in the center, insert and secure the rivets, working alternately towards each end. Install all parts supplied in the kit. **Ford replacement linings are ground and no further grinding is required.**

4. Check the clearance between the shoe and lining. The lining must seat tightly against the shoe with not more than 0.005 inch clearance between any two rivets.

MASTER CYLINDER

DISASSEMBLY

1. Press in against the piston removing the snap ring retainer, and then remove the piston assembly, cup, spring, residual check valve and seat (Fig. 23).

2. Remove secondary cup from the piston. Remove the cover by re-

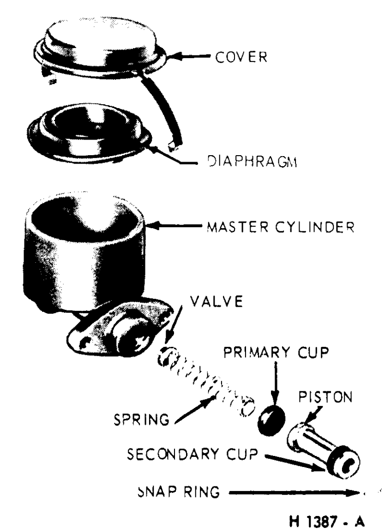

FIG. 23—Master Cylinder—Disassembled

leasing the spring clips on the sides, and remove the hermetic diaphragm.

ASSEMBLY

1. Clamp the master cylinder housing in a vise. Dip the hydraulic cylinder parts in brake fluid and assemble the check valve seal, residual check valve, and piston return spring in the bore of the cylinder in the order shown in Fig. 23.

2. If the secondary piston cup was removed from the piston, dip the cup in brake fluid and assemble the cup in the groove of the piston with the lip of the cup as shown.

3. Place the primary cup on the end of the piston assembly, and guide it into the cylinder bore.

4. Press in against the piston to compress the spring while seating the snap ring in the groove in the cylinder bore.

5. Install a new diaphragm (only if the old one is defective) in the cover, and attach the cover to the cylinder with the spring clips.

DISC BRAKE CALIPER

DISASSEMBLY

Do not remove the bridge bolts that hold the two halves of the caliper together. The two caliper housings are shown separated in Fig. 25 for illustration purposes only.

1. Remove the caliper assembly from the car as outlined in Section 2.

2. Remove the two retaining bolts and the caliper splash shield (Fig. 25).

3. Remove the two shoe and lining assemblies.

4. Remove the flexible brake hose from the caliper.

5. Remove the external transfer tube.

6. Remove the four dust boots from the caliper housings and piston grooves.

7. Clamp the caliper in a vise and secure it by the mounting flanges on the inboard housing (Fig. 24).

8. Remove the four pistons from the cylinder bores with the special tool shown in Fig. 24. To prevent cocking with consequent damage to the piston or bore, rotate the piston with the tool while pulling it outward at the same time. **Be careful to avoid scratching or damaging the outside diameter surface or dust boot retaining groove of the piston. Such damage causes poor sealing.**

If a piston is so completly seized in the cylinder bore that it can not be removed with the special tool, force the cylinder out of the bore by positioning two screwdrivers in the piston dust boot retaining groove and prying outward. To prevent cocking, tap the end of the piston lightly around the circumference with a hammer, while the prying force is being applied. Be careful to avoid damaging the dust boot retainer in the caliper housing (Fig. 25). If this method of removal is used, the pistons must be replaced.

If the caliper dust boot retainer or retaining groove is damaged or scratched, pry the retainer out of the caliper housing with screwdrivers.

9. Remove the rubber piston seals from the grooves in the cylinder bores by carefully inserting the point of a small knife or other pointed instrument under the seal and raising the seal up far enough to be pulled out with the fingers.

CLEANING AND INSPECTION

Clean all metal parts with alcohol or a suitable solvent (Fig. 25). Use clean, dry, compressed air to clean out and dry the grooves and passage ways. Be sure that the caliper bore and component parts are completely free of any foreign material.

Check the cylinder bores and pistons for damage or excessive wear. Replace the piston if it is pitted, scored, or the chrome plating is

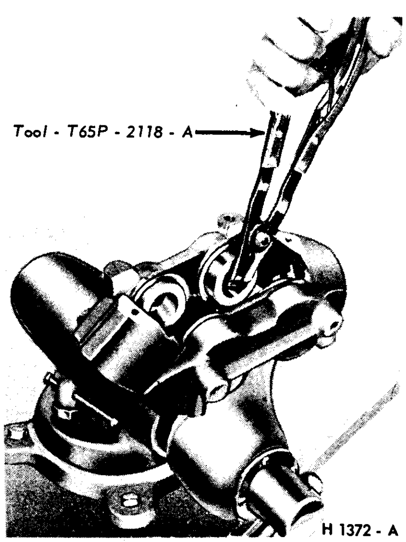

FIG. 24—Removing or Installing Pistons

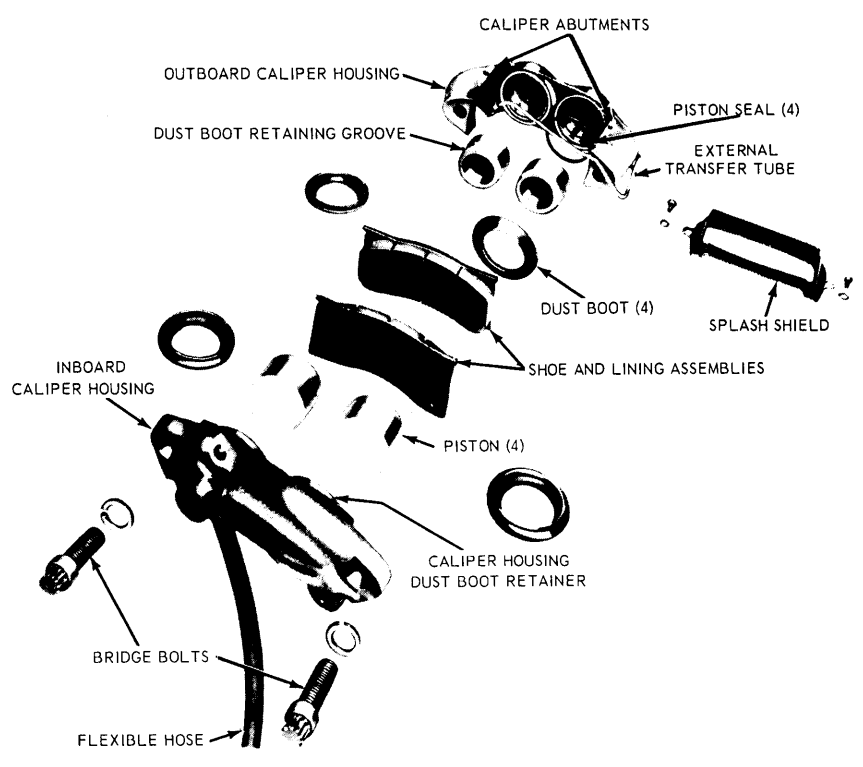

FIG. 25—Caliper Assembly—Exploded View

worn off. Check the caliper dust boot retainer for wear or damage.

ASSEMBLY

1. Clamp the caliper in a vise and secure it by the mounting flange on the inboard housing.

2. If a new caliper dust boot retainer is to be installed, thoroughly clean the contact area on the caliper housing and apply Loctite Sealant, Grade H to the retainer surface that seats in the housing. Install the retainer in the caliper housing.

3. Apply a film of clean brake fluid to **new** caliper piston seals and install them in the grooves of the cylinder bore. The seal should be positioned at one area in the groove and gently worked around. **Do not use the original seals.**

4. Coat the outside diameter of the pistons with brake fluid and install them in the cylinder bores so that the open end of the piston and the boot retaining groove face out of the bore. To avoid cocking, locate the piston squarely in the bore and apply a slow steady pressure. If a piston will not easily go all the way into the bore, remove it and thoroughly inspect the cylinder bore, the piston seal and the installation of the seal. If the piston still will not go in with bore in good condition and the piston seal properly installed, use the tool shown in Fig. 24. Rotate the piston with the tool while pushing it inward at the same time.

5. Carefully install four **new** dust boots on the caliper housings and pistons. Be sure that each boot is fully seated in the groove of its respective caliper housing and piston (Fig. 25). **Do not use the original dust boots.**

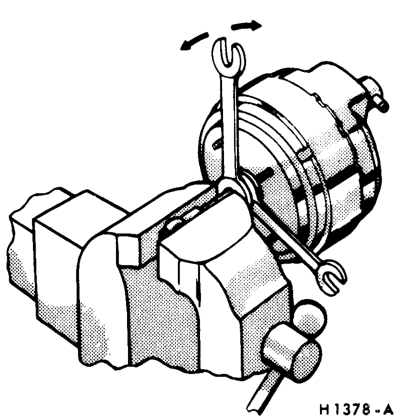

FIG. 26—Removing Valve Rod and Poppet Assembly

6. Install the external transfer tube.

7. Install the flexible brake hose to the caliper.

8. Install the caliper assembly on the spindle, and install the shoe and lining assemblies and the splash shield as outlined in Section 2.

9. Check the caliper for fluid leaks under maximum pedal pressures. **Do not move the car until a firm brake pedal is obtained.**

DISASSEMBLY OF BOOSTER

REMOVAL OF EXTERNAL PARTS

1. Make scribe marks across the front and rear shells, the master cylinder flange and the mounting bracket.

2. Remove the master cylinder mounting nuts and lock washers and remove the master cylinder.

3. Remove the retaining nuts and lock washers and the mounting brackets.

4. Apply alcohol to the eye of the valve rod and the small diameter of the dust guard, and then carefully remove the dust guard from the valve rod and the hub of the rear shell (Fig. 28).

5. Remove the hydraulic push rod from the front shell and remove the seal from the push rod.

REMOVAL OF VALVE ROD AND POPPET ASSEMBLY

1. With the valve rod in a vertical position, squirt alcohol down the rod to wet the rubber grommet in the valve plunger and the ball end of the rod.

2. Clamp the valve rod in a vise (Fig. 26), leaving just enough space between the steel retainer on the plastic valve hub and the side of the vise jaw for two medium-sized, open-end wrenches. Use the wrench nearest the vise as a pry to force the valve plunger off the ball end of the valve rod (Fig. 26).

When separating the valve rod from the plunger, hold the power unit to prevent it from falling. When prying with the wrenches be careful not to damage the plastic valve hub.

3. Remove the valve rod from the vise. Pry the retainer off the end of the valve housing being careful not to chip the plastic housing (Fig. 28).

4. Remove the valve return spring, the poppet retainer and the poppet.

DISASSEMBLY OF POWER SECTION

1. Clamp the base of Bendix tool 73800 in a vise and insert the studs of the rear shell in the holes in the base (Fig. 27).

2. Place the bar wrench and the clamp bar over the studs of the front shell, attach the hook bolts to the base and tighten the center bolt just enough to free the lock at the front shell outer rim.

3. Turn the bar counterclockwise until the lances in the front shell align with the notched sections of the rear shell outer flange. Loosen the center bolt. The shells should begin to separate as the load on the bolts is removed. If the shells do not separate, check the alignment of the lances with the notched sections and tap the front shell with a soft hammer to break the bond between the front shell, the diaphragm and the rear shell.

4. Press down firmly on the front shell while disconnecting the hook bolts so that the diaphragm return spring will not fly out of the assembly.

5. Remove the top clamp bar, the bar wrench, the front shell, and the return spring from the diaphragm and shell assembly.

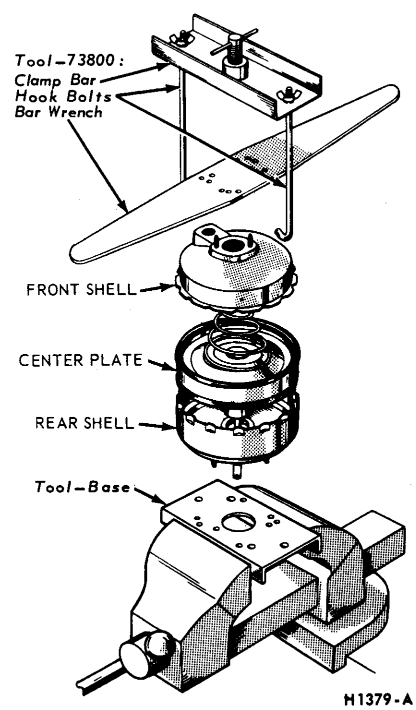

FIG. 27—Disassembly and Assembly of Power Section

6. Lift the diaphragm and plate assembly from the rear shell, and remove the rear shell from the fixture base.

7. Place the rear shell on the bench with the studs up, and drive out the seal with a punch or screw driver. **Do not remove the rear seal unless the seal is defective or a new seal is available.**

DISASSEMBLY OF DIAPHRAGM, PLATES, RETAINER AND PLUNGER

1. Wet the rear diaphragm spring retainer with alcohol and remove, using the fingers only. Remove the rear diaphragm from the rear plate (Fig. 28).

2. Set a piece of 1¹⁄₁₆-inch hex bar stock 2 inches long in the bench vise. Set the diaphragm and plate assembly on the hex stock with the hex opening in the front plate seated on the bar. Twist the rear plate counterclockwise, using hand leverage only on the atmospheric pressure channel or outside circumference of the rear plate.

3. After the plates have been loosened, remove the assembly from the vise and complete the disassembly on the bench with the front plate down. Unscrew the rear plate completely and carefully lift it off the front plate hub, grasping the valve plunger and spring with the other hand and removing them from the bore of the front plate hub.

4. Remove the square ring seal from the shoulder of the rear plate. The ring seal may stick to the shoulder of the front plate hub.

5. Using a small rod or screw driver through the center bore of the front plate, push out the reaction disc. Loosen the front diaphragm from the center plate, and slide the center plate carefully off the front plate hub. **Do not damage or remove the seal assembly from the center plate.** Remove the front diaphragm from the front plate.

6. To remove the vacuum check valve from the front shell, work from inside the front shell. Cut off the bead of the rubber grommet. Remove the check valve and grommet. Do not remove the valve unless it is defective.

ASSEMBLY OF BOOSTER

ASSEMBLY OF PLATES, PLUNGER, AND DIAPHRAGMS

1. Place the rear shell on a block of wood, studs down, and press a new seal, plastic bearing face first, into the recess in the rear shell. Press the top outside flange of the seal approximately ⁵⁄₁₆ inch below the flat shell surface next to the seal (Fig. 28).

2. Install the front diaphragm on the front plate. Apply a light film of Bendix type "O" lubricant to the outside surface of front plate hub. Apply liberally to the seal in the center plate. Carefully guide the center plate and seal assembly, seal side first, onto the front plate hub.

3. Apply Bendix type "O" lubricant lightly to the front and rear bearing surfaces of the valve plunger, being careful not to get any lubricant on the rubber grommet. Assemble the valve plunger return spring on the valve plunger as shown, and set the spring and plunger in the recess of the front plate hub, grommet side up.

4. Place the square ring seal firmly against the shoulder on the outside of the front plate hub.

5. Set the rear plate threaded bore down, over the valve plunger. Using hands only, screw the rear plate to front plate hub. To tighten the plates, place 1¹⁄₁₆-inch hex bar stock in the vise, and set the plate assembly, front plate down, on the hex bar. Hand-torque the plates to 120 to 180 inch pounds. Remove the plate assembly from the vise.

6. Install the rear diaphragm on the rear plate and over the lip of the center plate. Assemble the diaphragm retainer over the rear diaphragm and lip of the center plate. Using the fingers, press the retainer onto center plate until it seats against the shoulder of the center plate.

ASSEMBLY OF DIAPHRAGM AND PLATES IN FRONT AND REAR SHELLS

1. Apply talcum powder to the inside wall of the rear diaphragm shell. Apply Bendix type "O" lubricant liberally to the bearing seal in the rear shell. Apply DC-4 lubricant liberally to scalloped bearing surface of the front shell.

2. Clamp the holding fixture base of Bendix tool 73800 in the vise and insert the studs of the rear shell through the matching holes of the fixture (Fig. 27). When assembling the center plate and diaphragm assembly in the rear shell, the rear diaphragm and center plate lugs must be aligned between the lances on the rear shell. Carefully guide the valve housing sleeve through the bearing seal in the rear shell keeping the center plate and diaphragms in

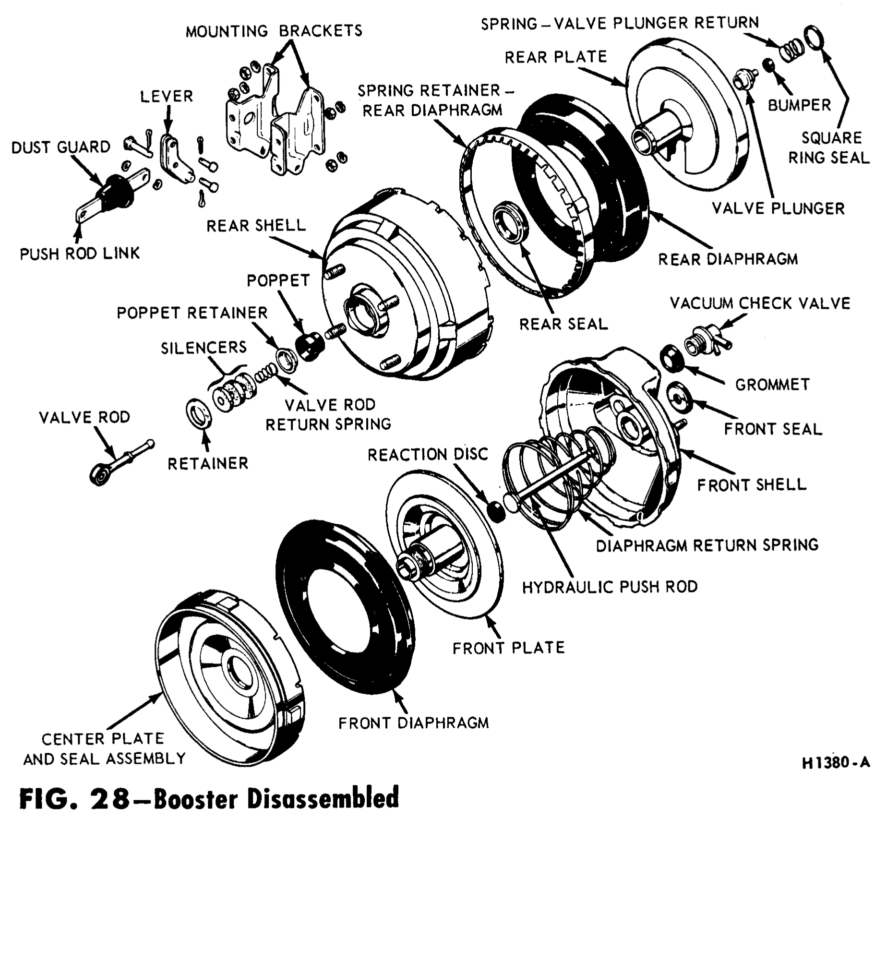

FIG. 28—Booster Disassembled

correct alignment. Work the outer rim of the front diaphragm into the rear shell so that outer rim of the front diaphragm is under each of the retaining lances on the rear shell. Place the large diameter end of the diaphragm return spring over the front plate hub, and position the front shell on the spring so that the scribe marks on the front and rear shells will be aligned when the shells are locked in place.

3. Place the bar wrench over the studs of the front shell, and then attach the clamp bar with the hook bolts. Before tightening the center bolt, make certain that the notched sections on the front shell are aligned with the retaining lances on the rear shell. Guide the rim of the diaphragm into the rear shell. Tighten the center bolt until the rim of the front diaphragm will clear the lock on the front shell. Then twist the front shell clockwise in relation to the rear shell until the stop is contacted.

4. Remove the hold-down plate and bar wrench, and remove the power unit from the holding fixture.

ASSEMBLY OF VACUUM CHECK VALVE, REACTION DISC AND HYDRAULIC PUSH ROD

1. Apply Bendix type "O" lubricant liberally to the entire surface of the reaction disc and to the piston end of the hydraulic push rod (Fig. 28). Place the reaction disc on the piston end of the push rod. Apply Bendix type "O" lubricant sparingly on the rod of the push rod, keeping lubricant away from the adjusting screw end of the push rod. **Under no condition should the lubricant be allowed to get on the adjustment screw threads.**

2. Insert the push rod with the reaction disc on the piston end into reaction disc hub. Twist the push rod to make certain that the reaction disc is seated in the reaction disc hub and to eliminate air bubbles between the reaction disc and the push rod piston.

3. Assemble the seal, support plate side first, over the adjustment screw end of the push rod. Press the seal into the recess in the front shell until the seal bottoms in the recess.

4. If the vacuum check valve was removed, wet the new grommet in alcohol and press the grommet into the front shell, beveled side first. Make certain that the grommet is seated in the front shell. Wet the shoulder of the check valve in alcohol, and assemble the check valve in the grommet. Press the check valve into the grommet until the entire circumference of the check valve flange bears against the grommet.

INSTALLATION OF VALVE ROD AND POPPET ASSEMBLY

1. Wet the poppet valve in alcohol, and assemble the poppet in the valve housing, small diameter end of poppet first (Fig. 28). Wet the poppet retainer in alcohol and assemble it in the housing with the flange out. Press in against the retainer to make certain that the shoulder on the retainer is positioned inside the poppet.

2. Assemble the retainer, valve silencers, and valve return spring over the ball end of the valve rod as shown.

3. Wet the rubber grommet in the valve plunger and the ball end of the valve rod in alcohol. Guide the spring, and silencers into the valve housing, and assemble the ball end of the valve rod in the valve plunger. Tap the end of the valve rod with a soft hammer to lock the ball end of the rod in the valve plunger.

4. Assemble the retainer on the end of the valve housing, being careful not to chip the plastic housing.

INSTALLATION OF EXTERNAL PARTS

1. Dip the small diameter of the dust guard in alcohol, and assemble the dust guard over the eye of the valve rod (Fig. 28). Do not tear the guard. Press the guard against the valve housing and seat the large end of the guard over the scalloped flange of the rear shell. Before mounting the master cylinder, check the distance from the end of the hydraulic push rod to the hydraulic cylinder mounting face at the front end of the power unit as shown in Figure 2, Part 2-1. If the push rod length is not correct, follow the push rod adjustment procedure outlined in Part 2-1, Section 2. When the push rod length is correct, attach the master cylinder to the power section with lock washers and nuts. Torque the nuts to specification. Attach the mounting bracket to studs on the rear shell with lock washers and nuts and torque to specifications.

PART 2-3 SPECIFICATIONS

DRUM BRAKE DIMENSIONS—IN INCHES

Drum Inside Diameter	Drum Maximum Boring Limit	Lining Length		Lining Width		Wheel Cylinder Bore Diameter	Master Cylinder Bore Diameter
		Primary	Secondary	Primary	Secondary		
11.090	11.150	9.39	12.21	2.50	2.50	15/16	15/16

BRAKE CHECKS AND ADJUSTMENTS

Type of Check or Adjustment	Specification	
Brake Shoe Repair	**Drum Diameter** 11.120-11.150 inch	**Brake Lining Required** Oversize
	Brake Lining Clearance (Midway between Rivets) Maximum 0.008 inch	
	Lining Wear Limit (From Top of Rivets) Maximum 1/32 inch	
Master Cylinder	Hydraulic Master Cylinder Bore, Honed Diameter. Maximum 0.9405 inch	
Power Unit	Push Rod Adjustment 0.990-0.995 inch	
Drum Out-of-Round	Refinish if Total Indicator Runout Exceeds 0.007 inch	
Rotor Runout	Replace if Runout Exceeds 0.002 inch	

TORQUE LIMITS

Description	Ft Lbs
Front Brake Hose Bracket to Chassis Bolt	10-15
Rear Brake Drum to Rear Axle Shaft Flange	Hand Push Fit
Rear Wheel to Axle Shaft to Drum	75-110
Rear Brake Carrier Plate and Bearing Retainer to Axle Housing	50-70
Master Cylinder to Booster	12-18
Master Cylinder Tube Fitting	6-12
Brake Booster to Dash Panel and Pedal Support Bracket	15-25
Parking Brake Control to Mounting Bracket	15-19

DISC BRAKE SHOE AND LINING DIMENSIONS

Lining Material	Bonded Johns Mansville—1398
Lining Size	5.36″ x 1.90″
Lining Area	10.03 Sq. In./segment
Shoe and Lining Thickness	0.600″ nominal
Lining Thickness	0.436″ nominal
Shoe and Lining Maximum Wear Limit	0.195″
Lining Maximum Wear Limit (from surface of shoe)	0.030″
Lining to Rotor Clearance (brakes released)	0.002-0.010″
Proportioning Valve	450 PSI cut in (43½% reduction in rear line pressure over 450 PSI)

DISC BRAKE TORQUE SPECIFICATIONS

Caliper Assembly to Spindle	75-100 Ft-Lbs
Caliper Bleeder Screw	10 Ft-Lbs (120 in-lbs)— Maximum—must be leakproof
Caliper Splash Shield	7-9 Ft-Lbs
Caliper Bridge Bolts	65-75 Ft-Lbs
Rotor Splash Shield to Spindle	10-20 Ft-Lbs
Brake Tube Fitting Nuts to Proportioning Valve	70 In-Lbs—Maximum—must be leakproof
Hub and Rotor Assembly to Front Wheel Spindle	17-25 Ft-Lbs—Rotate rotor while torqueing*
Wheel Assembly to Front Wheel Hub and Rotor Assembly	75-110 Ft-Lbs
*.0005" to .0065" maximum bearing end play with torque specification of 17-25 Ft-Lbs	

SERVICE TOOLS

Ford Tool No.	Former No.	Description
—	—	Brake Cylinder Retaining Clamp
—	2018-A	Brake Adjusting Tool
—	2162	Adapter Cap
—	2035-N 2086-L	Brake Shoe R & R Spring
TOOL-33621	33621	Internal Snap Ring Pliers
	Milbar 1112-144	In.-lb. Torque Wrench
	Bendix 73800	Booster Disassembly and Assembly tool
TOOL-4235C	4235C	Axle Shaft Remover

HYDRAULIC FLUID AND LUBRICANT

Description	Hydraulic Fluid and Lubricant
Brake Shoe Adjusting Screw Lubricant	General Chassis Grease C1AZ-19590-B
Brake Fluid	SAE 70R3 Wagner 21B(301)

SUSPENSION, STEERING, WHEELS AND TIRES

GROUP 3

PART 3-1 SUSPENSION, STEERING, WHEELS AND TIRES—GENERAL SERVICE

1 DIAGNOSIS AND TESTING

Table 1 lists various suspension, steering, and wheel and tire trouble symptoms and their possible causes. The possible causes are listed in the table in the order in which they should be checked. For example, refer to the fourth trouble symptom in Table 1, "Hard Turning When Stationary". When checking the possible causes, check item 1 (tire pressure) and item 2 (tire size) before proceeding with items 12, 17, and 21 as indicated.

Refer to Table 2, for Movable Steering Column Trouble Symptoms and Possible Causes.

PRELIMINARY CHECKS

The following preliminary checks should always be made before performing any trouble shooting operations. Also, see Table 1.

AIR BLEEDING

Air in the power steering system (shown by bubbles in the fluid) should be bled. After making sure that the reservoir is filled to specification (the fluid must be at normal operating temperature when the check is made), turn the steering wheel through its full travel three or four times with the windshield wiper in operation. **Do not hold the wheels against their stops.** Recheck the fluid level.

CHECK FLUID LEVEL

Run the engine until the fluid is at normal operating temperature. Then turn the steering wheel all the way to the left and right several times, and shut off the engine.

Check the fluid level in the power steering reservoir. The level must be at the full mark on the dipstick. If the level is low, add enough automatic transmission fluid C1AZ-19582-A to raise the level to the F

TABLE 1—Steering Diagnosis Guide

POWER STEERING FLUID LEVEL LOW OR FLUID LEAKAGE	Jerky steering. Hard steering and/or loss of power assist.	Hard turning when stationary. Steering and suspension noises.
AIR IN POWER STEERING SYSTEM	Jerky steering. Hard steering and/or loss of power assist.	Steering and suspension noises. Shimmy or wheel tramp.
OBSTRUCTION IN POWER STEERING LINES	Hard steering and/or loss of power assist.	Hard turning when stationary. Steering and suspension noises. Jerky steering.

TABLE 1—Steering Diagnosis Guide (Continued)

LOOSE STEERING GEAR MOUNTINGS	Jerky steering. Loose steering.	Steering and suspension noises. Shimmy or wheel tramp. Side-to-side wander.
INSUFFICIENT STEERING PUMP PRESSURE	Hard steering and/or loss of power assist.	Hard turning when stationary. Binding or poor recovery. Steering and suspension noises.
INCORRECT STEERING GEAR ADJUSTMENT	Jerky steering. Loose steering. Hard steering and/or loss of power assist. Steering and suspension noises.	Shimmy or wheel tramp. Side-to-side wander. Body sway or roll. Binding or poor recovery. Abnormal or irregular tire wear.
STEERING GEAR VALVE SPOOL BINDING OR OUT OF ADJUSTMENT	Hard steering and/or loss of power assist.	Binding or poor recovery. Heavier steering in one direction.
OBSTRUCTION WITHIN STEERING GEAR	Hard steering and/or loss of power assist. Hard turning when stationary.	Binding or poor recovery. Jerky steering. Steering and/or suspension noise.

mark on the dip stick. **Do not overfill the reservoir.**

CHECK PUMP BELT

If the pump belt is broken, glazed, or worn, replace it with a new belt. **Use only the specified type of belt.** Refer to Part 3-3 for belt adjustment.

CHECK FOR FLUID LEAKS

With the engine idling, turn the steering wheel from stop to stop several times. Check all possible leakage points. Tighten all loose fittings, and replace any damaged lines or defective seats.

CHECK TURNING EFFORT

With the front wheels properly aligned and tire pressures correct, check the effort required to turn the steering wheel.

1. With the car on dry concrete, set the parking brakes.
2. With the engine warmed up and running at idle speed, turn the steering wheel to the left and right several times to warm the fluid.
3. Attach a pull scale to the rim of the steering wheel. Measure the pull required to turn the wheel one complete revolution in each direction. The effort required to rotate the steering wheel should not exceed 3.5 pounds.

PUMP-FLUID PRESSURE TEST

A fluid pressure test will show whether the pump or some other unit in the power steering system is causing trouble in the system. Steps outlined below should be followed

TABLE 2—Movable Steering Column Trouble Symptoms and Possible Causes

BINDING, ROUGH, OR RASPING COLUMN MOVEMENT	Track to column bracket misalignment. Locking plate out of adjustment rubs pawl.	Shroud interference with instrument panel.
HARD COLUMN MOVEMENT	Slide tension out of adjustment. Track to column bracket misalignment.	Locking plate out of adjustment—rubs pawl.
POSSIBLE SHIFT INTO REVERSE WITH COLUMN AT EXTREME RIGHT	Locking plate out of adjustment.	
POOR SHIFTING INTO OR OUT OF PARK	Left stop out of adjustment.	Lock pawl arm binding in pivot bushing.
LATERAL LOOSENESS IN COLUMN WHEN LOCKED	Locking pawl arm loose in pivot bushing.	Pivot bracket loose at steering gear. Left stop out of adjustment.
VERTICAL LOOSENESS IN COLUMN WHEN LOCKED	Loose track or braces. Pivot bracket loose at steering gear.	Slide tension out of adjustment.
RIGHT SHROUD HITS AIR CONDITIONING UNIT	Right stop bolt (on track) out of adjustment.	

TABLE 3—Trouble Symptoms and Possible Causes

POSSIBLE CAUSES OF TROUBLE / TROUBLE SYMPTOMS	Jerky Steering	Loose Steering	Hard Steering and/or Loss of Power Assist	Hard Turning When Stationary	Steering and Suspension Noises	Shimmy or Wheel Tramp	Pull to One Side	Side-to-Side Wander	Body Sway or Roll	Tire Squeal on Turns	Binding or Poor Recovery	Abnormal or Irregular Tire Wear	Sag at One Wheel	Hard or Rough Ride	Rear Suspension Misalignment (Dog-Tracking)
1. Incorrect Tire Pressure			X	X	X	X	X	X	X	X		X	X	X	
2. Tire Sizes Not Uniform			X	X		X	X	X				X	X		
3. Overloaded or Unevenly Loaded Vehicle								X				X	X	X	
4. Power Steering Fluid Level Low-Leak	X		X	X	X										
5. Sagging or Broken Spring					X	X	X	X	X			X	X	X	
6. Glazed, Loose or Broken Power Steering Pump Belt	X		X	X	X										
7. Rear Spring Tie Bolt Off Center							X					X			X
8. Broken Rear Spring Tie Bolts					X	X	X	X	X			X			X
9. Rear Spring Front Hanger Mislocated							X					X			X
10. Bent Spindle Arm							X	X		X		X			
11. Bent Spindle							X	X		X		X			
12. Lack of Lubrication			X	X	X						X			X	
13. Air in Power Steering System	X		X		X	X									
14. Obstruction in Power Steering Lines			X	X	X										
15. Loose or Weak Shock Absorber					X	X			X			X		X	
16. Loose or Worn Suspension Arm Bushings					X	X						X		X	
17. Binding Front Suspension Ball Joints or Steering Linkage	X		X	X	X						X			X	
18. Loose, Worn, or Damaged Steering Linkage or Connections	X	X			X	X		X		X		X			
19. Loose Steering Gear Mountings	X	X			X	X		X	X						
20. Insufficient Steering Pump Pressure			X	X							X				
21. Incorrect Steering Gear Adjustment	X	X	X	X	X	X		X	X		X	X			
22. Incorrect Brake Adjustment	X				X		X					X			
23. Incorrect Front Wheel Bearing Adjustment	X	X			X	X	X	X				X			
24. Wheel Out of Balance	X				X	X						X		X	
25. Incorrect Front Wheel Alignment			X		X	X	X	X		X	X	X			
26. Out-of-Round Wheel or Brake Drum						X						X		X	
27. Frame of Underbody Out of Alignment							X					X			X
28. Bent Rear Axle Housing					X		X					X			X
29. Excessive Wear of Steering Pump Internal Parts					X										
30. Steering Gear Valve Spool Binding or Out of Adjustment			X	X							X				
31. Obstruction Within Steering Gear			X	X							X				

to determine the cause of the trouble.

1. Measure the pump belt tension.

When adjusting the belt tension on the power pump, do not pry against the pump to obtain the proper belt load.

A half inch cast boss has been incorporated on the front face of the pump cover plate onto which a 9/16" open end wrench can be fitted to pry the pump and obtain the proper belt tension.

2. Disconnect the pressure line hose from the pump outlet, and install a 0-2000 psi pressure gauge (Tool T56L-33610-D) and shut off valve between the end of the hose and the pump outlet.

Be sure that the pressure gauge is between the pump and the shut off valve, all connections are tight, and the shut off valve is fully open.

3. Connect a tachometer to the engine.

4. Start the engine and operate it at idle speed for at least two (2) minutes to warm up the fluid.

5. Cycle the steering wheel from stop-to-stop several times to expel any air from the system; stop the engine. Remove the reservoir filler cap and check the fluid level in the reservoir. If necessary, add lubricant C1A-19582-A to the proper level.

6. With the engine running at **approximately** 500 rpm and no steering effort applied, and the lubricant at normal operating temperature, the pressure gauge should show a pressure of less than **50** psi. If the pressure is higher, inspect the hoses for kinks and obstructions.

7. Increase the engine speed to 1000 rpm, then slowly close the gauge shut-off valve. With the valve fully closed, the pump pressure should be 1000 to 1150 psi.

Do not close the valve for more than a few seconds, as this would abnormally increase the lubricant temperature and cause undue pump wear.

If pressure is more or less than specification, replace the pump assembly. If pressure is as specified and steering efforts are heavy, the gear and/or control valve could be at fault.

8. Remove the tachometer.

FRONT WHEEL ALIGNMENT CHECKS

Do not attempt to check and adjust front wheel alignment without first making a preliminary inspection of the front-end parts. Refer to Section 3.

Check all the factors of front wheel alignment except the turning angle before making any adjustments. The turning angle should be checked only after caster, camber and toe-in have been adjusted to specifications.

The front wheel alignment specifications given in Part 3-5 are correct only when the car is at "Curb Height". Before checking or adjusting the alignment factors, the suspension alignment spacers must be installed to obtain the curb height.

EQUIPMENT INSTALLATION

Equipment used for front wheel alignment inspection must be accurate. Alignment height spacers (Figs. 2 and 3) are used to check caster, camber and toe-in. If the car is operated under abnormal load conditions, the spacers should be omitted when checking toe-in.

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. With the car in position for the front end alignment inspection and adjustment, install the suspension alignment spacers as follows to establish the curb height.

Lift the front of the car and position the suspension alignment spacers between the suspension upper arm and the edge of the frame spring pocket as shown in Fig. 2. The lower end of the alignment spacers should be placed over the head of the ball joint retaining nut. Position the alignment spacers for the rear of the car between the rear axle and the frame side rail as shown in Fig. 3. Lower the rear of the car so that the weight of the body will hold the alignment spacers in place.

3. 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.

CASTER

Check the caster angle at each front wheel. Caster is the forward or rearward tilt at the top of the wheel spindle (Fig. 4). If the spindle tilts to the rear, caster is positive. If the spindle tilts to the front, caster is negative. The correct caster angle,

FIG. 1—Typical Straight Ahead Position Marks

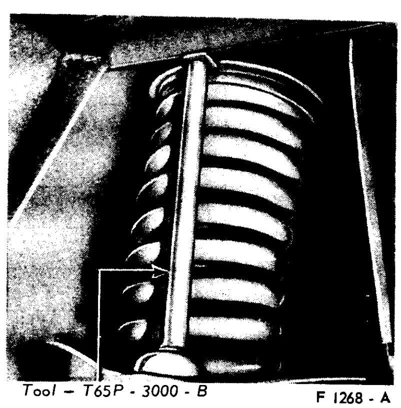

FIG. 2—Alignment Spacer Installation—Front

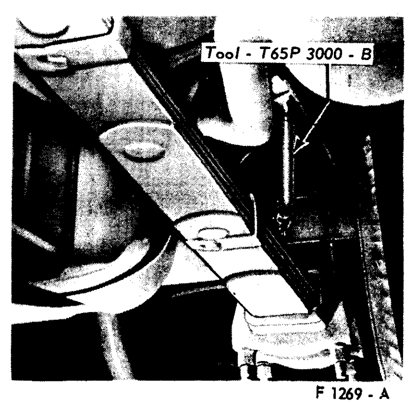

FIG. 3—Alignment Spacer Installation—Rear

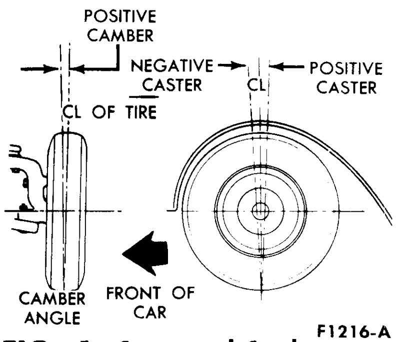

FIG. 4—Caster and Camber Angles

or tilt is specified in Part 3-5.

The maximum difference between both front wheel caster angles should not exceed ½°. However, a difference of not more than ¼° is preferred.

CAMBER

Check the camber angle at each front wheel. The camber angle is the amount the front wheels are tilted at the top (Fig. 4). If a wheel tilts outward, camber is positive. If a wheel tilts inward, camber is negative. The correct camber angle, or outward tilt, is specified in Part 3-5. 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

Alignment height spacers are used on all cars to check and adjust toe-in, except on those operated under abnormal conditions. Toe-in should only be checked and adjusted after the caster and camber has been adjusted to specifications.

Check the toe-in with the front wheels in the straight-ahead position. Measure the distance between the extreme front and also between the extreme rear of both front wheels. The difference between these two distances is the toe-in.

Correct toe-in, or inward pointing of both front wheels at the front, is specified in Part 3-5.

FRONT WHEEL TURNING ANGLE

When the inside wheel is turned 20°, the turning angle of the outside wheel should be as specified in Part 3-5. The turning angle cannot be adjusted directly, because it is a result of the combination of caster, camber, and toe-in adjustments and should, therefore, be measured only after these adjustments have been made. If the turning angle does not measure to specifications, check the spindle or other suspension parts for a bent condition.

2 COMMON ADJUSTMENTS AND REPAIRS

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.**

CAMBER

Adjust the camber by removing or installing shims between the pivot bracket of the front suspension lower arm and the mounting bracket on the underbody in the engine compartment (Fig. 5).

The removal of shims between the mounting and pivot brackets will move the lower ball joints inward. The installation of shims between the mounting and pivot brackets will move the lower ball joint outward. Camber adjusting shims are available in several standard shim thicknesses. A 1/16-inch change of shim thickness will change the camber angle ⅓°. The total shim stack thickness should not exceed 11/16-inch.

CASTER

The caster adjustment is made by repositioning the strut on the lower arm as shown in Fig. 5. Adjust the caster by loosening the rearward washers, nuts and bolts. Lift the strut so that the strut serrations will

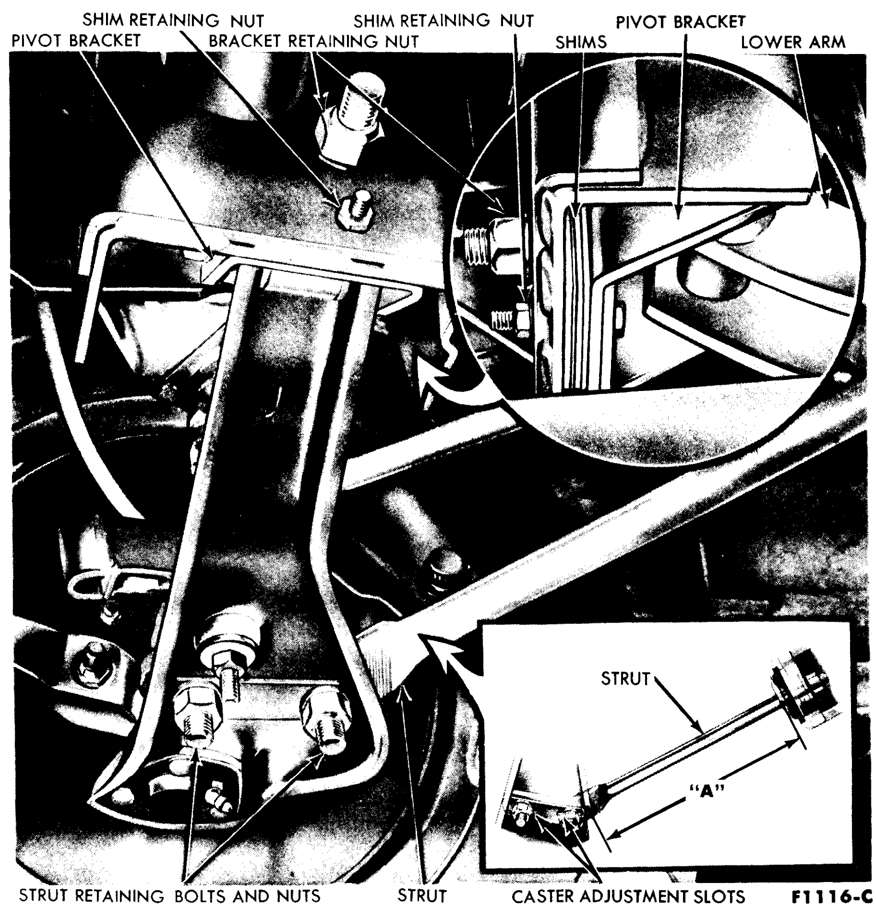

FIG. 5—Caster and Camber Adjustments

be free from the serrations on the lower arm. Lengthen the distance between the strut forward mount and the side of the lower arm (Fig. 5, dimension "A") to decrease the caster angle. Decrease the distance between the strut forward mount and the side of the lower arm (Fig. 5, dimension "A") to increase the caster angle. Tighten the rearward nuts that retain the strut to the lower arm. Check the caster, camber, and toe-in alignment for the correct settings listed in the specifications. Remove the suspension alignment spacers.

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. The toe-in specification is specified in Part 3-5.

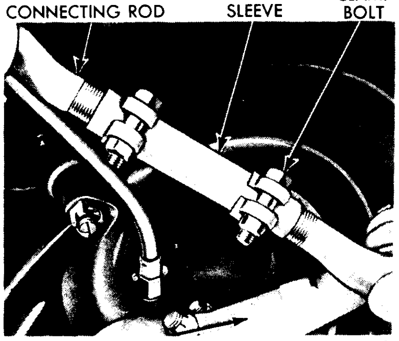

FIG. 6—Spindle Connecting Rod Sleeve

1. Loosen the two clamp bolts on each spindle connecting rod sleeve (Fig. 6).

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. 7). 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. 8).

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. 8).

4. When toe-in and steering wheel spoke alignment are both correct, torque the clamp bolts on both connecting rod sleeves to specifications.

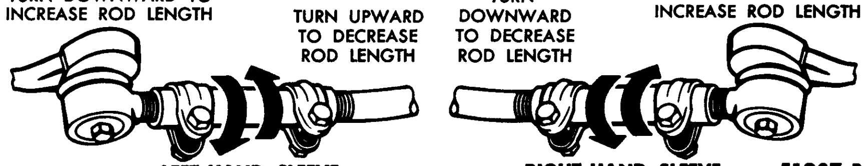

FIG. 7—Spindle Connecting Rod Adjustments

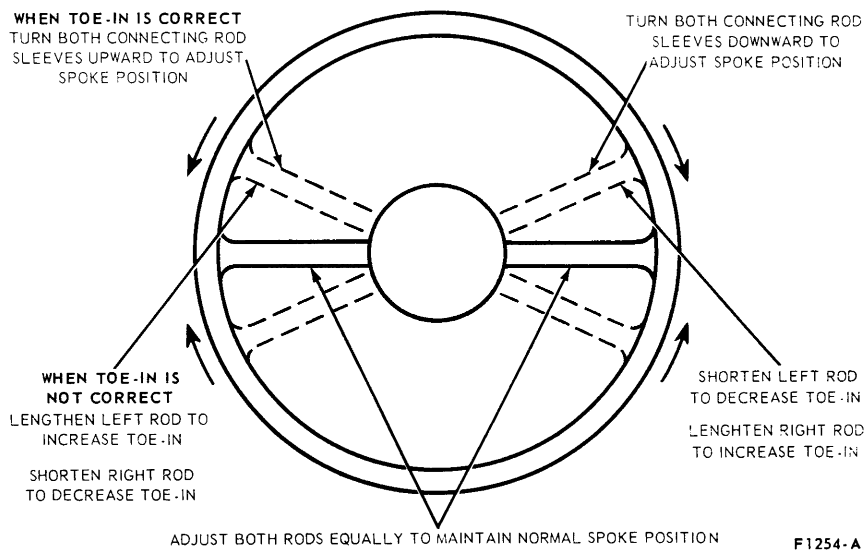

FIG. 8—Toe-In and Steering Wheel Spoke Alignment Adjustments

3 CLEANING AND INSPECTION

FRONT END GENERAL 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 four tires.

2. Raise the front of the car off the floor. Shake each front wheel grasping the upper and lower surfaces of the tire. Check the front suspension ball joints and mountings for looseness, wear and damage. Check the brake caliper attaching bolts. Torque all loose nuts and bolts to specifications. Replace all worn parts as outlined in Part 3-2.

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 as outlined in Part 3-3.

4. Check the front wheel bearings. If any in-and-out free play is noticed, adjust the bearings to specification. Replace worn or damaged bearings as outlined in Part 3-4.

5. Spin each front wheel with a wheel spinner, and check and balance each wheel as required.

6. Check the action of the shock absorbers. 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.

WHEEL INSPECTION

Wheel hub nuts should be inspected and tightened to specification at predelivery. Loose wheel hub nuts may cause shimmy and vibration. Elongated stud holes in the wheels may also result from loose hub nuts.

Keep the wheels and hubs clean. Stones wedged between the wheel and rotor or rear 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.

FLUSHING THE POWER STEERING SYSTEM

Should a power steering pump become inoperative, the shaft and pulley should be checked for freedom of rotation. If the pump shaft does not turn freely (binding), it is an indication that there is wear on the pump internal components and the need for flushing the steering system, when installing a **new** pump.

1. Remove the power steering pump and pulley as outlined in Part 3-3.

2. Install a new pump and connect only the pressure hose to the pump (Part 3-3).

3. Place the oil return line in a suitable container and plug the reservoir return pipe.

4. Fill the reservoir with lubricant C1AZ-19582-A.

5. Disconnect the coil wire to prevent the engine from starting and raise the front wheels off the ground.

6. While approximately two quarts of steering gear lubricant are being poured into the reservoir, turn the engine over using the ignition key, at the same time cycle the steering wheel from stop to stop.

7. As soon as all of the lubricant has been poured in, turn off the ignition key, and attach the coil wire.

8. Remove the plug from the reservoir return pipe, and attach the return hose to the reservoir.

9. Check the reservoir fluid level; if low add fluid C1AZ-19582-A to the proper level. **Do not overfill.**

10. Lower the car.

11. Start the engine and cycle the steering wheel from stop to stop to expel any trapped air from the system.

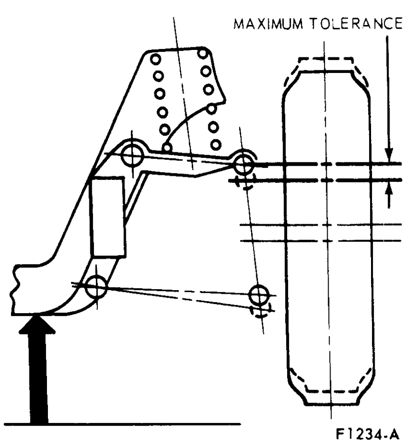

FIG. 9—Measuring Upper Ball Joint Axial Play

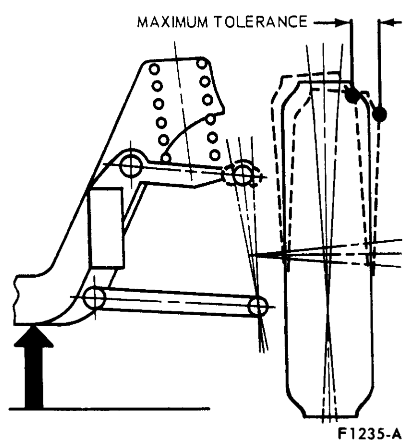

FIG. 10—Measuring Upper Ball Joint Radial Play

UPPER BALL JOINT INSPECTION

1. Raise the car on a frame contact hoist or by floor jacks placed beneath the underbody until the wheel falls to the full down position as shown in Figs. 9 and 10. This will unload the upper ball joint.

2. Adjust the wheel bearings as described in Part 3-4.

3. Attach a dial indicator to the upper arm. Position the indicator so that the plunger rests against the underside of the spindle at the upper ball joint stud.

4. Grasp the tire at the front and rear sides and slowly move the tire up and down (Fig 9). If the dial indicator reading (axial play) exceeds specifications (Part 3-5), replace the upper ball joint.

5. With the dial indicator attached to the upper arm, position the indicator so that the plunger rests against the inner side of the wheel rim adjacent to the upper arm ball joint.

6. Grasp the tire at the top and bottom, and slowly move the tire in and out (Fig. 10). Note the reading (radial play) on the dial indicator. If the reading exceeds specifications (Part 3-5), replace the upper ball joint.

LOWER BALL JOINT INSPECTION

To determine if the lower ball joint is excessively worn or loose, perform the following procedure.

1. Raise the car on a frame contact hoist or by floor jacks placed beneath the underbody until the wheel falls to the full down position.

2. Ask an assistant to grasp the lower edge of the tire and move the wheel in and out.

3. As the wheel is being moved in and out, observe the lower end of the spindle and the lower arm.

4. Any movement between the lower end of the spindle and the lower arm indicates ball joint wear and loss of preload. If any such movement is observed, replace the lower arm.

During the foregoing check, the upper ball joint will be unloaded and may move. Disregard all such movement of the upper ball joint. Also, do not mistake loose wheel bearings for a worn ball joint.

PART 3-2 SUSPENSION

1 DESCRIPTION AND OPERATION

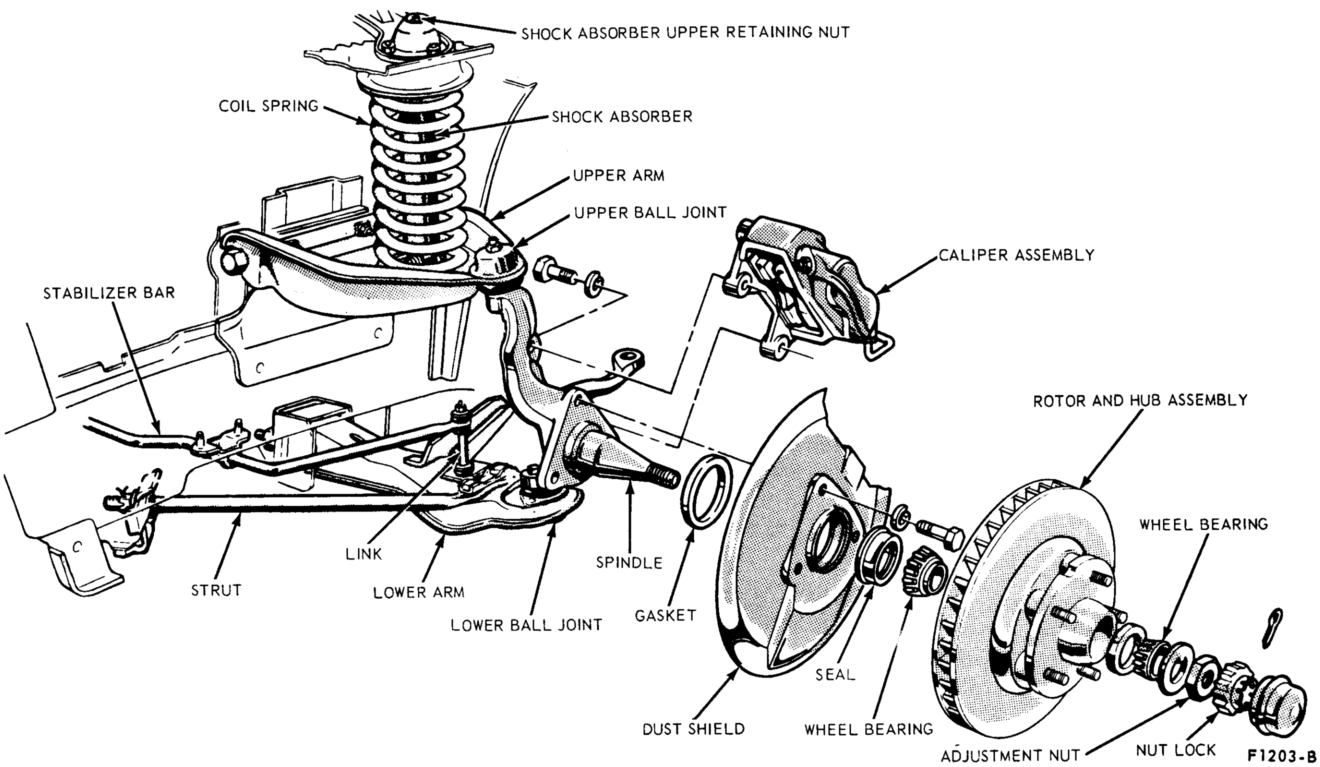

FIG. 1–Front Suspension

FRONT SUSPENSION

Each front wheel rotates on a spindle. The upper and lower ends of the spindle are attached to upper and lower ball joints which are mounted to an upper and lower arm respectively. The upper arm pivots on a bushing and shaft assembly which is bolted to the underbody. The lower arm pivots on a bolt mounted in a bracket which is bolted to the underbody (Fig. 1). A coil spring seats between the upper arm and the top of the spring housing. A double-acting shock absorber is bolted to the upper arm and the top of the spring housing.

The swiveling action of the ball joints allows the wheel and spindle assemblies to move up and down with changes in road surface. The swiveling ball joints also permit the spindles and wheels to be turned to the left or right by the steering gear and linkage.

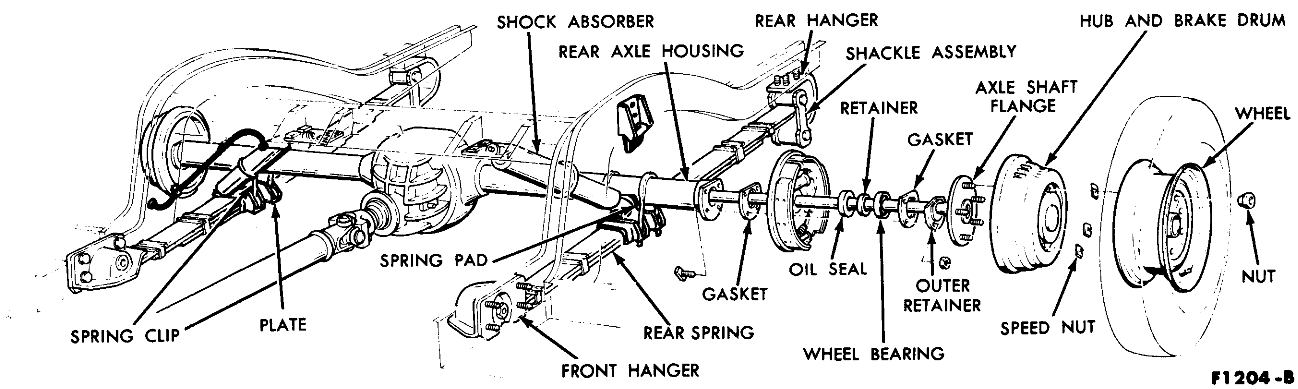

FIG. 2–Rear Suspension

The pivoting action of the suspension arms provides **up and down** movement for the spindles and wheels as required by bumps or depressions in the road surface. The coil springs, shock absorbers, and stabilizer bar control the front suspension up and down movements.

The struts, which are connected between the suspension lower arms and the underbody, prevent the suspension arms from moving forward and backward.

REAR SUSPENSION

Each rear wheel, hub and brake drum assembly is bolted to the rear axle shaft flange. The wheel and axle shaft assembly rotates in the rear axle housing. Two spring pads, integral with the axle housing, rest on two leaf spring assemblies. The axle housing is fastened to the center of the springs by spring clips (U-bolts), spring clip plates, and nuts (Fig. 2). Each spring assembly is suspended from the underbody side rail by hanger and shackle assemblies at the front and rear. The upper end of each shock absorber is mounted to a bracket in the under body; the lower end is mounted to the spring pad at the axle housing.

The springs and shock absorbers provide for up and down movement of the rear axle and wheels as required by changes in the road surface. They also cushion road shocks.

2 IN-CAR ADJUSTMENT AND REPAIRS

UPPER BALL JOINT REPLACEMENT— ARM IN CAR

1. Raise the front of the car and position safety stands under the chassis.
2. Remove the wheel and tire assembly.
3. Loosen the upper stud (ball joint-to-arm) nut.
4. Remove the cotter pin and loosen the upper ball joint stud nut. Place a box wrench over the lower end of tool T57P-3006-A, and position the tool 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 cotter

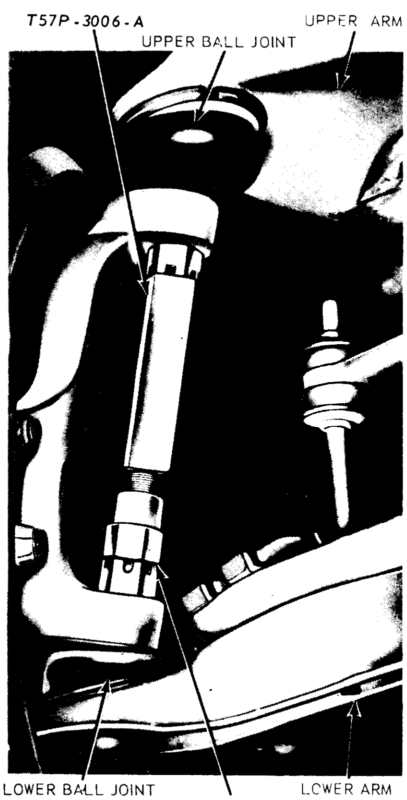

FIG. 3—Loosening Ball Joint Stud

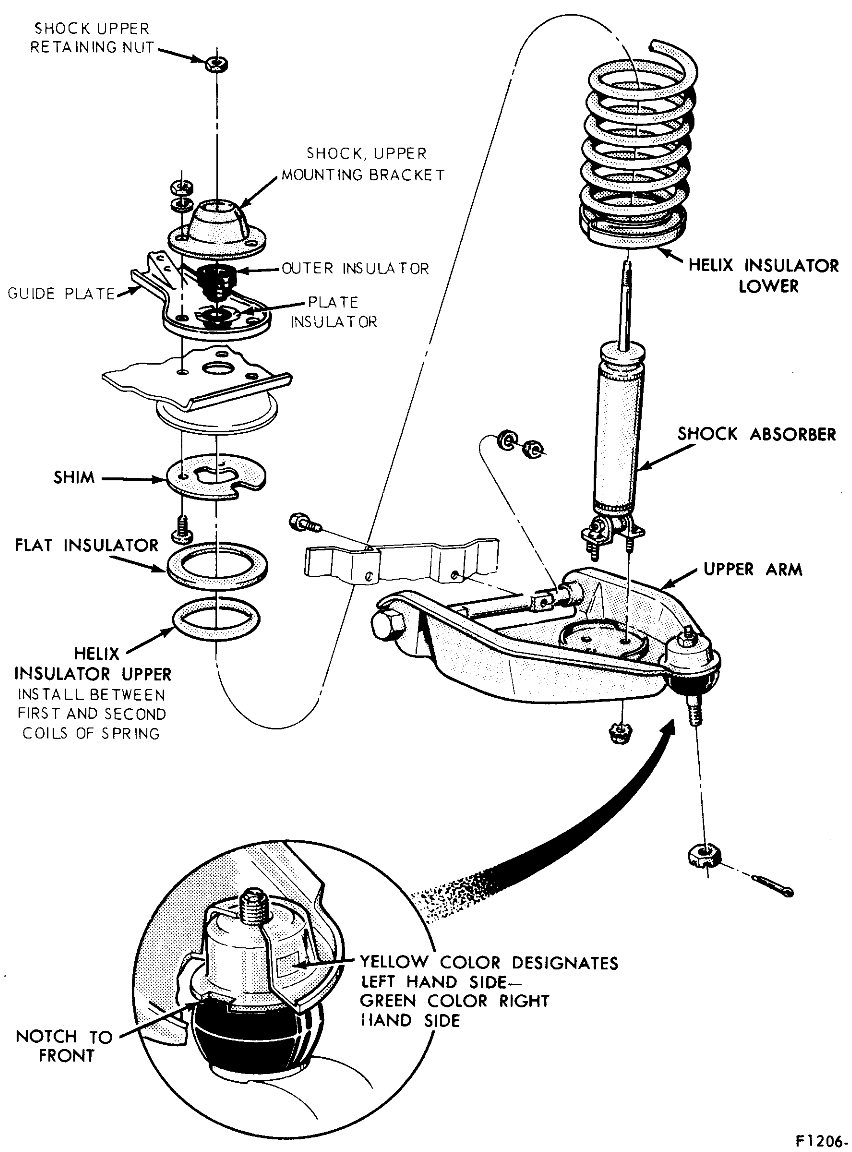

FIG. 4—Upper Arm, Shock Absorber and Spring Connections

pin from the lower ball joint stud if the cotter pin prevents the tool from seaitng on the lower stud.

5. Turn the wrench until both studs are under tension, then loosen the stud from the spindle by tapping the spindle near the upper stud with a hammer. **Do not loosen the stud with tool pressure alone.** Remove the ball joint stud nut.

6. Slide the ball joint stud out of the spindle upper bore. Remove the upper retaining nut, and drive the ball joint out of the suspension arm.

8. Position the replacement ball joint in its recess in the upper arm so that the ball joint notch faces the front of the car (Fig. 4-B). Install the retaining nut on the upper stud and draw the ball joint into place by tightening the nut.

9. Position the ball joint stud in the spindle bore, install the stud nut, and torque to specifications. Install a new cotter pin. Tighten the nut, if necessary, to align the cotter pin hole.

10. Install the wheel and tire assembly.

11. Remove the safety stands, lower the car, and check camber, caster and toe-in.

STABILIZER REPAIR

To replace the end bushings on each stabilizer link, use the following procedure.

1. Raise the car on a hoist.

2. Remove the link-to-stabilizer bar retaining nut, washers, and insulators, and disconnect the link from the bar (Fig. 1).

3. Remove the link-to-lower arm retaining nut, washers, and insulators, and remove the link from the arm.

4. Assemble the link and new washers and insulators to the lower arm, then install the link-to-lower arm retaining nut.

5. Connect the link to the bar with new washers and insulators and secure with the retaining nut.

6. Lower the car.

3 REMOVAL AND INSTALLATION

Be sure the car is centered on the hoist before servicing any front end components to avoid bending or damaging the rotor splash shields on full right or left wheel turns.

FRONT WHEEL SPINDLE

REMOVAL

1. Raise the front of the car and position safety stands under the chassis.

2. Remove the wheel cover and remove the wheel and tire from the hub.

3. Remove 2 bolts and washers retaining the caliper to the spindle (Fig. 1). Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose.

4. Remove the hub and rotor from the spindle.

5. Remove 3 bolts and remove the splash shield and gasket from the spindle.

6. Remove the cotter pin and retaining nut, then disconnect the spindle connecting rod end from the spindle arm with Tool 3290-C.

7. Remove the cotter pins and loosen the ball joint stud nuts.

8. Position a box wrench over the lower end of the tool T57P-3006-A and position the tool as shown in Fig. 3. **The tool should seat firmly against the ends of both studs, not against the stud nuts.**

9. Turn the wrench until the tool places the studs under tension, then loosen the studs in the spindle by tapping the spindle near the studs with a hammer. **Do not loosen the studs in the spindle with tool pressure alone.**

10. Remove the stud nuts and the spindle from both studs.

INSTALLATION

1. Position the new spindle to the upper and lower ball joint studs, install the stud nuts, and tighten the nuts to specifications. Continue to tighten both nuts until the cotter pin holes line up with slots, then install new cotter pins.

2. Connect the spindle connecting rod end to the spindle arm, and install the retaining nut. Tighten the nut to specifications, align slot and install cotter pin.

3. Install the gasket and splash shield on the spindle. Tighten the retaining bolts to specifications.

4. Install the hub and rotor on the spindle and adjust the wheel bearings.

5. Position the caliper over the rotor and install the retaining bolts. Tighten the bolts to specifications. Check for the correct flexible hose routing (Part 2-2).

6. Install the wheel and tire on the hub.

7. Lubricate the steering stop on the lower arm and the mating flat on the spindle with specified lubricant.

8. Remove the safety stands, lower the car, and check camber, caster, and toe-in.

FRONT SHOCK ABSORBER

REMOVAL

1. Raise the front of the car and position a safety stand under the lower suspension arm; then, lower the car slightly.

2. Disconnect the shock absorber lower mounting bracket from the upper arm by removing the three retaining nuts and washers (Fig. 4).

3. Open the hood; then, remove the three retaining nuts and the shock absorber upper mounting bracket. Remove the two bolts that attach the guide plate to the dash panel brace. Remove the shock absorber, guide plate, and lower bracket as an assembly.

INSTALLATION

1. Position the shock absorber and guide plate assembly through the top of the spring housing so that the three lower mounting studs enter the holes in the suspension upper arm. Install the lower retaining nuts on the studs.

2. Install the two bolts that attach the guide plate to the dash panel brace. Install the upper mounting bracket and the three retaining nuts.

3. Remove the safety stands, and lower the car.

REPLACEMENT

1. Remove the front shock absorber as outlined under "Removal."

2. Remove the shock absorber upper retaining nut and insulator, then separate the shock absorber from the guide plate (Fig. 4).

3. Remove the retaining nut and bolt, and transfer the lower mounting bracket to the replacement shock absorber (Fig. 5).

4. Pry loose the insulator retaining tabs and remove the insulator from the guide plate (Fig. 4).

5. Install a new insulator in the guide plate and secure by crimping the retaining tabs.

6. Assemble the guide plate, then the outer insulator and retaining nut to the shock absorber shaft.

7. Install the shock absorber as outlined under "Installation."

FRONT SPRING

REMOVAL

1. Raise the front of the car, position safety stands under the suspension lower arms; then, lower the car slightly.

2. Remove the wheel and tire assembly. Remove the front shock absorber as described in steps 2 and 3 under "Removal" in the foregoing procedure.

3. Raise the car slightly in order to lower the suspension upper arm. Install spring tool T63P-5310-A. Slide the tool bearing and upper plate over the shaft screw against the shaft nut. Insert the tool assembly through the upper opening in the spring housing so that the shaft screw goes through the top of the coil spring with the tool upper plate holes going over the studs as shown in Fig. 6.

4. From under the car, place the tool lower plate under the fourth coil from the bottom. Secure the plate to the coil by installing the tool retainer in the groove in the shaft screw (Fig. 7).

5. Insert a ½-inch square drive flex-handle wrench in the drive hole in the lower plate to prevent the tool with spring from turning (Fig. 7). While holding the tool, compress the spring by turning the tool shaft nut clockwise (Fig. 6).

6. Remove the two nuts and lock washers that retain the upper arm inner shaft to the chassis, and swing the arm out of the way. The arm pivots on the ball joint.

7. Remove the bolt that retains the clip and brake line to the chassis, then move the brake line out of the way (Fig. 7).

8. Disconnect the stabilizer bar from the link at both left and right hand suspension lower arms by removing the bar-to-link retaining nuts and upper bushings (Fig. 1). Position the bar out of the way.

9. Fully release the spring tension by turning the tool shaft nut counterclockwise (Fig. 6). **Be sure to hold the lower plate of the tool with the ½-inch square drive flex-handle wrench so that the tool will not turn or snap loose during spring release (Fig. 7).**

10. Remove the spring tool, then remove the spring from the car.

INSTALLATION

1. On cars equipped with air conditioning, install the tapered shim in the top of the spring housing with the thick portion of the shim toward the centerline of the car. Retain the shim in the housing with tape.

2. Insert one helix-type insulator between the two top coils of the spring and attach the other to the bottom coil (Fig. 8). Secure both insulators with tape.

3. Place the flat rubber insulator over the top of the spring (Fig. 4), and secure it with tape in three places.

4. Assemble the upper components of tool T63P-5310A by sliding the tool bearing and the upper plate over the shaft screw against the shaft nut. Position the spring from under the car so that its upper end is seated in the spring housing. Insert the tool assembly through the upper opening in the spring housing so that the shaft screw goes through the top of the coil spring with the tool upper plate holes going over the studs as shown in Fig. 6.

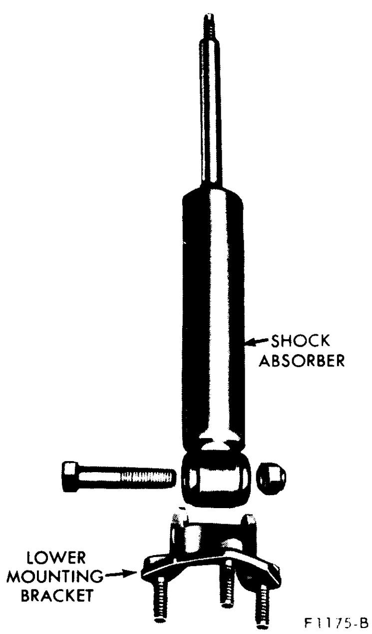

FIG. 5—Front Shock Absorber and Mounting Bracket

FIG. 6—Compressing or Releasing Spring—Upper View

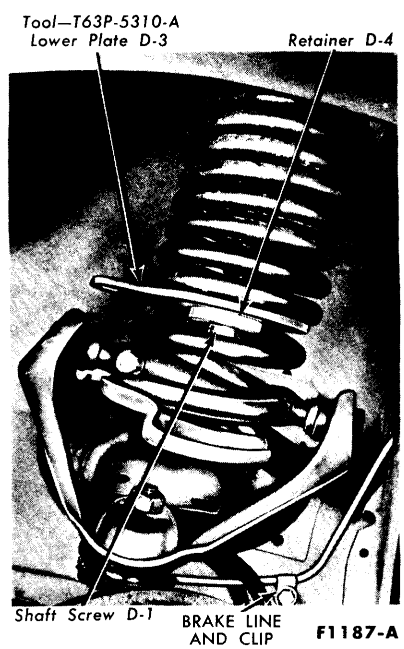

FIG. 7—Compressing or Releasing Spring—Lower View

5. From under the car, place the tool lower plate under the fourth coil from the bottom. Secure the plate to the coil by installing the tool retainer to the groove in the tool shaft screw.

6. Compress the spring by turning the tool shaft nut clockwise (Fig. 6). Hold the tool lower plate from turning during spring compression. Use the ½-inch square drive flex-handle wrench.

7. Position the stabilizer bar on the left and right-hand links and install the rubber bushings and nuts (Fig. 1).

8. Position the brake line and clip on the chassis and install the retaining bolt.

9. Swing the upper arm into position and install the arm inner shaft-to-chassis retaining nuts. **Do not tighten.**

10. Partially release the spring tension by turning the shaft nut of tool T63P-5310-A counterclockwise (Fig. 6). As the spring is being released, pry the lower coil so that it will seat in the groove of the upper arm. **Hold the tool lower plate with the square drive wrench.**

11. Tighten the upper arm inner shaft-to-chassis retaining nuts to specifications. Release the spring completely, then remove the tool. **Hold the tool lower plate from turning during spring release. Use the ½-inch square drive flex-handle wrench.**

12. With the safety stands placed under the suspension lower arms, lower the car enough to compress the spring slightly.

13. Position the shock absorber and upper mounting plate assembly through the top of the spring housing so that the three lower mounting studs enter the holes in the suspension upper arm. Install the lower retaining nuts on the studs.

14. Install the two bolts that attach the mounting plate to the dash panel brace. Install the three mounting plate retaining nuts.

15. Install the wheel and tire assembly. Remove the safety stands. Check caster, camber and toe-in.

UPPER ARM

REMOVAL

1. Remove the shock absorber and coil spring assemblies, and disconnect the arm inner shaft from the chassis as outlined in the "Front Spring" procedure under "Removal."

2. Remove the cotter pin and loosen the upper ball joint stud nut. Place a box wrench over lower end of tool 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 cotter pin from the lower ball joint stud if the cotter pin prevents the tool from seating on the lower stud.

3. Turn the wrench until both studs are under tension, then loosen the upper stud from the spindle by tapping the spindle near the upper stud with a hammer. **Do not loosen the stud with tool pressure alone.** Remove the upper stud nut, and disengage the upper ball joint and stud from the spindle. Remove the upper arm from the car.

INSTALLATION

1. Position the arm on the car by inserting the upper ball joint stud

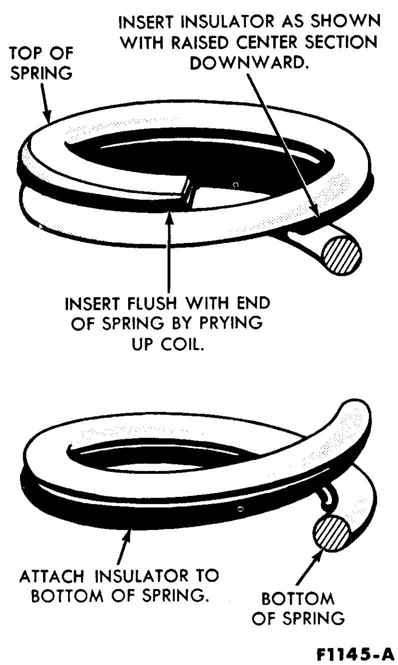

FIG. 8—Front Spring Insulator Installation

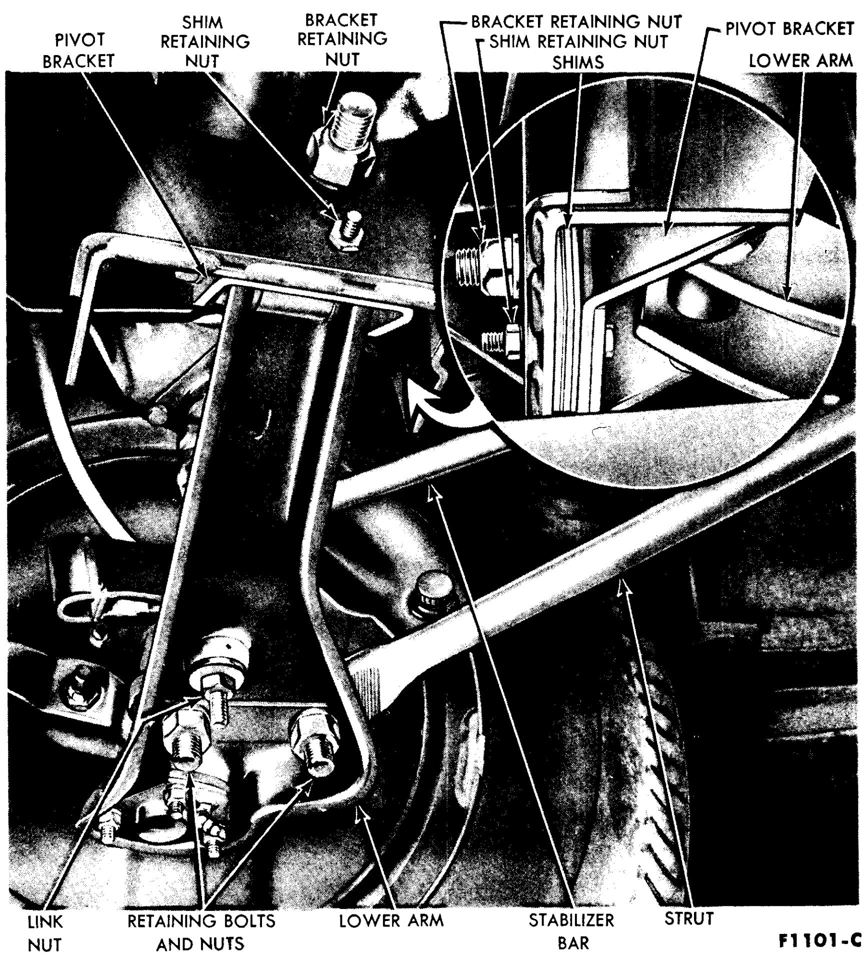

FIG. 9—Suspension Lower Arm Installed

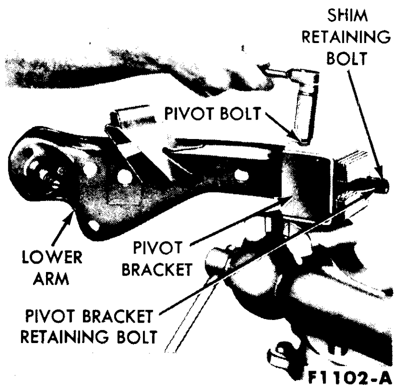

FIG. 10–Lower Suspension Arm Assembly

in the spindle upper bore. Install the stud nut. Tighten the nut to specifications, then continue to tighten until the cotter pin holes are aligned with the slots. Install a new cotter pin.

2. Install the coil spring, connect the upper arm inner shaft to the chassis, and install the shock absorber. Follow the steps in the "Front Spring" procedure under "Installation."

LOWER ARM

REMOVAL

1. Raise the front of the car, and install safety stands.

2. Remove the wheel and tire from the hub.

3. Remove 2 bolts and washers retaining the caliper to the spindle. Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose.

4. Remove the hub and rotor from the spindle.

5. Remove the splash shield and gasket from the spindle.

6. Remove the link nut underneath the arm (Fig. 9), and disconnect the stabilizer link from the arm.

7. Remove the retaining nuts, bolts, washers and plates, and disconnect the strut from the lower arm (Fig. 9).

8. Remove the cotter pin and loosen the lower ball joint stud nut. Place a box wrench over the end of tool T57P-3006-A, and position the tool 180° from the position shown in Fig. 3 (wrench at the top). The tool should seat firmly against the ends of both studs, not against the upper stud nut. It may be necessary to remove the cotter pin from the upper ball joint stud if the cotter pin prevents the tool from seating on the upper stud.

9. Turn the wrench until both studs are under tension, then loosen the stud from the spindle by tapping the spindle near the lower stud with a hammer. **Do not loosen the stud with tool pressure alone.** Disengage the lower ball joint and stud from the spindle.

10. Remove the pivot bracket retaining nut and the shim retaining nut (Fig. 9), then remove the bracket and lower arm assembly from the car.

11. Place the assembly in a vise and remove the nut from the pivot bolt (Fig. 10). Remove the pivot bolt, and separate the pivot bracket from the lower arm.

INSTALLATION

1. Assemble the pivot bracket to the new lower arm with the pivot bolt, place the assembly in a vise, and install the pivot bolt nut (Fig. 10). Tighten the nut snug. Do not torque it until the lower arm assembly is installed in the car.

2. Slide the shims over the retaining bolts against the pivot bracket (Fig. 10), then mount the lower arm and pivot bracket assembly to the chassis mounting bracket (Fig. 9). Install the pivot bracket and shim retaining nuts.

3. Insert the lower ball-joint stud in the lower bore of the wheel spindle, and install the stud nut. Tighten the nut to specifications, then continue to tighten until the cotter pin

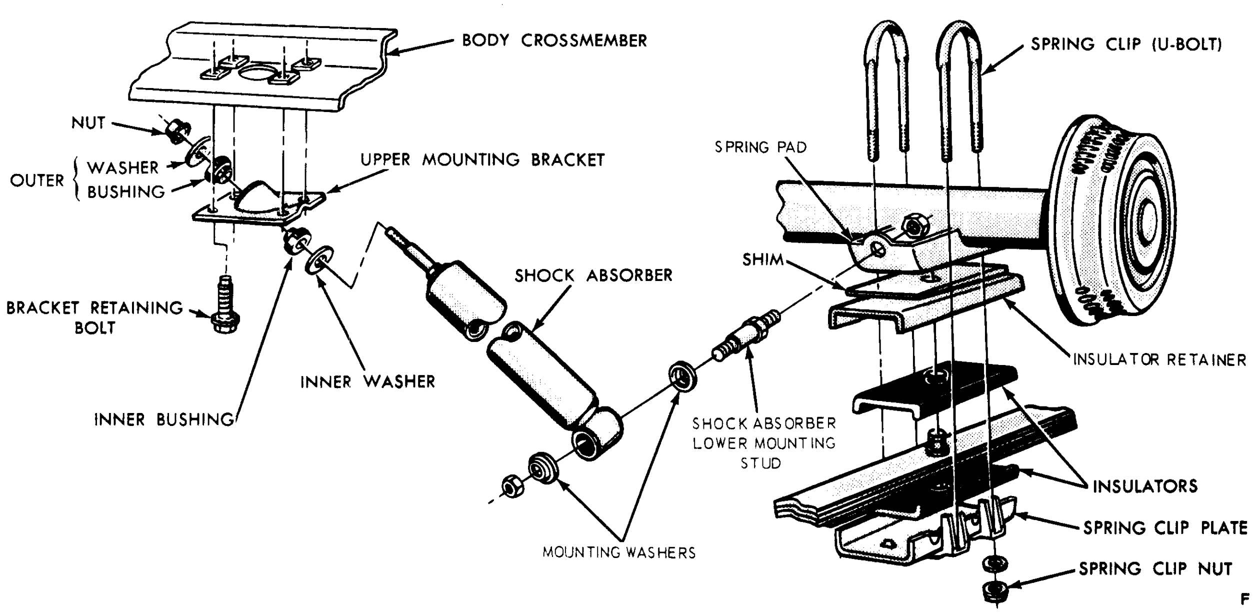

FIG. 11–Rear Shock Absorber and Spring Center Mounting

holes are aligned with the slots. Install a new cotter pin.

4. Position and connect the lower arm strut to the lower suspension arm with retaining plates, bolts, washers, and nuts (Fig. 9). Torque the nuts.

5. Connect the stabilizer bar link to the lower suspension arm, and install the washers, bushings and link retaining nut. Tighten the nut to specifications.

6. Tighten the pivot bolt and nut at the lower arm pivot bracket to specifications.

7. Lubricate the steering stop on the lower arm and the mating flat on the spindle. Refer to Group 19 for specified lubricant.

8. Install the gasket and splash shield on the spindle. Tighten the retaining bolts to specifications.

9. Install the hub and rotor on the spindle and adjust the wheel bearings.

10. Install the caliper to the spindle and tighten the retaining bolts to specifications. Check for the correct flexible hose routing (Part 2-2).

11. Install the wheel and tire on the hub.

12. Remove the safety stands, lower the car, and check the camber, caster, and toe-in.

REAR SHOCK ABSORBER

REMOVAL

1. Raise the rear end of the car. Remove the bolts that retain the shock absorber mounting bracket to the underbody (Fig. 11).

2. Remove the retaining nut and outer washer from the shock absorber lower mounting stud at the spring pad on the axle housing. Disconnect the shock absorber from the stud. Compress the shock absorber and remove it from the car.

3. Remove the nut, outer washer and bushing that retain the shock absorber to the mounting bracket, and remove the bracket.

4. If the shock absorber is serviceable and requires new bushings, remove the inner bushing and washer from the shock absorber upper mounting stud.

INSTALLATION

1. Place the inner washer and bushing on the shock absorber upper mounting stud.

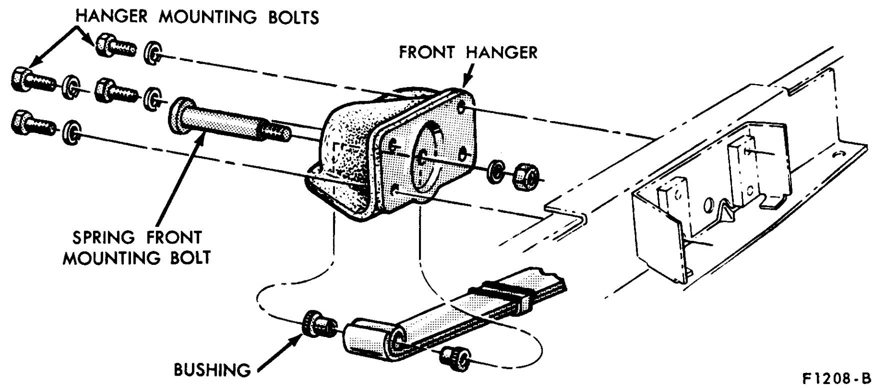

FIG. 12—Rear Spring and Front Hanger Mounting

2. Connect the upper stud to the mounting bracket, and install the bushing, washer, and nut on the stud. Torque the nut to specifications.

3. Connect the mounting bracket and shock absorber to the underbody (Fig. 11). Torque the bolts to specifications.

4. Connect the lower eye of the shock absorber to the mounting stud on the spring pad with inner and outer washers and retaining nut. Torque the nut to specifications.

REAR SPRING

REMOVAL

1. Raise the car until the rear wheels clear the floor, and place supports beneath the underbody.

2. Remove the anti-rattle coil-type spring that retains the parking brake cable to the rear spring. Remove the hook-type retainer from the brake cable and spring clip (U-bolt).

3. Place a jack and a block of wood underneath the spring clip plate, then raise the center of the spring to reduce the tension.

4. Remove the spring clip (U-bolt) nuts (Fig. 11), then lower the jack enough to remove the spring clips.

5. Remove the spring front hanger-to-underbody mounting bolts and lock washers (Fig. 12).

6. Remove the rear shackle nuts and shackle bar, then remove the shackle assembly from the rear hanger and spring (Fig. 13).

7. Lower the jack until the spring and front hanger assembly is free of the car.

8. Lift the shim (if used), upper insulator retainer, and insulator from the top of the spring.

9. Remove the spring and front hanger as an assembly from the jack, and separate the spring clip plate and the lower insulator from the spring.

INSTALLATION

1. Position the lower insulator and spring clip plate on the center of the spring. Place the entire assembly on a wood block and jack, then raise the jack until the spring is in mounting position.

2. Position the rear eye of the pring on the rear hanger and install the shackle assembly to the spring and hanger (Fig. 13). The rear eye is at the long end of the spring from the center tie bolt. Install the shackle bar and retaining nuts. **Do not tighten the nuts at this time.**

3. Position the spring and front hanger assembly on the underbody, and install the hanger mounting bolts (Fig. 12). Do not tighten the bolts at this time.

4. Install the upper insulator and retainer on the spring (Fig. 11). Install the axle shim if one was used.

5. Raise the jack until the center of the spring, the insulators, the

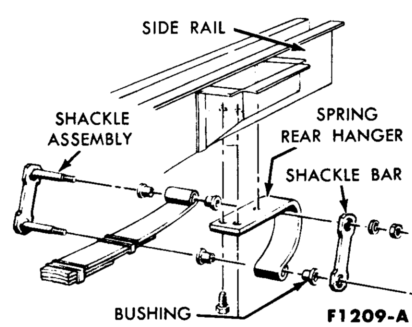

FIG. 13—Rear Spring and Rear Hanger Mounting

retainer, and the spring clip plate are all properly aligned and positioned against the spring pad on the axle housing (Fig. 11).

6. Install the spring clips over the axle housing and through the holes in the spring clip plate. Install the spring clip nuts, but do not tighten at this time.

7. Torque the rear shackle nuts and the front hanger mounting bolts to specification.

8. Torque the spring clip nuts evenly to specification. Make sure that the lower insulator retainer contacts the upper retainer. Remove the jack and wood block.

9. Install the hook-type retainer to the parking brake cable and the spring clip. Secure the parking brake cable to the top of the spring with the small anti-rattle, coil-type spring. Remove the supports and lower the car.

4 MAJOR REPAIR OPERATIONS

UPPER ARM OVERHAUL—ARM REMOVED

INSPECTION

Inspect the upper arm and the inner shaft for cracks, bends or other damage. Replace the parts as required.

Replacement arms come with the bushings, inner shaft, and ball joint installed. If the original arm is to be used, these components should be replaced on the bench.

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. Position the upper arm inner shaft in a vise, then unscrew the bushings from the shaft and arm. Remove the assembly from the vise, and separate the inner shaft from the arm.

2. Position the shaft in the arm, apply grease to the new bushings, and install the bushings loose on the shaft and 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. 14.

3. Fabricate a 9¼-inch spacer from a section of ¾-inch diameter pipe or metal of comparable size and strength.

4. Position the arm and inner shaft assembly in a vise. Position the spacer parallel with the inner shaft, and force the spacer between the flanges of the upper arm.

If the spacer can not be forced between the arm flanges due to excessive distortion, replace the upper arm assembly.

5. With the spacer positioned in the arm, torque the bushings to specification. Pivot the arm on the shaft to be sure that no binding exists, then remove the spacer.

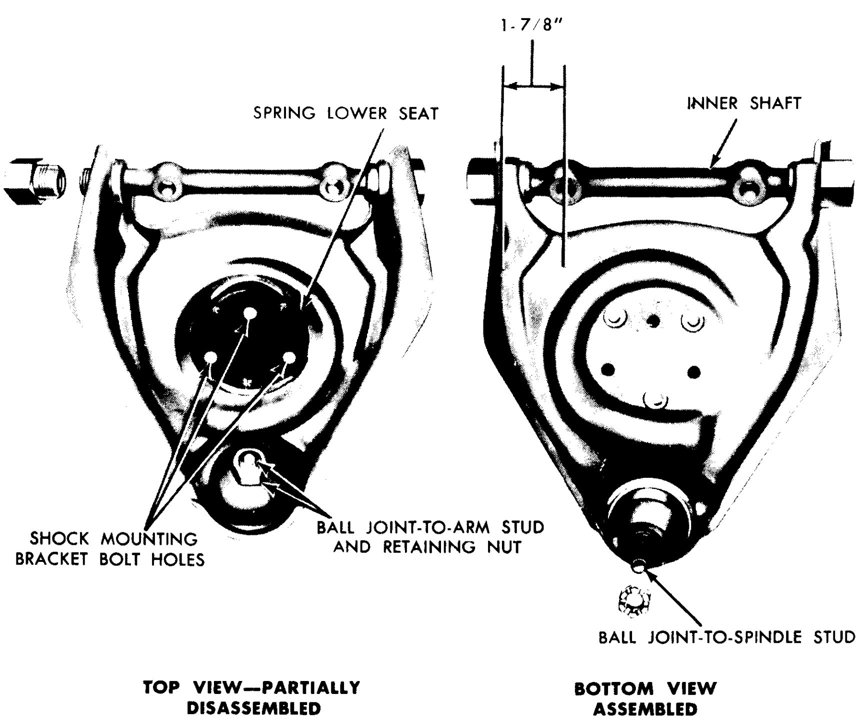

FIG. 14—Upper Suspension Arm

BALL JOINT REPLACEMENT

1. Remove the ball joint-to-arm retaining nut and remove the ball joint from the upper arm (Fig. 14).

2. Install the replacement ball joint in its recess in the upper arm so that the ball joint notch faces the front of the car (Fig. 4).

3. Install the retaining nut and torque to specifications (Fig. 14).

LOWER ARM OVERHAUL—ARM REMOVED

INSPECTION

Inspect the lower arm, the inner bushings, and the pivot bolt for cracks, bends, wear or other damage, and replace the arm if necessary.

Replacement arms come with the ball joint installed. If the original arm is to be used, the ball joint should be replaced on the bench.

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 in the "Lower Arm" procedure under "Removal."

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 specifications.

6. Install the lower arm as outlined in the "Lower Arm" procedure under "Installation."

REAR SPRING OVERHAUL—SPRING REMOVED

FRONT HANGER ASSEMBLY

If the front hanger or bushings are to be replaced, proceed as follows:

1. Remove the nut and lock washer from the spring front mounting bolt (Fig. 12).

2. Tap the spring mounting bolt out of the bushings and hanger, then separate the hanger from the spring. Remove the bushings.

3. Position the bushings in the front eye of the spring. Assemble the front hanger to the spring eye and install the spring mounting bolt through the hanger, bushings, and spring eye as shown in Fig. 12.

4. Install the lock washer and nut on the mounting bolt and tighten to the specified torque.

REAR SHACKLE AND HANGER ASSEMBLY

Inspect the rear shackle bushings, and studs for wear or damage. Replace parts where necessary (Fig. 13).

If the rear shackle bushings are to be replaced, it will be necessary to remove the rear hanger assembly. Torque the hanger attaching bolts to specification when re-installed.

SPRING LEAVES AND TIE BOLT

Check for broken spring leaves. Inspect the anti-squeak inserts between the leaves, and replace them if they are worn. **The spring leaves must be dry and free of oil and dirt before new inserts are installed.**

Inspect the spring clips for worn or damaged threads (Fig. 11). Check the spring clip plate and insulator retainers for distortion.

If the spring center tie bolt requires replacement, clamp the spring in a vise to keep the spring compressed during bolt removal and installation.

PART 3-3 STEERING

1 DESCRIPTION AND OPERATION

DESCRIPTION

The power steering unit is a torsion-bar type of hydraulic assisted system. This system furnishes power to reduce the amount of turning effort required at the steering wheel. It also reduces road shock and vibrations.

The torsion bar power steering unit includes a worm and one piece rack piston, which is meshed to the gear teeth on the steering sector shaft. The unit also includes a hydraulic valve, valve actuator, and torsion bar assembly which are mounted on the end of the worm shaft and operated by the twisting action of the torsion bar.

The torsion-bar type of power steering gear is designed with the one piece rack-piston, worm and sector shaft in one housing and the valve spool in an attaching housing (Fig. 1). This makes possible internal fluid passages between the valve and cylinder, thus eliminating all external lines and hoses, except the pressure and return hoses between the pump and gear assembly.

The power cylinder is an integral part of the gear housing. The piston is double acting, in that fluid pressure may be applied to either side of the piston.

A selective metal shim, located in the valve housing of the gear is for the purpose of tailoring steering gear efforts. If efforts are not within specifications they can be changed by increasing or decreasing shim thickness as follows:

Efforts heavy to the left—Increase shim thickness

Efforts light to the left—Decrease shim thickness

A change of one shim size will increase or decrease steering efforts approximately 1½ in.-lbs.

Shims are available in the following thicknesses:

0.0057-0.0063 inch
0.0077-0.0083 inch
0.0097-0.0103 inch
0.0117-0.0123 inch
0.0137-0.0143 inch

Do not use more than one shim.

The operation of the hydraulic control valve spool is governed by the twisting of a torsion bar. All effort applied to the steering wheel is transmitted directly through the input shaft and torsion bar to the worm assembly and integral piston. Any resistance to the turning of the front wheels results in twisting of the bar. The twisting of the bar increases as the front wheel turning effort increases. The control valve spool actuated by the twisting of the torsion bar, directs fluid to the side of the piston where hydraulic assist is required.

The upper end of the torsion bar is drilled and pinned to the input shaft. The lower end of the torsion bar is inserted into the worm, then drilled and pinned to the lower end of the worm, after the valve spool has been centered. The actuator is attached to the upper end of the worm by three helical splines. The valve spool is held on the actuator by a snap ring. The actuator is coarsely splined to the outside diameter of the input shaft. The coarse spline fit between the actuator and input shaft is sufficiently loose to allow upward and downward movement of the actuator and valve spool. As the torsion bar twists, its radial motion is transferred into axial mo-

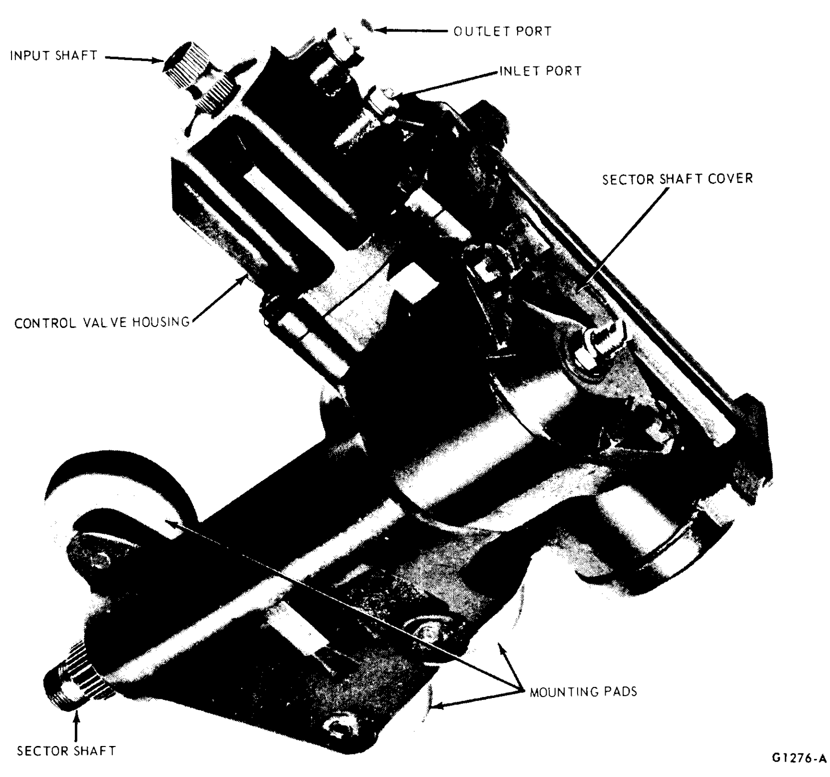

FIG. 1—Steering Gear

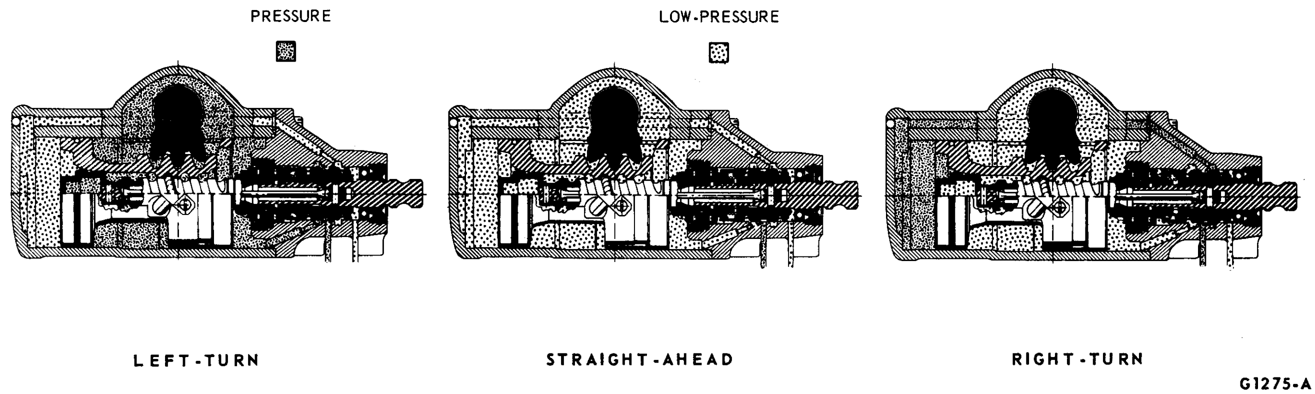

FIG. 2—Power Flows

tion by the three helical threads. Thus, the valve is moved off center, and fluid is directed to one side of the piston or the other.

The resistance of the torsion bar gives the driver a feel of the road, and at the same time the driver is receiving full power assist in steering.

OPERATION

STRAIGHT-AHEAD POSITION (NEUTRAL)

When the power unit is not assisting in the steering effort, the valve spool is in the neutral (straight-ahead) position. The fluid flows from the pump through the inlet port of the steering gear to the center groove and over the lands of the valve, exhausting through holes in the outer grooves to the center of the valve and out the exhaust port to the pump (Fig. 2). Therefore, no area of the valve spool or steering gear is under high pressure in this position. The amount of pressure in neutral position is approximately 150 psi at normal operating temperatures.

RIGHT TURN

When the steering wheel is turned to the right, the piston on the worm resists being turned due to load on the sector shaft from the front end weight of the car. Thus, the torsion bar will start to twist.

For a right turn the valve spool moves up, allowing fluid from the pump to enter against the lower side of the power piston (Fig. 2). The fluid on the upper side of the piston is free to return through the valve to the pump. Therefore, the power assist is to the lower side of the piston, pushing it upward and providing assist in turning of the sector shaft.

LEFT TURN

If the steering wheel is turned to the left, it will cause a similar action but in the opposite direction. The torsion bar twists to the left moving the valve spool downward, allowing fluid from the pump to enter against the upper side of the power piston (Fig. 2). The fluid on the lower side of the piston is free to return through the valve to the pump. Therefore, the power assist is to the upper side of the piston, pushing it downward. The instant the driver stops applying steering effort to the steering wheel the valve spool is returned to its neutral position by the unwinding of the torsion bar.

POWER STEERING PUMP

The power steering pump is a belt driven slipper type pump which is integral with the reservoir. It is constructed so that the reservoir is attached to the rear side of the pump housing front plate and the pump body is incased within the reservoir.

The pump rotor has 8 slippers and

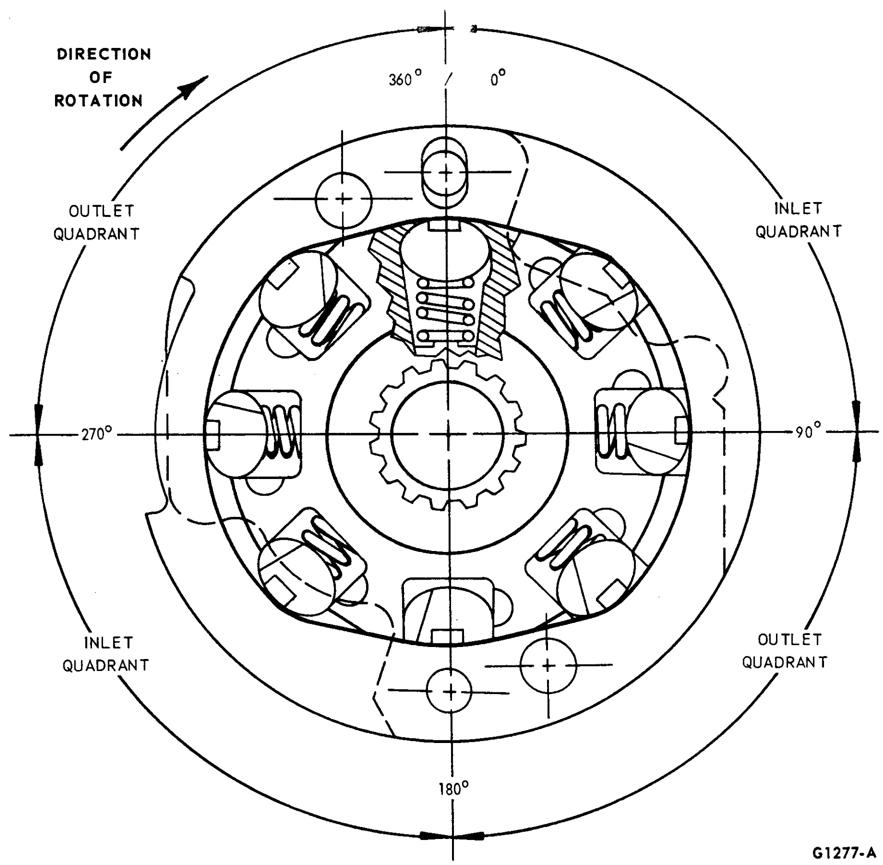

FIG. 3—Power Steering Pump Cycle

springs which rotate inside a cam insert containing two lobes 180° from each other. The cam insert and the pump port plates provide a sealed chamber within which the rotor and slippers rotate between the two lobes for pump operation.

As the rotor turns, the slippers are forced outward against the inner surface of the cam insert by a combination of centrifugal force, slipper spring force and fluid pressure acting on the under side of the slipper. A pair of adjacent slippers, along with the surfaces of the rotor, cam and pressure plates, form a sealed chamber within the crescent-shaped void. As this sealed chamber moves through the crescent shaped void its volume changes, resulting in a pumping action.

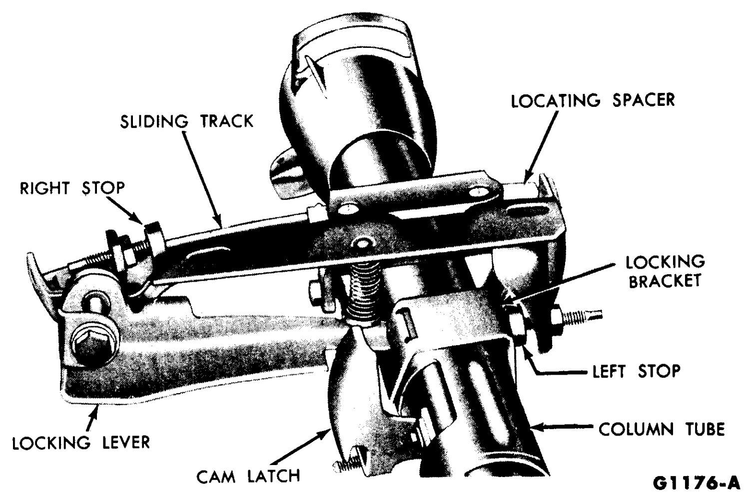

FIG. 5—Movable Steering Column Mechanism

As the rotor rotates 90° (Fig. 3), the slipper slides outward in its slot, riding on the cam and the volume of the sealed chamber increases. This creates a vacuum and sets up a suction area. With the inlet port placed in this area, the chamber will fill with fluid. As the rotor rotates 90° to 180°, the volume of the sealed chamber decreases, thus creating a pressure area. The pressure or outlet port is located in this area. While this pumping action is going on between 0° and 180°, the same condition is occurring between 180° and 360°. This combination creates what is known as a balanced rotor pump. The two pressure and suction quadrants are diametrically opposite each other.

Flow Control Valve. Since the pump is a constant displacement pump, the internal flow will vary directly with the pump speed. However, a power steering gear requires a relatively high constant rate of flow in the parking zone and up to approximately 2800 rpm and thereafter a lower rate of flow. This is accomplished by means of a variable orifice mechanism shown in Fig. 4.

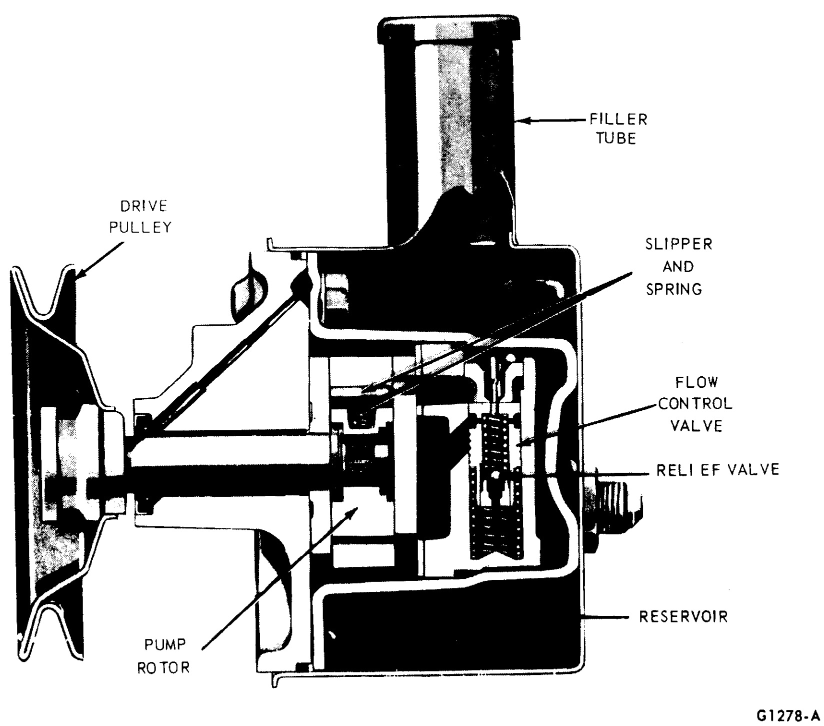

FIG. 4—Flow Control Valve and Pressure Relief Ball

All of the internal pump flow is ported from the pumping mechanism (rotor, slippers, and cam insert) through passage "A" into the flow control zone. All of the flow goes through the orifice and out into the line until the bypass port is cracked open. This is the regulation point. The oil drops in pressure in moving through the orifice. The lower pressure is then sensed through a hole drilled in the cover communicating to the rear of the spool valve. The differential in pressure thus created on the spool valve increases steadily and proportionately with increasing RPM and this moves the valve progressively back into its bore, thus increasing the opening of the bypass port.

The metering pin (Fig. 4) travels with the spool valve decreasing the net area of the orifice at higher speeds. This action reduces flow to the steering gear.

Pressure Relief Valve. When the steering wheel is turned completely to the "stop position" in the right or left turn direction, or in the case of a road load of sufficient magnitude, the steering gear will not accept any flow from the pump, except for a very limited volume of oil due to leakage past valve seals. Because of this resistance, excessive hydraulic pressure would be developed, if it were not limited by the pressure relief valve.

When relief pressure is reached, the pressure relief ball is forced off its seat, allowing oil to pass through the spool valve and dump into the bypass port (Fig. 4). The relief valve will continue to limit oil pressure to the relief setting for the duration of the overload condition.

MOVABLE STEERING COLUMN

The movable column combines a lateral-movement mechanism (Fig. 5) at the instrument panel with a flexible coupling that attaches to the steering gear input shaft. The steering column lower end pivots on a bracket that is fastened to the dash panel.

With the column in the straight-ahead position and the gear shift lever at any position other than P, the column is locked to the brake pedal support assembly. It is locked by a locking lever controlled by the selector tube. A coil spring provides positive engagement of the locking bracket when the shift lever is at any position other than P.

When the selector lever is moved to park position, a cam latch (fastened to the selector tube) disengages the locking lever from the locking bracket. The steering column assembly may then be moved about 8 inches to the right. Whenever the locking lever is disengaged, and the column is moved over, the transmission cannot be shifted. As the column is moved back to its extreme left (or straight-ahead) position, the locking lever engages the bracket, locking the column and the transmission can be shifted by the selector lever.

2 IN-CAR ADJUSTMENTS AND REPAIRS

VALVE SPOOL CENTERING CHECK

1. Install a 0-2000 psi pressure gauge tool T56L-33610-D in the pressure line between the power steering pump outlet port and the integral steering gear inlet port.
2. **Make sure that the valve on the gauge is in the fully open position.**
3. Check the fluid level in the reservoir and fill it to the proper level with the specified fluid.
4. Start the engine and cycle the steering wheel from stop-to-stop, to bring the steering lubricant up to normal operating temperature. Stop the engine and recheck the reservoir. Add fluid if necessary.
5. With the engine running at approximately 1000 rpm and the steering wheel centered, attach an inch-pound torque wrench to the steering wheel retaining nut. Apply sufficient torque to the torque wrench in each direction, either side of center, to get a gauge reading of 250 psi.
6. The torque reading should be the same in both directions when 250 psi is reached. If the difference between the readings exceed 4 in-lbs, the steering gear must be removed and the valve centering shim removed from the valve housing and a thicker or thinner shim installed. Only one shim to be used.

The **"out of car"** procedure for valve centering check is the same as for "in car" except the torque and simultaneous pressure reading must be made at the right and left stops instead of either side of center.

STEERING GEAR ADJUSTMENTS

During the breaking-in period of the car, it is probable that some of the factory adjustments will change. These changes in adjustment do not necessarily affect the satisfactory operation of the steering gear assembly, and therefore ordinarily do not require readjustment unless there is excessive lash or other malfunctioning.

ADJUSTMENT IN CAR

Preload (thrust bearing adjustment) and worm to rack preload cannot be changed in service. (The only adjustment which can be performed is the total over center position load, to eliminate excessive lash between the sector and rack teeth.)

1. Disconnect the pitman arm from the sector shaft.
2. Disconnect the fluid return line at the reservoir, at the same time cap the reservoir return line pipe.
3. Place the end of the return line in a clean container and cycle the steering wheel in both directions as required, to discharge the fluid from the gear.
4. Remove the ornamental cover from the steering wheel hub and turn the steering wheel to 45° from the left stop.
5. Using an inch-pound torque wrench on the steering wheel nut, determine the torque required to rotate the shaft slowly through an approximately ⅛ turn from the 45° position.
6. Turn the steering gear back to center, then determine the torque required to rotate the shaft back and forth across the center position. Loosen the adjuster nut, and turn the adjuster screw (Fig. 6) in until a reading of 11-12 in. lbs. greater than the torque 45° from the stop is obtained.

Retighten the lock nut while holding the screw in place.

7. Recheck the readings and replace pitman arm and steering wheel hub cover.
8. Connect the fluid return line to the reservoir and fill the reservoir with specified lubricant to the proper level.

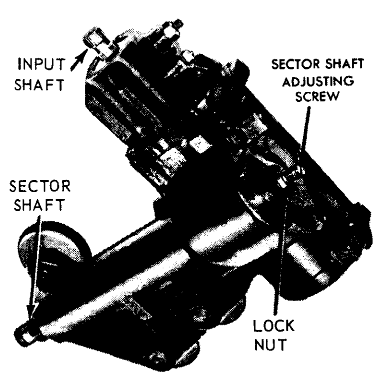

FIG. 6—Adjusting Mesh Load

PUMP BELT TENSION ADJUSTMENT

Pump drive belt tension cannot be checked accurately using the thumb pressure or belt deflection methods. Correct belt adjustment is assured only with the use of a belt tension gauge.

1. Check the belt tension with a belt tension gauge tool T63L-8620-A. With a new belt, or one that has been run for less than 15 minutes, the tension should be within 120-150 lbs. With a belt that has been run for more than 15 minutes, the tension should be within 90-120 lbs.
2. To adjust the belt, loosen the mounting bolts incorporated on the

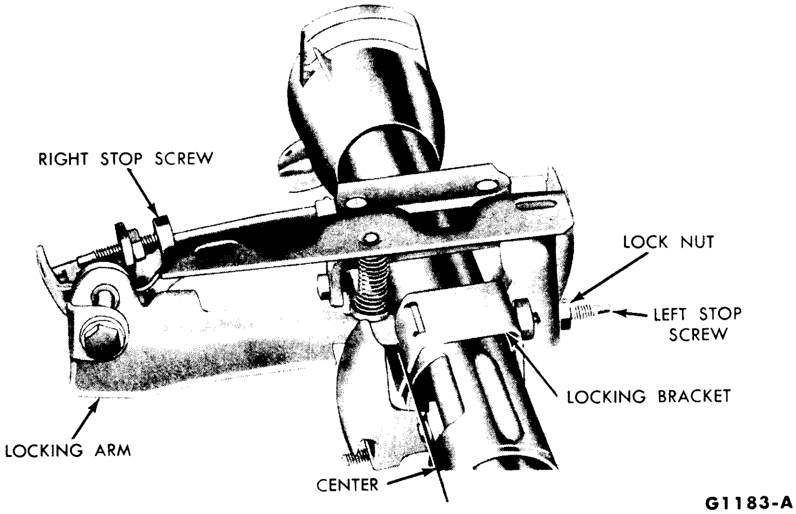

FIG. 7—Steering Column Stop Adjustments

front face of the pump cover plate (hub side) and one nut at the rear. Fix a 9/16" open end wrench on the projecting ½" boss on the cover plate and pry upward to correct tension.

Do not pry against the reservoir to obtain proper belt load as it can be deformed and cause a leak.

3. Recheck the belt tension. When the tension has been correctly adjusted, tighten the bolts and the nut to 30-40 ft-lbs torque.

MOVABLE COLUMN

STOP ADJUSTMENTS

1. Remove the instrument panel extension and the radio access panel.
2. Loosen the left stop screw lock nut.
3. Adjust the stop screw as required to center the locking arm on the locking bracket (Fig. 7).
4. Tighten the stop screw lock nut.
5. Move the column to the extreme right and observe for interference at the instrument panel, or air conditioner if so equipped.
6. If an interference is noted, loosen the lock nut on the stop screw at the right side of the track. Thread the screw inward as required to shorten the travel and eliminate the interference. Tighten the stop screw lock nut.

LOCK MECHANISM

1. Place the selector lever in the P (Park) position. Note the position of the locking arm.
2. If interference is noted, loosen the cam latch screw lock nut (Fig. 8).
3. Turn the screw (Fig. 8) in or out as required to provide clearance between the locking arm and bracket and also at the cam latch.
4. Tighten the cam latch screw lock nut.
5. If adjusting the cam latch screw does not correct the trouble, fabricate a gauge as shown in Fig. 9 and remove the column from the car and adjust the cam latch as shown in (Fig. 10).

SLIDE FRICTION

1. Remove the two column-to-sliding track attaching bolts.
2. Connect a pull scale to the track and check the sliding effort as shown in Fig. 11.
3. To adjust the sliding effort, loosen the two lock nuts shown in Fig. 11. Tighten or loosen the two Allen head adjustment bolts as required to obtain a 10 lb. pull.
4. Tighten the two lock nuts. Recheck the pull effort.
5. Install the spacer shown in Fig. 18. Secure the column to the track with the two attaching bolts. Be careful when tightening the two column attaching bolts so as not to create a bind in the track.
6. Remove the nylon locating spacer from the track.

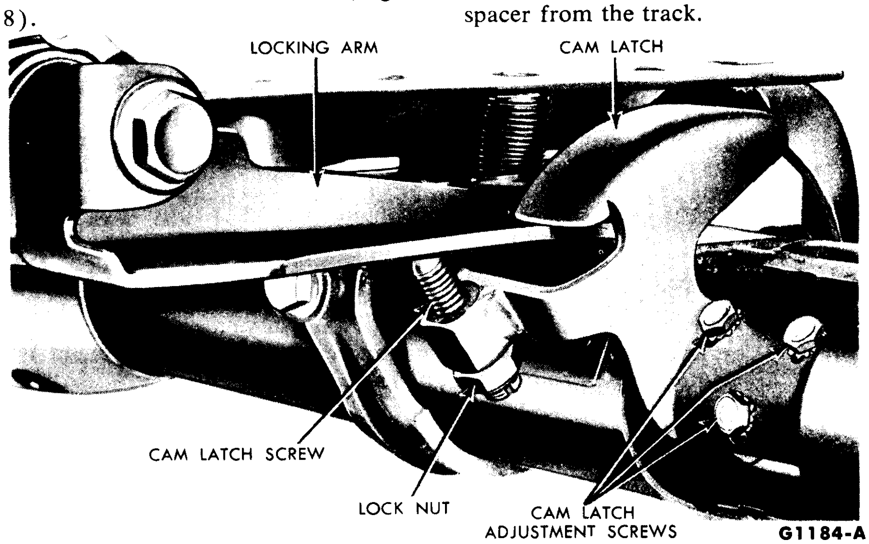

FIG. 8—Steering Column Locking Mechanism

3 REMOVAL AND INSTALLATION

STEERING GEAR REPLACEMENT

REMOVAL

1. Disconnect the pressure and the return line from the steering gear. Cap each line and plug each port in the gear to prevent the entry of dirt.
2. Remove the bolt that secures the flex joint to the steering gear. Loosen the bolt that attaches the flex joint to the steering shaft.

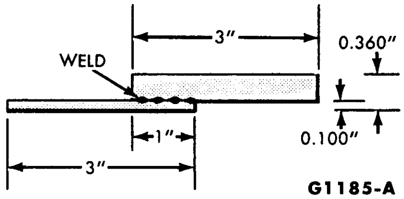

FIG. 9—Cam Latch Guage (Fabricated)

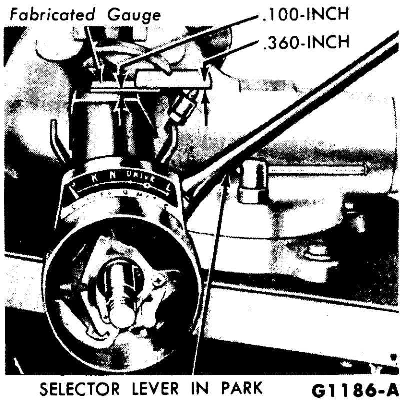

FIG. 10—Adjusting Cam Latch

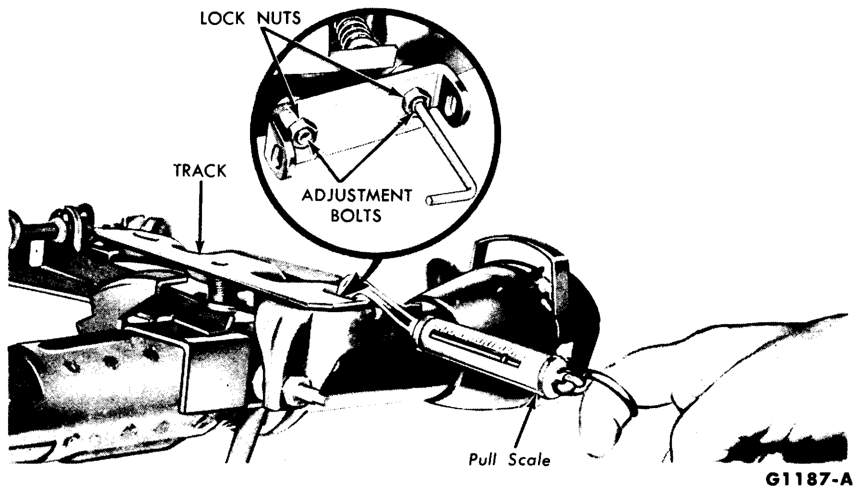

FIG. 11—Checking Track Sliding Effort

3. With a pry bar, carefully loosen the flex joint from the steering shaft.

4. Remove the two bolts that secure the left strut to the underside of the car and remove the strut.

5. Remove the nut and lock washer that secures the Pitman arm to the sector shaft. Remove the Pitman arms as shown in Fig. 12.

6. Remove the three bolts that attach the steering gear to the side rail and remove the gear.

7. Remove the three mounting pads from the gear as shown in Fig. 13.

INSTALLATION

1. Install the three mounting pads on the steering gear as shown in Fig. 13 and torque them to specifications.

2. Position the flex joint on the gear.

3. Align the flat spot on the flex joint with the one on the steering shaft then slide the gear into place on the side rail. Install the three gear to side rail attaching bolts and tighten to specifications.

4. Position the Pitman arm on the sector shaft and secure it with nut and lock washer. Tighten the nut to specifications.

5. Hold the left strut in position and install the two attaching bolts. Torque the bolts to specifications.

6. Install the flex joint-to-steering shaft attaching bolt. Tighten both flex joint attaching bolts to specification.

7. Remove the plugs from the gear ports and the caps from the lines. Connect the pressure line and the return line to the steering gear.

8. Fill the reservoir to the proper level with the specified fluid.

9. Start the engine and cycle the system to bleed the system.

10. Recheck the fluid level and fill the system as required.

POWER STEERING PUMP

1. Remove the power steering fluid from the pump reservoir by disconnecting the fluid return line at the reservoir, and allow the fluid to drain into a suitable container.

2. Disconnect the pressure line from the pump.

3. Remove 1 nut and 3 bolts attaching the pump to the mounting bracket; disconnect the belt from the pulley and remove the pump from the car.

4. Position the pump to the mounting bracket and install the 3 bolts and 1 nut.

5. Place the belt on the pulley and adjust the belt tension (Section 2) with Tool T63L-8620-A and tighten the bolts and nut to specifications.

6. Connect the pressure line to the pump fitting and tighten the retaining nut.

7. Place a new clamp on the return hose and connect the hose to the pump. Then, tighten the clamp.

8. Fill the power steering pump reservoir with transmission fluid C1AZ-19582-A and cycle the system to remove air from the steering gear, wiper motor, and lines.

9. Check for leaks and again check the fluid level. Add fluid as necessary.

STEERING WHEEL REPLACEMENT

1. Remove the hub cap from the steering wheel.

2. Remove the steering wheel nut, and then remove the steering wheel with a puller as shown in Fig. 14.

3. Transfer all serviceable parts to the new steering wheel.

4. Position the steering wheel on the shaft so that the alignment mark on the hub of the wheel is adjacent to the one on the shaft. Install and torque the nut to specification. Stake the nut securely.

5. Install the hub cap.

UPPER STEERING SHAFT BEARING REPLACEMENT

1. Remove the steering wheel and the upper bearing spring.

2. Remove the turn signal lever from the switch.

3. Remove the three turn signal clamp attaching screws.

4. Remove the three bearing retainer attaching screws and remove the retainer (Fig. 15).

5. Carefully lift the turn signal switch from the column. Use care to move the attaching wires only enough for the switch to clear the shaft.

6. Working from the engine compartment, disconnect the upper steer-

FIG. 12—Removing Pitman Arm

ing shaft from the flexible coupling.

7. Lift the upper shaft and bearing from the column.

8. Remove the C ring from the upper end of the shaft and press the bearing off the shaft. Remove the rubber insulator from the bearing.

9. Slide a new bearing onto the upper end of the shaft until it contacts the C-ring. Install a new C-ring above the bearing.

Install the rubber insulator on the bearing outer race.

10. Install the shaft and bearing in the column making sure that the lower end of the shaft enters the flexible coupling in the engine compartment and that the bearing is seated in the bore.

11. Secure the upper shaft to the flexible coupling.

12. Position the turn signal switch and the bearing retainer in the column and install the three attaching screws.

13. Pull the turn signal wires from the lower end of the column just enough to remove all slack. Install the thru wire retaining clips.

14. Install the turn signal lever.

15. Install the upper bearing spring and the steering wheel.

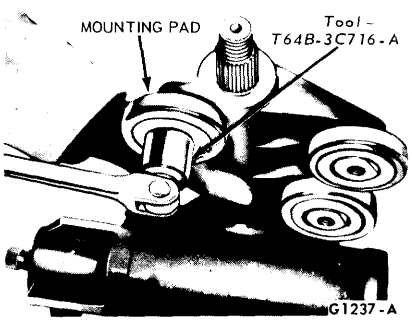

FIG. 13—Removing or Installing Steering Gear Mounting Pads

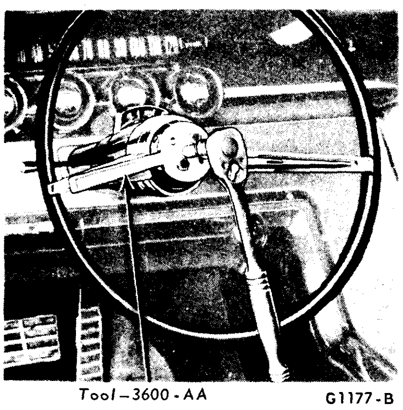

FIG. 14—Removing Steering Wheel

SHIFT TUBE AND LEVER REPLACEMENT

REMOVAL

1. Disconnect the ground cable from the battery.

2. Working from under the hood, remove the two steering column tube bracket attaching bolts (Fig. 16).

3. Disconnect the shift rod from the selector lever at the lower end of the steering column.

4. Remove the bolt that secures the steering shaft to the flexible coupling.

5. Remove the steering wheel, the turn signal switch retainer, and the turn signal lever.

6. Carefully lift the turn signal switch off the steering column.

7. Pull the steering shaft assembly out of the steering column.

8. Remove the moulding cap, finish panel extension, console rear panel, rear panel moulding, left side moulding and the two lower edge mouldings (Fig. 16) from the left side of the console.

9. Remove the lower edge moulding retainers.

10. Remove the radio access cover.

11. Remove the headlamp switch and bezel from the instrument panel.

12. Remove the instrument panel moulding cover attaching screws and cover from the panel.

13. Remove the instrument panel finish panel attaching screws and remove the finish panel.

14. Remove the dust boot retainer-to-dash attaching bolts.

15. Disconnect the turn signal wires at the connector.

16. Disconnect the two wires and the two vacuum hoses from the neutral safety switch.

17. Remove the two steering column-to-track attaching bolts.

18. Remove the lower half of the cover at the column by pulling down and remove the two screws that attach the clamp retaining the doors to the column.

19. Remove the clip that secures the two door actuating levers to the pivot bracket (Fig. 16). Carefully remove the doors from the column.

20. Remove the two bolts that secure the pivot bracket to the instrument panel and remove the bracket.

21. Remove the three screws that secure the locking cam to the selector lever tube (Fig. 17) and remove the cam.

22. Remove the two neutral switch attaching screws and remove the switch.

23. Lift the column part way out of the instrument panel and remove

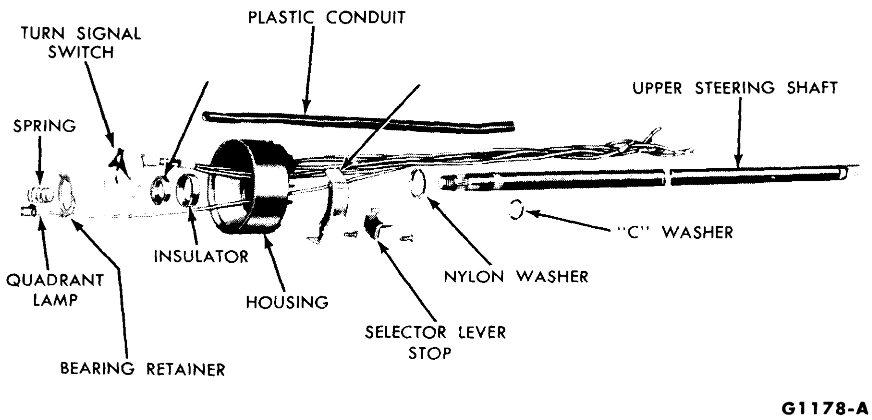

FIG. 15—Upper Steering Shaft Disassembled

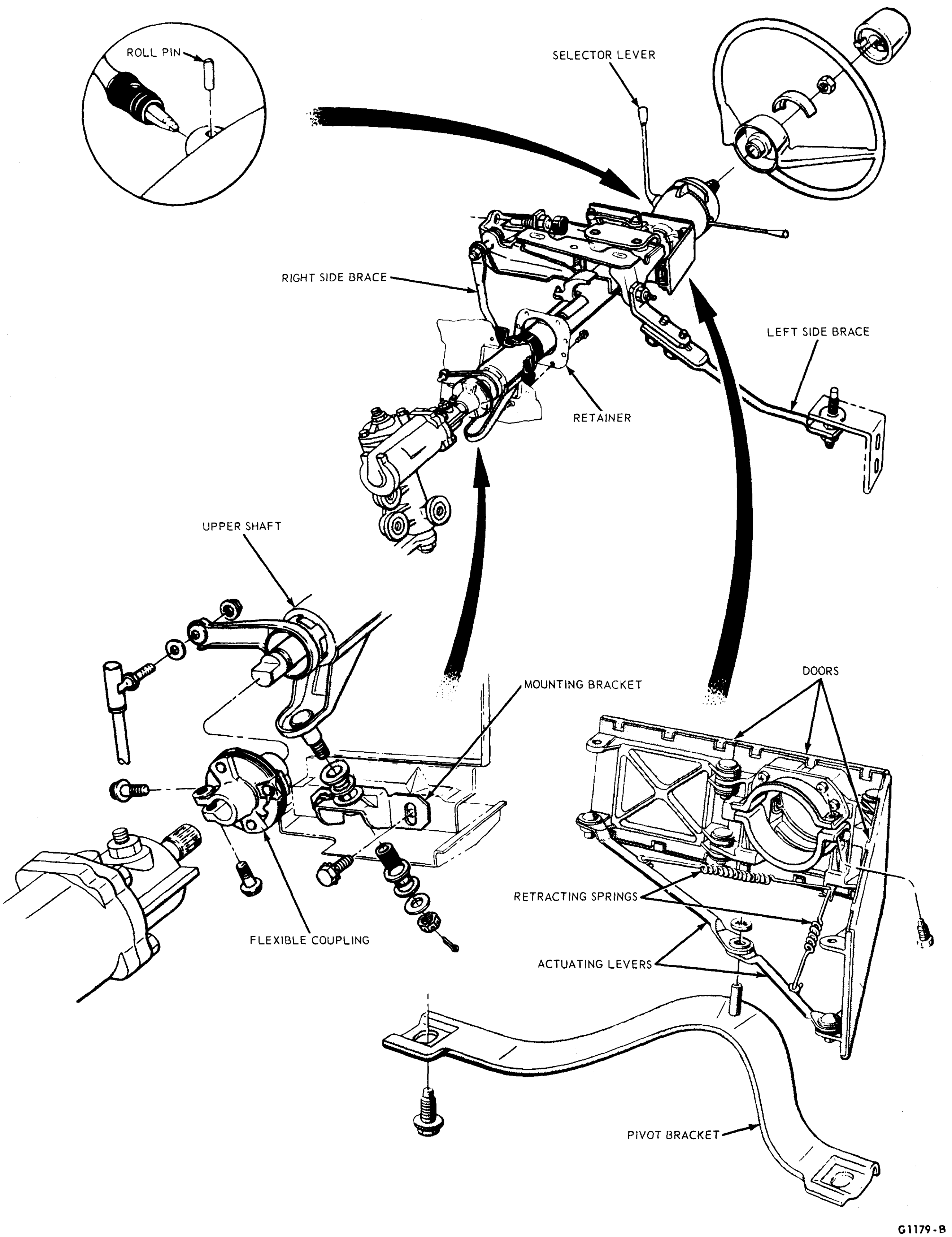

FIG. 16—Movable Steering Column Installation

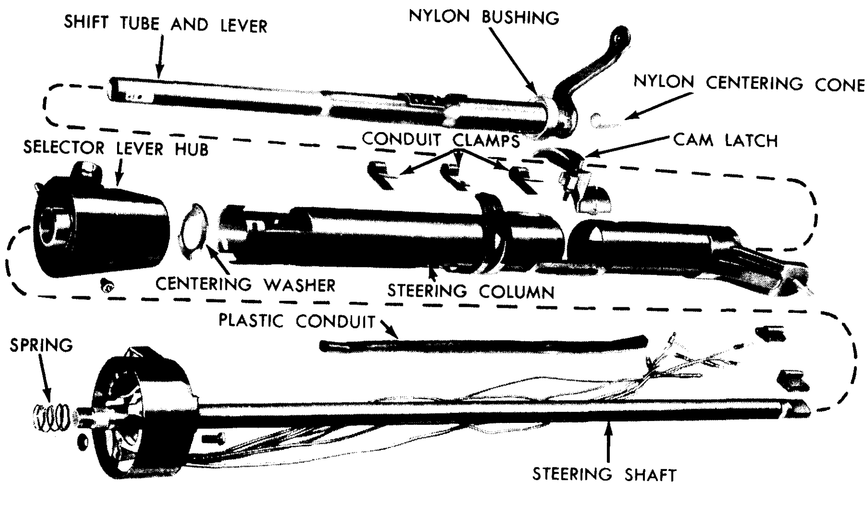

FIG. 17—Steering Column Disassembled

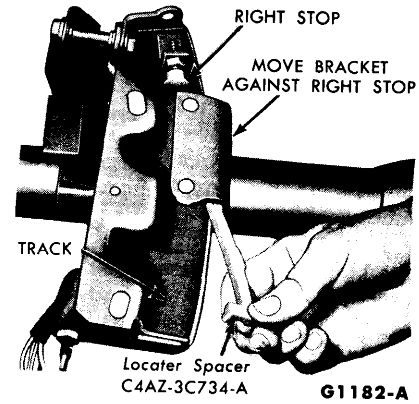

FIG. 18—Removing or Installing Locater Spacer

the dust boot retainer from the lower end of the column. Remove the column from the instrument panel.

24. Remove the selector lever roll pin, then remove the lever.

25. Remove the neutral switch stop attaching screws and remove the stop from the shift tube.

26. Remove the screw that attaches the shift lever tube to the hub.

27. Slip the shift tube and lever from the lower end of the column.

28. Spread the nylon bushing enough to clear the neutral switch mounting pad then remove it from the tube. Pull the nylon centering cone from the lower end of the tube with pliers.

INSTALLATION

1. Work the plastic centering cone into the lower end of the shift lever tube making sure that the taper is toward the bottom of the tube.

2. Slide the nylon bushing to the lower end of the tube spreading only enough to provide clearance at the neutral safety switch mounting pad.

3. Slide the shift tube and lever into the lower end of the column until the upper end enters the selector lever hub and the molded stop is in the slot in the tube.

4. Secure the shift tube to the selector lever hub with the attaching screw (Fig. 17).

5. Secure the neutral switch stop to the shift tube with the attaching screws.

6. Position the selector lever in the hub and secure it with a roll pin. Install the nylon locating spacer on the track (Fig. 18).

7. Enter the lower end of the column in the instrument panel opening and install the dust boot retainer on the column. Continue to lower the steering column until the mounting bracket is on the engine compartment side of the dash panel.

8. Install, but do not tighten the bracket attaching bolts.

9. Secure the column to the track with the two attaching bolts. Tighten the bracket-to-dash attaching bolts at this time.

10. Secure the cam latch to the shift tube with the attaching screws.

11. Secure the neutral safety switch to the shift tube. Connect the neutral safety switch wires and the two vacuum hoses to the switch.

12. Connect the turn signal wires at the connector.

13. Secure the dust boot and retainer to the dash with the attaching bolts.

14. Secure the column door pivot bracket to the lower end of the instrument panel.

15. Position the doors on the steering column tube and install the clamp, but do not tighten the screws. Install the lower cover at the column.

16. Secure the two door actuating levers to the pivot bracket with the pin, washers and the retainer.

17. Slide the doors to approximately $\frac{3}{16}$ inch from the instrument panel. Move the column to the side slowly and observe the operation of the door. It should be moved as close as possible to the instrument panel and still have clearance through the full movement. Tighten the two screws and install the two retracting springs (Fig. 16). The pivot bracket can be adjusted from side to side and fore and aft to make the doors parallel with the instrument panel.

18. Install the instrument panel finish panel.

19. Install the instrument panel moulding cover.

20. Install the headlamp switch on the instrument panel.

21. Install the radio access cover on the left side of the console and instrument panel.

22. Install the lower edge moulding retainers.

23. Install the two lower edge mouldings, left side moulding, rear panel moulding, console rear panel finish panel extension and the moulding cap.

24. Place the steering shaft assembly in the steering column making sure that the lower end enters the flexible coupling.

25. Place the turn signal switch over the shaft and secure it with the retainer and attaching screws.

26. Install the steering wheel.

27. Install the flexible coupling-to-steering shaft attaching bolt.

28. Connect the transmission shift rod to the shift lever.

29. Connect the battery ground cable to the battery.

30. Adjust the steering column and the neutral safety switch as required.

4 MAJOR REPAIR OPERATIONS

STEERING GEAR

DISASSEMBLY

In most cases, complete disassembly of the power steering unit will not be necessary. It is suggested that only those assemblies that are faulty be disassembled. Disassembly and reassembly of the unit and the subassemblies must be made on a clean workbench. As in repairing any hydraulically operated unit, cleanliness is of utmost importance. Therefore, the bench, tools, and parts must be kept clean at all times. Thoroughly clean the exterior of the unit with a suitable solvent and, when necessary, drain as much of the hydraulic oil as possible. Handle all parts very carefully to avoid nicks, burrs, scratches and dirt, which could make the parts unfit for use.

1. Remove the three mounting pads from the housing (Fig. 13).
2. Hold the steering gear over a drain pan in an inverted position and cycle the input shaft six times to drain the remaining fluid from the gear.
3. Mount the gear in a soft jawed vise.
4. Remove the teflon lock nut and the brass washer from the adjusting screw.

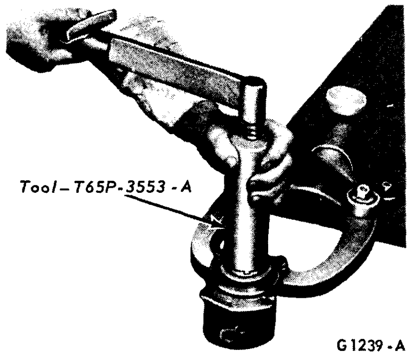

FIG. 20—Removing or Installing Lock Nut

5. Turn the input shaft to either stop then, turn it back approximately 1¾ turns to center the gear.
6. Remove the two sector shaft cover attaching screws and the identification tag.
7. Tap the lower end of the sector shaft with a soft-faced hammer to loosen it then, lift the cover and shaft from the housing as an assembly. Discard the O-ring.
8. Turn the sector shaft cover counterclockwise off the adjuster screw.
9. Remove the four valve housing attaching bolts. Lift the valve housing from the steering gear housing while holding the piston to prevent it from rotating off the worm shaft. Remove the valve housing and the lube passage O-rings and discard them.
10. Stand the valve body and piston on end with the piston end down. Rotate the input shaft counterclockwise out of the piston allowing the ball bearings to drop into the piston.
11. Place a cloth over the open end of the piston and turn it upside down to remove the balls.
12. Remove the two screws that attach the ball guide clamp (Fig. 19) to the ball nut and remove the clamp and the guides.
13. Install valve body assembly in holding fixture (do not clamp in vise) and remove the lock nut and the retaining nut as shown in Fig. 20.
14. Carefully slide the worm and valve assembly out of the valve housing.
15. Remove the shim from the valve housing bore.

PARTS REPAIR OR REPLACEMENT

Valve Housing.

1. Remove the dust seal (Fig. 21) from the rear of the valve housing

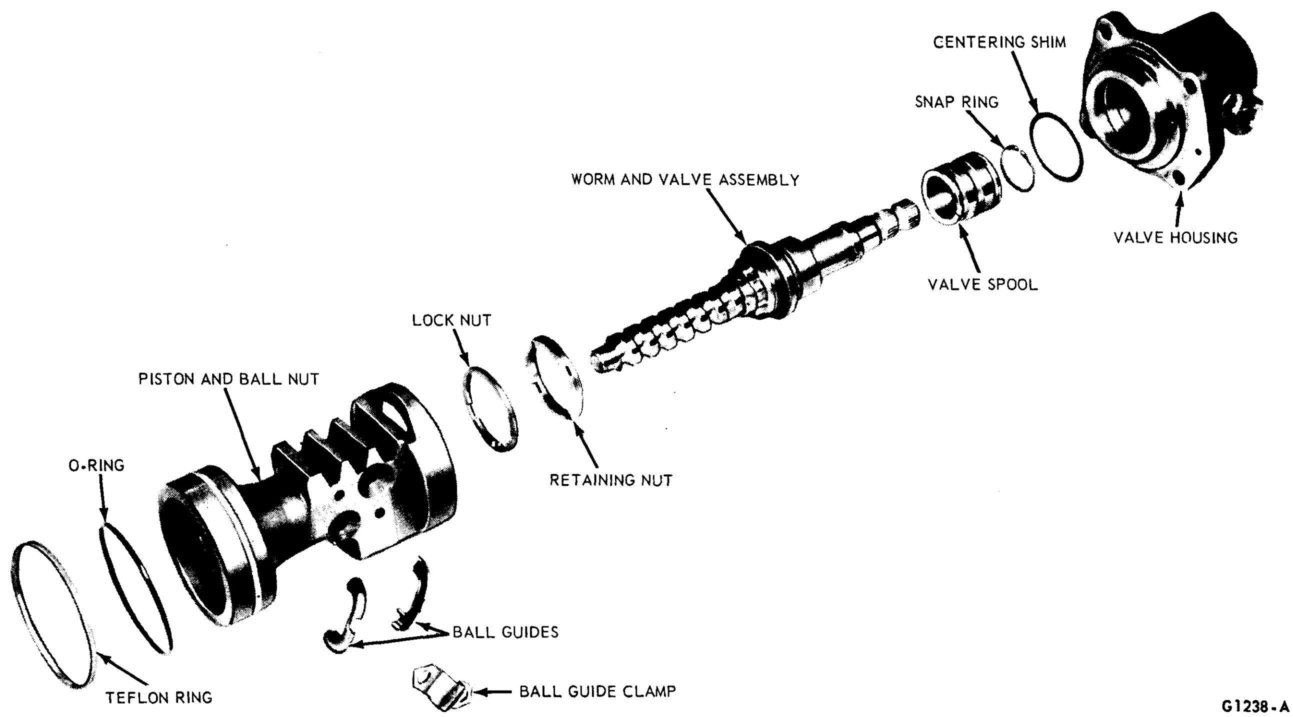

FIG. 19—Ball Nut and Valve Housing Diasssembled

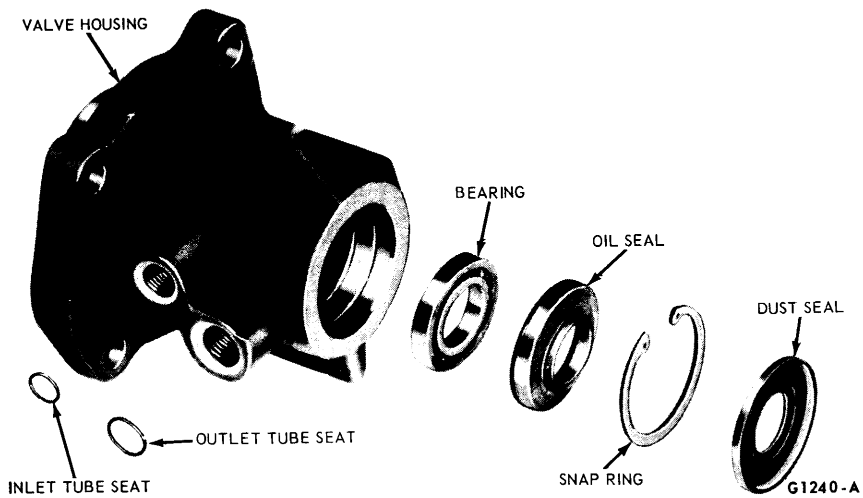

FIG. 21—Valve Housing Disassembled

with Tool T59L-100-B and T58L-101-A.

2. Remove the snap ring from the valve housing.

3. Turn the fixture to place the valve housing in an inverted position.

4. Insert special tool in the valve body assembly, opposite the seal end and gently tap the bearing and seal out of the housing as shown in Fig. 22. Discard the seal. Caution must be exercised when inserting and removing the tool to prevent damage to the valve bore in the housing.

5. Remove the oil inlet and outlet tube seats with an EZ-out if they are damaged.

6. Coat the oil inlet and outlet tube seats with vaseline and position them in the housing. Install and tighten the tube nuts to press the seats to the proper location.

7. Coat the bearing and seal surface of the housing with a film of vaseline.

8. Position the bearing in the valve housing. Seat the bearing in the housing with the tool shown in Fig. 23.

9. Dip the new oil seal in gear lubricant then place it in the housing with the metal side of the seal facing outward. Drive the seal into the housing until the outer edge of seal does not quite clear the snap ring groove (Fig. 24).

10. Place the snap ring in the housing, then drive on the ring with the tool shown in Fig. 24 until the snap ring seats in its groove to properly locate the seal.

11. Place the dust seal in the housing with the dished side (rubber side) facing out. Drive the dust seal into place with the tool shown in Fig. 24. The seal must be located behind the undercut in the input shaft when it is installed.

Worm and Valve.

1. Remove the snap ring from the end of the actuator.

2. Slide the control valve spool (Fig. 19) off the actuator.

3. Install valve spool evenly and slowly with a slight oscillating motion into flanged end of valve housing with valve identification groove between the valve spool lands outward, checking for freedom of valve movement within housing working area. Valve spool should enter housing bore freely and fall by its own weight.

4. If valve spool is not free, check for burrs at the outward edges of the working lands in the housing and remove with a hard stone.

5. Check valve for burrs and if burrs are found, stone valve in a **radial direction only.** Check for freedom of valve again.

6. Remove valve spool from housing.

7. Slide the spool onto the actuator making sure that the groove in the spool annulus is toward the worm.

8. Install the snap ring to retain the spool.

9. Check the clearance between the spool and the snap ring. The clearance should be between 0.002-0.005 inch. If the clearance is not within these limits, select a snap ring that will allow a clearance of 0.003 inch.

Piston and Ball Nut.

1. Remove the teflon ring and the O-ring (Fig. 19) from the piston and ball nut.

2. Dip a new O-ring in gear lubricant and install it on the piston and ball nut.

3. Install a new teflon ring on the piston and ball nut being careful not to stretch it any more than necessary.

STEERING GEAR HOUSING DISASSEMBLY

1. Remove the snap ring and the spacer washer (Fig. 25) from the

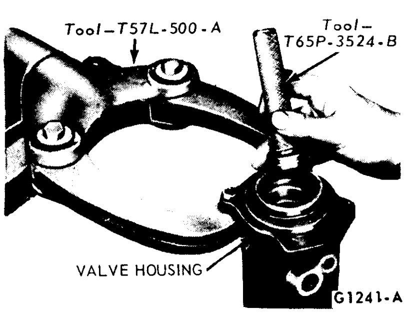

FIG. 22—Removing Bearing and Oil Seal

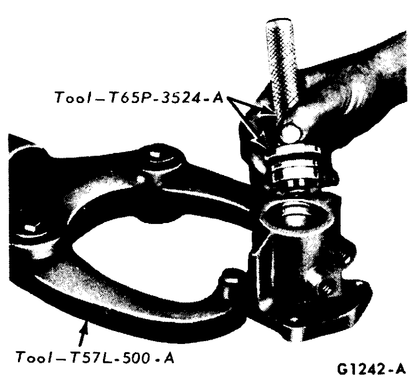

FIG. 23—Installing Valve Housing Bearing

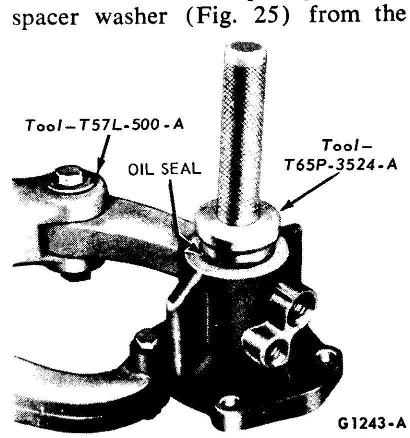

FIG. 24—Installing Oil Seal in Valve Housing

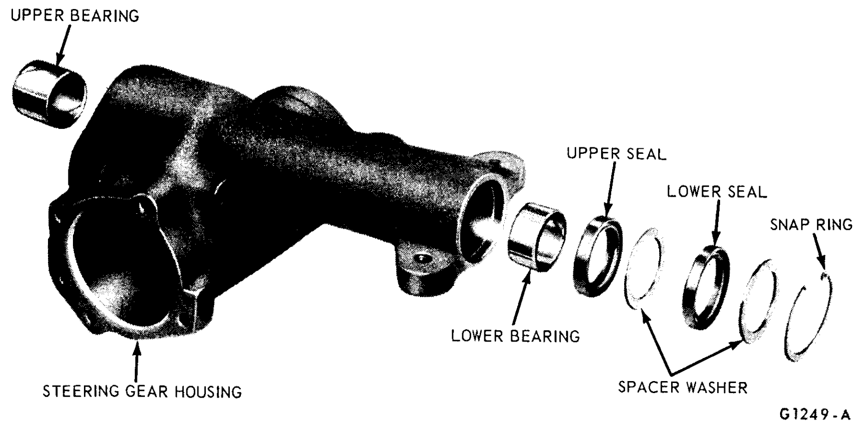

FIG. 25—Steering Gear Housing Disassembled

lower end of the steering gear housing.

2. Remove the outer seal from the housing as shown in Fig. 26. Lift the spacer washer from the housing.

3. Remove the upper seal in the same manner as the lower seal.

4. Place the steering gear housing on blocks in a press as shown in Fig. 27 and press the upper and the lower bushing from the housing if worn or defective. Make sure that the blocks are positioned to clear the tool as it passes through the housing.

5. Press the upper bushing into place with the tools shown in Fig. 28.

6. Press the lower bushing into place with the tools shown in Fig. 29.

7. Dip both sector shaft seals in gear lubricant.

8. Position the sector shaft inner seal (widest seal) into the housing with the lip facing inward. Place a spacer washer (Fig. 25) on top of it. Press the seal into place with the tool shown in Fig. 30.

9. Place the outer seal in the housing with the lip facing inward. Place a spacer washer on top of it and press it into place as shown in Fig. 31.

10. Position the snap ring in the housing. Press the snap ring into the housing with the tool shown in Fig. 30 to properly locate the seals and engage the snap ring in the groove.

ASSEMBLY

1. Mount the valve housing in the holding fixture with the flanged end up.

2. Place the required thickness valve spool centering shim (Fig. 19) in the housing. **Use one shim only.**

3. Carefully install the worm and valve in the housing.

4. Install the retaining nut in the housing and torque it to 55-65 ft. lbs. (Fig. 20).

5. Install the lock nut and tighten it to 20-30 ft. lbs. torque.

6. Place the piston on the bench with the ball guide holes facing up. Insert the worm shaft into the piston so that the first groove is in alignment with the hole nearest to the center of the piston (Fig. 32).

7. Place the ball guide in the piston. Place the 27 balls in the ball

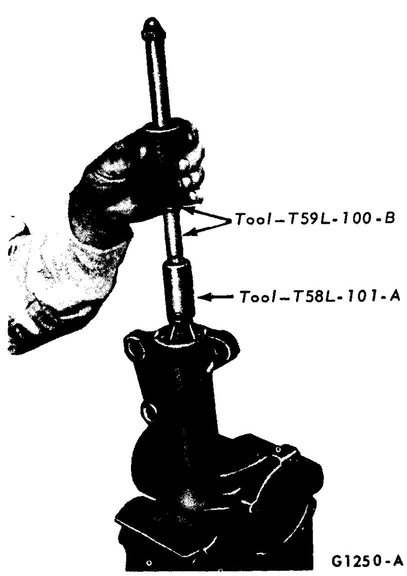

FIG. 26—Removing Outer Seal

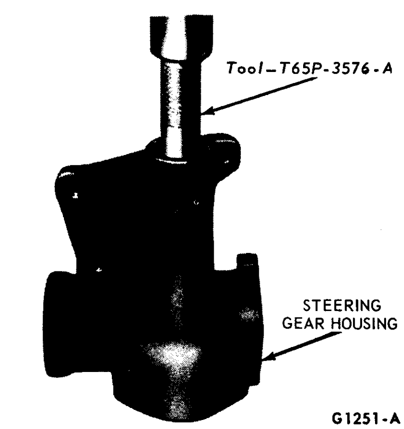

FIG. 27—Removing Steering Gear Housing Upper and Lower Bushings

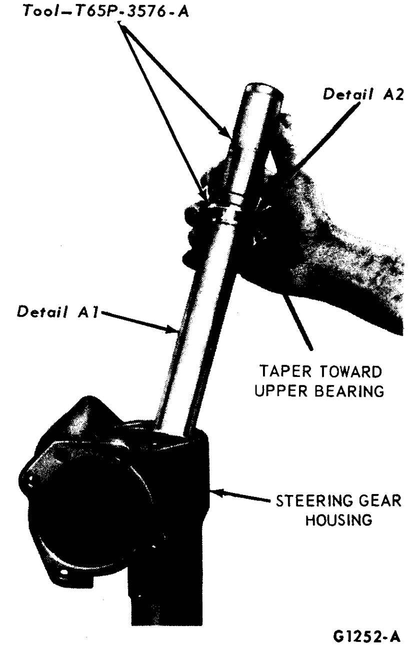

FIG. 28—Installing Upper Bushing In Steering Gear Housing

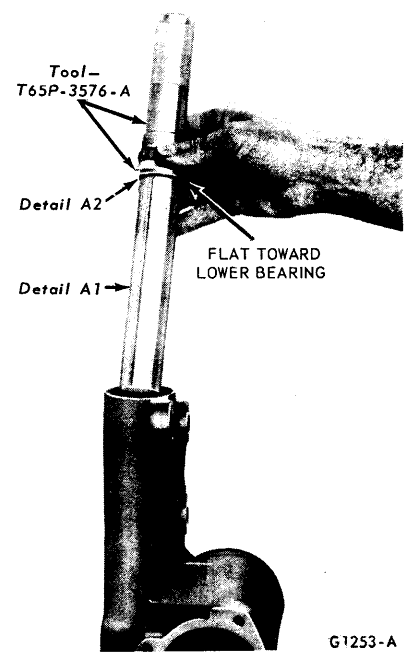

FIG. 29—Installing Lower Bushing In Steering Gear Housing

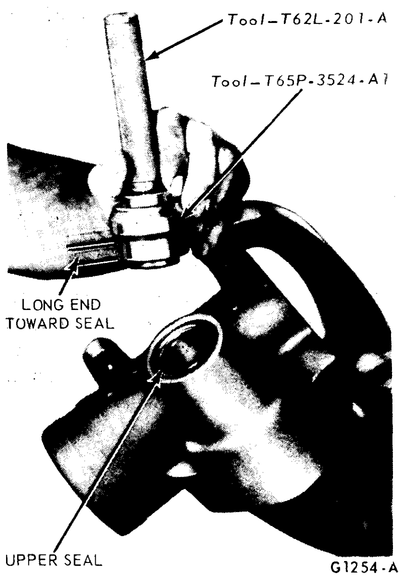

FIG. 30—Installing Sector Shaft Inner Seal

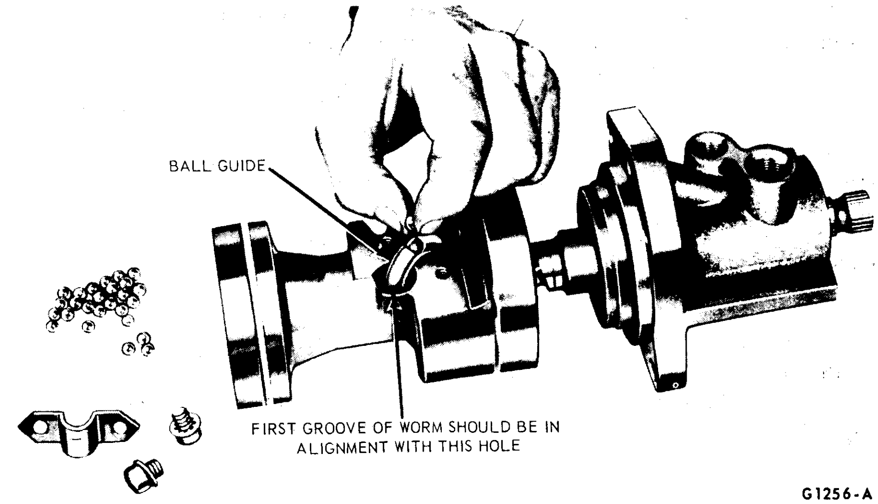

FIG. 32—Assembling Piston on Worm Shaft

guide (Fig. 32) turning the worm in a clockwise direction as viewed from the input end of the shaft. If all of the balls have not been fed into the guide upon reaching the right stop, rotate the input shaft in one direction and then in the other while installing the balls. After the balls have been installed, do not rotate the input shaft or the piston more than 3½ turns off the right stop to prevent the balls from falling out of the circuit.

8. Secure the guides in the ball nut with the clamp (Fig. 19).

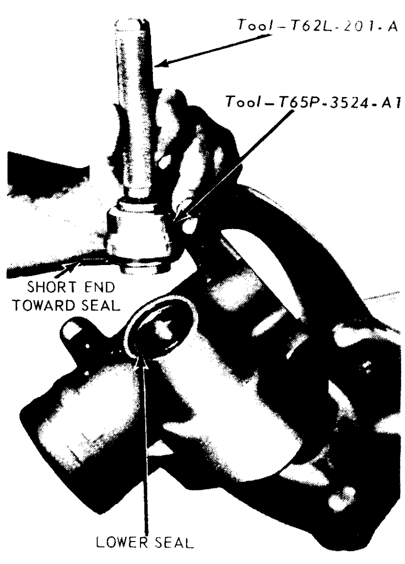

FIG. 31—Installing Sector Shaft Outer Seal

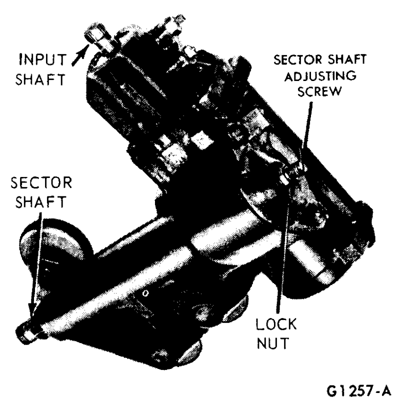

FIG. 33—Adjusting Mesh Load

9. Position a new lube passage O-ring in the counterbore of the gear housing.

10. Apply vaseline to the teflon seal on the piston.

11. Place a new O-ring on the valve housing.

12. Slide the piston and valve into the gear housing being careful not to damage the teflon seal.

13. Align the lube passage in the valve housing with the one in the gear housing, and install but do not tighten the attaching bolts.

14. Rotate the ball nut so that the teeth are in the same plane as the sector teeth. Tighten the four valve housing attaching bolts to specifications.

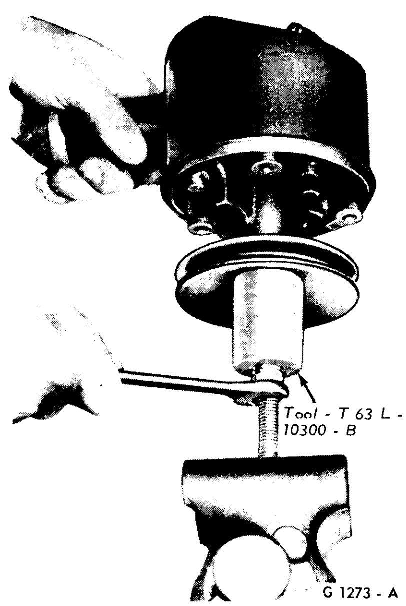

FIG. 34—Removing Power Steering Pump Pulley

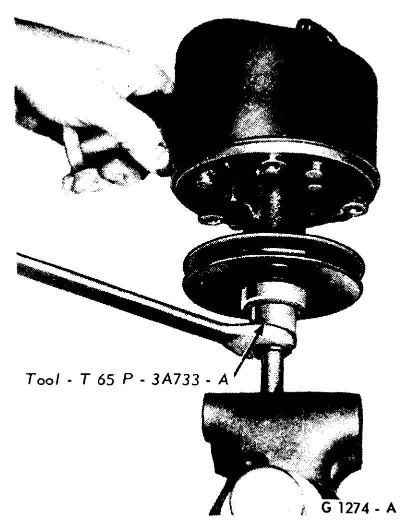

FIG. 35—Installing Power Steering Pump Pulley

15. Position the sector shaft cover O-ring in the steering gear housing. Turn the input shaft as required to center the piston.

16. Position the sector shaft and cover assembly in the gear housing. Install the steering identification tag and the two sector shaft cover attaching bolts. Torque the bolts to specifications.

17. Attach an in-lb torque wrench to the input shaft. Adjust the mesh load to specifications as shown in Fig. 33.

POWER STEERING PUMP PULLEY

REMOVAL

Other than pulley removal, pump should not be disassembled for any repairs but replaced as a unit.

1. Drain as much of the fluid as possible from the pump through filler pipe.

2. Install the pulley remover tool, T63L-10300-B on pulley hub, and place the tool and pump in a vise as shown in Fig. 6.

3. Hold the pump and rotate the tool nut counterclockwise to remove the pulley (Fig. 34). **The pulley must be removed without in and out pressure on the pump shaft to prevent damage to internal thrust areas.**

INSTALLATION

1. Position the pulley to the pump shaft and install Tool T65P-3A733-A as shown in Fig. 35.

2. Hold the pump and rotate the tool nut clockwise to install the pulley on the shaft. The pulley face will be flush with end of pump shaft. **Install the pulley without in and out pressure on the shaft to prevent damage to internal thrust areas.**

3. Remove the tool.

PART 3-4 WHEELS AND TIRES

1 DESCRIPTION AND OPERATION

FRONT WHEEL

Each front wheel and tire assembly is bolted to its respective front hub and rotor assembly. Two opposed tapered roller bearings are installed in each hub. A grease retainer is installed at the inner end of the hub to prevent lubricant from leaking on the rotor. The entire assembly is retained to its spindle by the adjusting nut, nut lock and cotter pin (Fig. 1). The front wheel assemblies rotate freely on their respective spindles and are driven by the motion of the car.

REAR WHEEL

The rear wheel hub and brake drum assembly is retained on studs on the rear axle shaft flange by three speed nuts (Part 3-2, Fig. 2). The wheel and tire assembly mounts on the same rear axle shaft flange studs and is held against the hub and drum by the wheel nuts. The rear wheel bearing is pressed onto the axle shaft just inside the shaft flange, and the entire assembly is retained on the rear axle housing by the bearing retainer plate which is bolted to the housing flange.

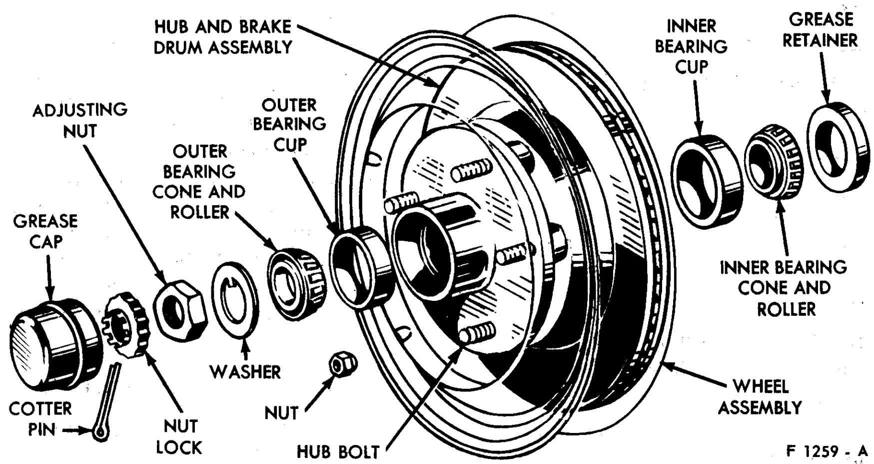

FIG. 1—Front Hub and Rotor, Bearings, and Grease Retainer

2 IN-CAR ADJUSTMENTS AND REPAIRS

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. **Front wheel bearing end play is critical and must be within specification.** The following procedure will bring the end play to specification.

1. Raise the car until the wheel and tire clear the floor.

2. Pry off the wheel cover and remove the grease cap (Fig. 1) from the hub.

3. Wipe the excess grease from the end of the spindle, and remove the adjusting nut cotter pin and nut lock.

4. While rotating the wheel, hub, and rotor assembly, torque the adjusting nut to 17-25 ft-lbs to seat the bearings (Fig. 2).

5. Locate the nut lock on the adjusting nut so that the castellations on the lock are aligned with the cotter pin hole in the spindle.

6. Using a 1⅛-inch box wrench, back off both the adjusting nut and the nut lock together until the next castellation on the nut lock aligns with the cotter pin hole in the spindle.

7. Install a new cotter pin, and bend the ends of the cotter pin around the castellated flange of the nut lock.

8. Check the front wheel rotation.

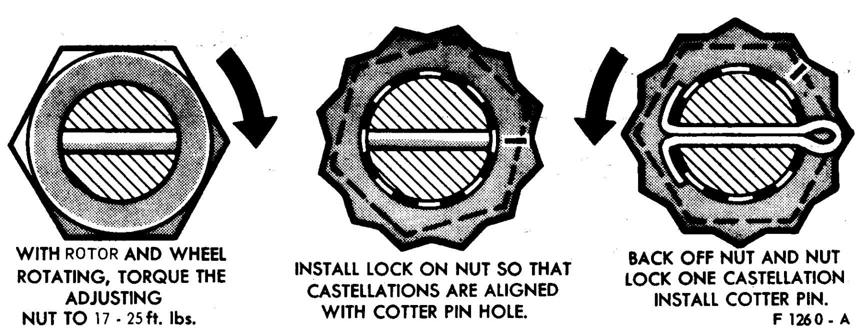

FIG. 2—Front Wheel Bearing Adjustment

If the wheel rotates properly, install the grease cap and the hub cap or wheel cover. If the wheel still rotates roughly or noisily, clean or replace the bearings and cups as required.

3 REMOVAL AND INSTALLATION

Exercise care not to interfere with and damage the caliper splash shield, the bleeder screw fitting or the transfer tube during removal and installation of a wheel and tire assembly.

WHEEL AND TIRE ASSEMBLY

REMOVAL

1. Pry off the wheel hub cap or cover. Loosen but do not remove the wheel hub nuts.
2. Raise the car until the wheel and tire clear the floor.
3. Remove the wheel hub nuts from the bolts, and pull the wheel and tire assembly from the hub and rotor.

REMOVING THE TIRE FROM THE WHEEL

The tire can be demounted on a mounting machine. **Be sure that the outer side of the wheel is positioned downward.** If tire irons are used, follow the procedure given here.

1. Remove the valve cap and core, and deflate the tire completely.
2. With a bead loosening tool, break loose the tire side walls from the wheel (Fig. 3).
3. **Position the outer side of the wheel downward,** and insert two tire irons about 8 inches apart between the tire inner bead and the back side of the wheel rim. **Use only tire irons with rounded edges or irons designed for demounting tubeless tires.**
4. Leave one tire iron in position, and pry the rest of the bead over the rim with the other iron. Take small "bites" with the iron around the tire in order to avoid damaging the sealing surface of the tire bead.
5. Stand the wheel and tire upright with the tire outer bead in the drop center well at the bottom of the wheel. Insert the tire iron between the bead and the edge of the wheel rim, and pry the wheel out of the tire.


F1058-A

FIG. 3—Bead Loosening Tool

MOUNTING TIRE TO WHEEL

1. If a used tire is being installed remove all dirt from the tire.

If a tire is being mounted on the original wheel, clean the rim with emery cloth or fine steel wool. Check the rim for dents.

If a new wheel is being installed, coat a new valve with RUGLYDE lubricant (B6A-19583-A) or similar rubber lubricant and position the valve in the new wheel. Use a rubber hammer or a valve replacing tool to seat the valve firmly against the inside of the rim.

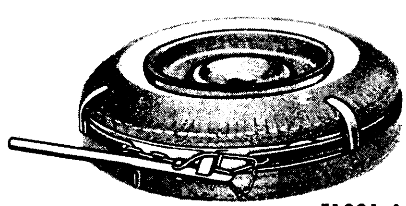
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FIG. 4—Tubeless Tire Mounting Band

2. Apply RUGLYDE or a similar rubber lubricant to the sealing surface on both tire beads. With the outer side of the wheel down, pry the beads over the wheel rim with two tire irons. **Do not use a hammer or mallet to force the beads over the rim.**
3. Align the balance mark on the tire with the valve on the wheel.
4. Hold the beads against the rim flanges by positioning a tire mounting band over the tire (Fig. 4). If a mounting band is not available, tie a tourniquet of heavy cord around the circumference of the tire. Tighten the cord with a tire iron. Center the tire on the wheel with a rubber mallet.
5. Give the tire a few quick bursts of air to seat the beads properly, then inflate the tire to 40 pounds pressure. Check to see that the bead positioning rings (outer rings near the side walls) are evenly visible just above the rim flanges all the way around the tire. If the rings are not even, deflate the tire completely and inflate it again.
6. When the rings are properly positioned, deflate the tire to the recommended pressure.

INSTALLATION

1. Clean all dirt from the hub and drum.
2. Position the wheel and tire assembly on the hub and drum. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and drum.
3. Lower the car to the floor, and torque the hub nuts to specification.
4. Install the hub cap or wheel cover taking care to center the valve stem in the hole provided.

4 MAJOR REPAIR OPERATIONS

FRONT WHEEL GREASE SEAL AND BEARING REPLACEMENT AND/OR REPACKING

If bearing adjustment will not eliminate looseness or rough and noisy operation, the hub and bearings should be cleaned, inspected, and repacked. If the bearing cups or the cone and roller assemblies are worn or damaged, they should be replaced.

1. Raise the car until the wheel and tire clear the floor.
2. Remove the wheel cover or hub cap from the wheel.
3. Remove the wheel and tire from the hub and rotor.

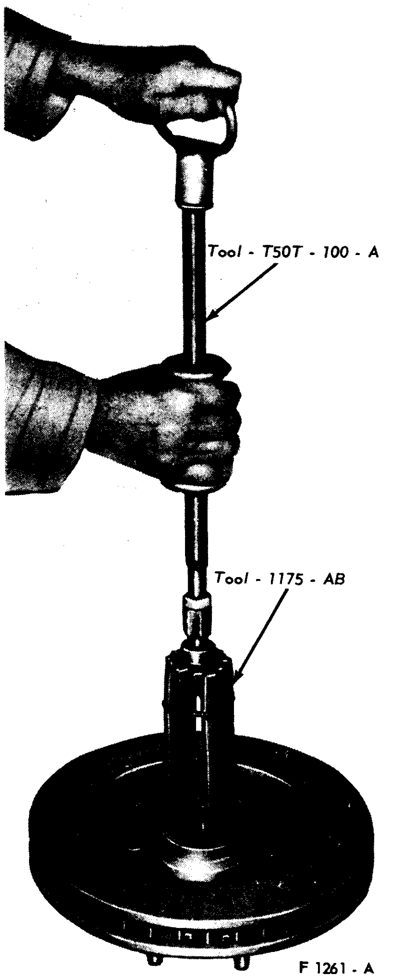


FIG. 5—Removing Grease Retainer

4. Remove 2 bolts and washers retaining the caliper to the spindle. Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose.

5. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone and roller assembly (Fig. 1).

6. Pull the hub and rotor assembly off the wheel spindle.

7. Remove the grease retainer. (Fig. 5) and the inner bearing cone and roller assembly from the hub.

8. Clean the lubricant off the inner and outer bearing cups with solvent and inspect the cups for scratches, pits, excessive wear, and other damage. If the cups are worn or damaged, remove them with a drift.

9. Thoroughly clean the inner and outer bearing cones and rollers with solvent, and dry them thoroughly. Do not spin the bearings dry with compressed air.

Inspect the cones and rollers for wear or damage, and replace them if necessary. The cone and roller assemblies and the bearing cups should be replaced as a set if damage to either is encountered.

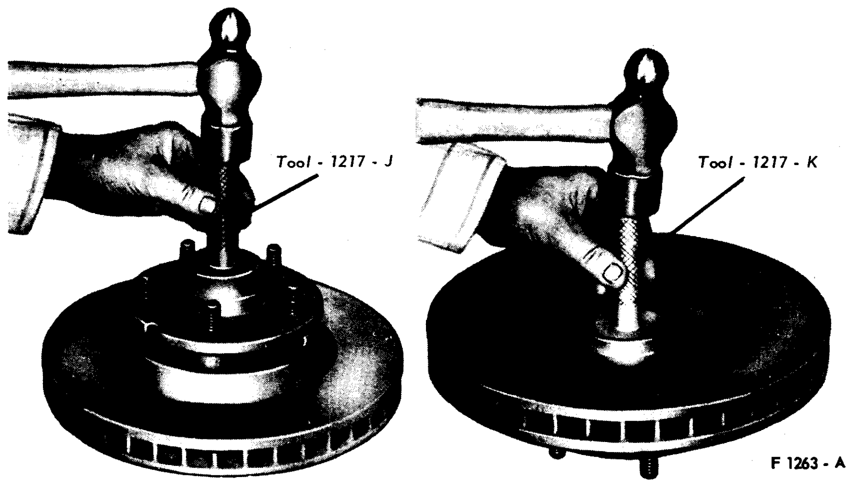


FIG. 6—Installing Front Wheel Bearing Cup

10. Thoroughly clean the spindle and the inside of the hub with solvent to remove all old lubricant.

Cover the spindle with a clean cloth, and brush all loose dust and dirt from the dust shield. **To prevent getting dirt on the spindle carefully remove the cloth from the spindle.**

11. If the inner and/or outer bearing cup(s) were removed, install the replacement cup(s) in the hub with the tools shown in Fig. 6. **Be sure to seat the cups properly in the hub.**

12. Pack the inside of the hub with the specified wheel bearing grease. Add lubricant to the hub only until the grease is flush with the inside diameter of both bearing cups. **All old grease should be completely cleaned from the bearings before repacking with new grease.**

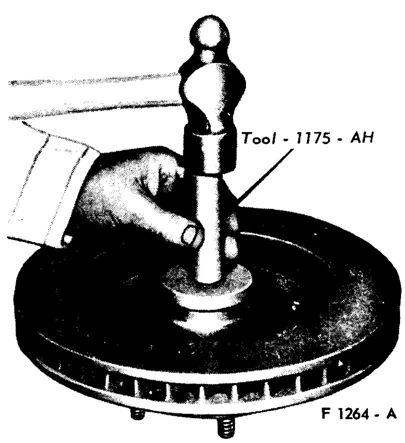


FIG. 7—Installing Grease Retainer

13. Pack the bearing cone and roller assemblies 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.

14. **Place the inner bearing** cone and roller assembly in the inner cup. Apply a light film of grease to the grease retainer and install the new grease retainer with the tool shown in Fig. 7. **Be sure the retainer is properly seated.**

15. Install the hub and rotor assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

16. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut.

17. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.

18. Install the caliper to the spindle and tighten the retaining bolts to specifications. Check for the correct flexible hose routing (Part 2-2).

19. Install the wheel and tire on the hub.

20. Install the wheel cover.

FRONT HUB AND ROTOR ASSEMBLY REPLACEMENT

When the hub and rotor assembly is replaced, new bearings, cups, and grease retainer must be installed in the new assembly.

1. Raise the car until the wheel and tire clear the floor. Pry off the hub cap or wheel cover, and remove the wheel and tire assembly from the hub and rotor assembly.

2. Remove 2 bolts and washers retaining the caliper to the spindle. Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose.

3. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle, then, remove the outer bearing cone and roller assembly (Fig. 1).

4. Pull the hub and rotor off the spindle.

5. Remove the protective coating from the new hub and rotor with carburetor degreaser. Install new inner and outer bearing cups in the new hub with the tool shown in Fig. 6. **Be sure to seat the cups properly in the hub.**

6. Grease and install the inner bearing cone and roller assembly in the inner bearing cup. Apply a light film of grease on the grease retainer and install the grease retainer.

7. Install the new hub and rotor assembly to the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer.**

8. Install the outer bearing cone and roller assembly and the flat washer on the spindle; then, install the adjusting nut.

9. Install the caliper to the spindle and tighten the retaining bolts to specifications. Check for the correct flexible hose routing (Part 2-2).

10. Position the wheel and tire on the new hub and rotor. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and rotor.

11. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.

12. Install the hub cap or wheel cover.

PART 3-5 SPECIFICATIONS

FRONT SUSPENSION

Wheel Alignment	Checking Specifications			Optimum Re-Setting Specifications
	Min.	Max.	Maximum Variation Between Wheels	Desired Alignment
Caster	−1¼°	−3¼°	½°	−1½°
Camber	¾°	+1°	½°	+½°
Toe-In	1/32 inch	9/32 inch	—	5/32 inch
King Pin Angle	—	—	—	7°
Turning Angle of Outside Wheel with Inside Wheel Turned 20°	—	—	—	19½°

BALL JOINTS

	Axial Play (Inches) Max. Allowable	Radial Play (Inches) Max. Allowable
Upper Ball Joint	0.060	0.250
Lower Ball Joint	Replace if Perceptibly Loose	

TREAD WIDTH AND WHEELBASE

Front Tread Width	61 inches
Rear Tread Width	60 inches
Wheelbase	113 inches

REAR LEAF SPRINGS

Body Style	Number of Leaves	Capacity at Normal Load Height	Spring Length at Normal Load	Load	Rate
Hardtop	5	880-920 pounds	60 Inches	1020 ± 23	121 ± 6
Convertible	5	980-1020 pounds	60 Inches	1135 ± 24	134 ± 6

FRONT SUSPENSION—TORQUE LIMITS

Description	Ft — Lbs
Brace-Front—Suspension No. 2 Crossmember to Side Rails	40 — 55
Crossmember—½ x 2.00 Lateral to Siderails	40 — 55
Joint Assy.—Front Suspension Upper Arm Ball Joint to Front Spindle	60 — 80
Joint Assy.—Front Suspension Lower Arm Ball Joint to Front Spindle	60 — 80
Arm & Inner Shaft Assy—Upper Suspension Arm Shaft to Crossmember	50 — 76
Lower Arm Bracket Lower Suspension Arm Pivot Bracket to Crossmember	85 — 115
Arm & Bushing Assy.—Front Suspension Lower Arm To Pivot Bracket	60 — 80
Strut to Body Mounting Bracket	70 — 90
Strut to Lower Arm	120 — 165
Front Shock Absorber to Bracket Assembly	95 — 120
Front Shock Absorber to Spring Tower	20 — 28
Spring Tower Plate to Spring Tower	24 — 34
Bracket Assy.—Front Shock Absorber to Upper Arm	22 — 28
Stud Stabilizer Bar Link to Stabilizer Bar & Lower Arm	5 — 10
Front Stabilizer Bar Frame Mounting Bracket to Frame	11 — 18
Front Splash Shield—to Spindle Flange	10 — 20
Caliper to Spindle	75 — 100

STEERING—TORQUE LIMITS

Description	Ft — Lbs
Steering Pitman Arm Assy. to Rod Assy.—Pitman Arm to Idler Arm	35 — 47
Steering Idler Arm Assy. to Rod Assy.—Pitman Arm to Idler Arm	35 — 47
Steering Spindle Arm Connecting Rod and End Assy. to Rod Assy.—Pitman Arm to Idler Arm	40 — 55
Steering Spindle Arm Connecting Rod and End Assy. to Steering Spindle Arm	40 — 55
Steering Idler Arm Mounting Bracket to Frame Assembly	20 — 30
Steering Spindle Connecting Rod Clamp to Adjusting Sleeve	8 — 13
Steering Idler Arm Bushing Assy. to Idler Arm Mounting Bracket	60 — 80
Steering Wheel to Steering Gear Assembly	25 — 35
Steering Pitman Arm to Sector Shaft Assembly	150 — 200
Steering Gear Assy. to Frame Assy	35 — 50
Power Steering Drive Pulley and Crankshaft Pulley to Crankshaft	35 — 65
Power Steering Drive Pulley to Crankshaft Pulley	20 — 25
Pump Adjusting Bracket to Water Pump Housing	30 — 40
Power Steering Pump Support Bracket to Pump	30 — 40
Power Steering Pump Support Bracket to Cylinder Head	30 — 40
Upper Coupling Flange to Steering Column Shaft (Movable Column)	25 — 35
Lower Coupling Flange to Steering Gear Assy. (Movable Column)	25 — 35
Steering Column Track Assy. to Brake Pedal Support (Movable Column)	22 — 28
Steering Column Pivot Stud (Movable Column)	3 — 6
Insulator to Steering Gear	35 — 50
Track L.H. Stop Screw to Track Inner Brace (Movable Column)	10 — 13
Track Inner to Outer Brace (Movable Column)	10 — 13
Selector Assy. to Track Assy. (Movable Column)	6 — 9
Movable Column Door Pivot Bracket to Body	10 — 13
Track Rear Brace to Track & Floor Bracket	10 — 13
Rear Track Brace Floor Bracket to Floor Pan	34 — 42
Pressure Hose to Steering Gear Assembly	14 — 18
Outlet Tube Assy. to Power Steering Pump Assembly	18 — 25
Outlet Tube Assy. to Pressure Hose	18 — 25
Turn Signal Handle Assy.	15-20 In-Lbs
Track Outer Brace to Instrument Panel Support (Movable Column)	10 — 13

REAR SUSPENSION—TORQUE LIMITS

Description	Ft — Lbs
Rear Spring Rear Shackle Hanger to Underbody	14 — 26
Rear Spring Rear Shackle Assy. to Rear Spring Assy.	34 — 59
Rear Spring Shackle Assy. to Hanger	34 — 59
Rear Spring Assy. to Rear Axle	45 — 65
Rear Shock Absorber to Upper Mounting Bracket	15 — 25
Rear Shock Absorber Upper Mounting Bracket to Underbody	20 — 28
Rear Shock Absorber Assy. to Lower Attaching Stud	30 — 40
Rear Shock Absorber Attaching Stud to Rear Axle Spring Seat	120 — 156
Rear Axle Bumper Bracket to Underbody	20 — 28
Rear Spring Front Eye Stud & Washer Assy. to Rear Spring Front Hanger Bracket	86 — 110
Rear Spring Center Bolt	15 — 30
Rear Spring Front Hanger to Underbody	70 — 100

STEERING

Steering Gear Type	Recirculating Ball-Torsion Bar
Gear Ratio	17.0:1
Turns of wheel for full left to right turn (within gear)	3.6
Torsion Bar Diameter	0.188 inch
Hydraulic Fluid	CIAZ-19582-A
Hydraulic Fluid Capacity	1.6 pints (Approx.)
Phosphorescent dye additive (for leak detection)	4 oz. per quart of fluid

Adjustment Gear	Specification
Sector shaft mesh load—total over mechanical center position must be 9-13 lbs. in. greater than the off center torque of 2 to 7 lbs. in.	17 in lbs max.
Worm bearing preload—with the input shaft in place and 45° off of the left stop, check input torque through an approx. ⅛ turn from the 45° position	2-7 in lbs
Clearance between valve spool and retaining ring	0.002-0.005 in. Preferably 0.003″
Pressure variation between right and left turns (at 250 lbs. pressure) Steering gear in car—check efforts each side of center	4 in lbs max variation
Steering gear out of car—check efforts at right & left stops	4 in lbs max variation
Clearance between inner sector seal and housing	0.025 inch

WHEELS AND TIRES

Tire Size and Ply Rating		8.15 x 15
Inflation Pressure (psi)	Front	24
	Rear	24

GEAR TORQUE LIMITS

Description	Ft Lbs	In Lbs
Gear Cover to Gear Housing	50-60	
Valve Housing to Gear Housing	35-45	
Race Retaining Inner Nut	55-65	
Race Lock Nut	20-30	
Piston End Cap	50-75	
Guide Clamp Retaining Screw and Washer		42-70
Mesh Load Adjusting Screw Lock Nut	25-35	

TORQUE LIMITS

Description	Ft — Lbs
Wheel Assembly to Front Wheel Hub and Rotor Assembly	75 — 110
Front Wheel, Hub & Rotor Assembly to Front Wheel Spindle (Torque with Rotor Turning)	17 — 25
Wheel Assembly to Rear Axle Shaft to Drum Assembly	75 — 110

SERVICE TOOLS

Ford Tool No.	Former No.	Description
T50T-100-A	—	Slide Hammer—Long
T62L-201-A	—	Handle Adapter
TOOL-1175-AB	1175-AE	Seal Remover
TOOL-1175-AH	1175-AH	Seal Replacer
TOOL-1217-J	1217-J	Front Hub Outer Bearing Cup Replacer
TOOL-1217-K	1217-K	Front Hub Inner Bearing Cup Replacer
T65P-3000-B	—	Front Suspension Alignment Spacer
T57P-3006-A	3006-B	Ball Joint Remover Press
TOOL-3290-C	3290-C	Tie Rod Ball Ends and Control Valve Ball Stud Remover
T65P-3524-A	—	Remover and Installer—Input Shaft Bearing and Seals
T65P-3553-A	—	Wrench-Worm Bearing Nut and Locknut
T65P-3576-A	—	Remover-Replacer—Sector Shaft Bushings
T65P-3576-B	—	Replacer—Sector Shaft Seals
TOOL-3590-FCA	3590-FC	Steering Arm Remover
TOOL-3600-AA	3600-AA 3826	Steering Wheel Remover —Bolt On Type
T64B-3C716-A	—	Insulator Remover and Replacer Socket
T65P-3A733-A	—	Pulley Installer
T63P-5310-A	5310-B	Front Coil Spring Compressor
T63L-10300-B	—	Pulley Remover
T56L-33610-D	3500-E	Pressure Testing Gauge Assembly

REAR AXLE

GROUP 4

PART 4-1 GENERAL AXLE SERVICE

1 DIAGNOSIS AND TESTING

DIAGNOSIS GUIDE

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 before adjusting, repairing, or replacing any of the axle parts.

Also, certain trouble symptoms are common to both the conventional and locking differential axles, while still other symptoms are found only in the locking differential.

To determine whether the car is equipped with a conventional or a locking differential, check the car warranty plate and the axle ratio tag. Refer to CAR IDENTIFICATION at the front of this manual.

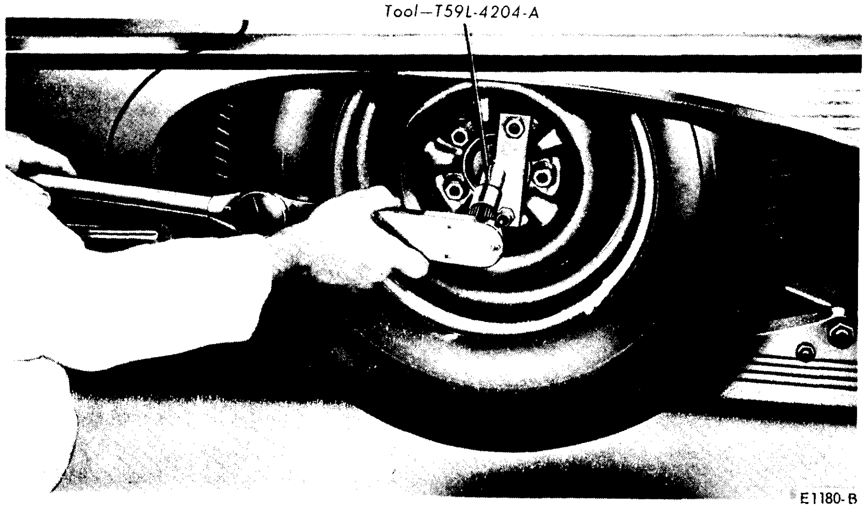


FIG. 1—Typical Locking Differential Check

LOCKING DIFFERENTIAL

The locking differential can be checked for proper operation without removing the carrier from the axle housing.

Jack up one rear wheel and remove the wheel cover. Install tool T59L-4204-A on the axle shaft flange studs as shown in Fig. 1.

Using a torque wrench of at least 200 foot-pounds capacity, rotate the axle shaft. **Be sure that the transmission is in neutral gear, one rear wheel is on the floor and the other rear wheel is raised off the floor.** The torque required to continuously rotate the shaft should be at least 75 foot-pounds. The initial breakaway torque may be higher than the continuous turning torque, but this is normal. The axle shaft should turn with even pressure throughout the check without slipping or binding.

If the torque reading does not exceed 75 foot-pounds, check the differential for improper assembly.

A car equipped with a locking differential will always have both wheels driving. If, while the car is being serviced, only one wheel is raised off the floor and the rear axle is driven by the engine, the wheel on the floor will drive the car off the stand or jack.

REAR AXLE TROUBLE SYMPTOMS AND POSSIBLE CAUSES

EXCESSIVE REAR AXLE NOISE (ALL REAR AXLES)	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. 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, provided that the car is equipped with a conventional differential. 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. Any noise produced by the sidegears and pinions in the differential case will be most pronounced on turns. A continuous whine under a light load between 20 and 35 miles per hour indicates rough or brinnelled pinion bearings. If the tone of drive, coast and float noise differs with speed and if the noise is very rough and irregular; worn, rough or loose differential or pinion shaft bearings are indicated. Remove, disassemble, and inspect the axle.
EXCESSIVE REAR AXLE BACKLASH (ALL REAR AXLES)	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 ring gear, excessive backlash in the differential gears, or bearings which are worn or out of adjustment.
ONE WHEEL SPINS EXCESSIVELY (LOCKING DIFFERENTIAL ONLY)	Use the procedure given under "Locking Differential" for checking the locking differential while the carrier assembly is in the car. If the torque required to rotate one rear wheel is less than 75 foot-pounds, the differential is not functioning properly. To repair the unit, the carrier assembly must be removed from the axle housing.
AXLE HAS A HIGH-PITCHED, CHATTERING NOISE ON TURNS (LOCKING DIFFERENTIAL ONLY)	Drive the car in a fairly tight circle, making five circles clockwise and five counterclockwise. This will permit the lubricant to work in between the clutch plates. If the noise does not disappear during the drive test, it is probable that the axle does not have the approved Ford lubricant. The lubricant may be checked by draining two tablespoonfuls from the axle and mixing it with an equal amount of white alcohol, such as rubbing alcohol. Mix the lubricant and alcohol thoroughly and let it stand for at least two minutes. If the sample now has a blue tint, the lubricant is approved Ford lubricant. If it has a yellow tint, it is not the correct lubricant. Drain and refill the axle with the approved lubricant. It is not necessary to flush the axle housing. After refilling the axle, drive the car in fairly tight circles clockwise and counterclockwise. The chattering noise should disappear as soon as the new lubricant works in between the clutch plates.

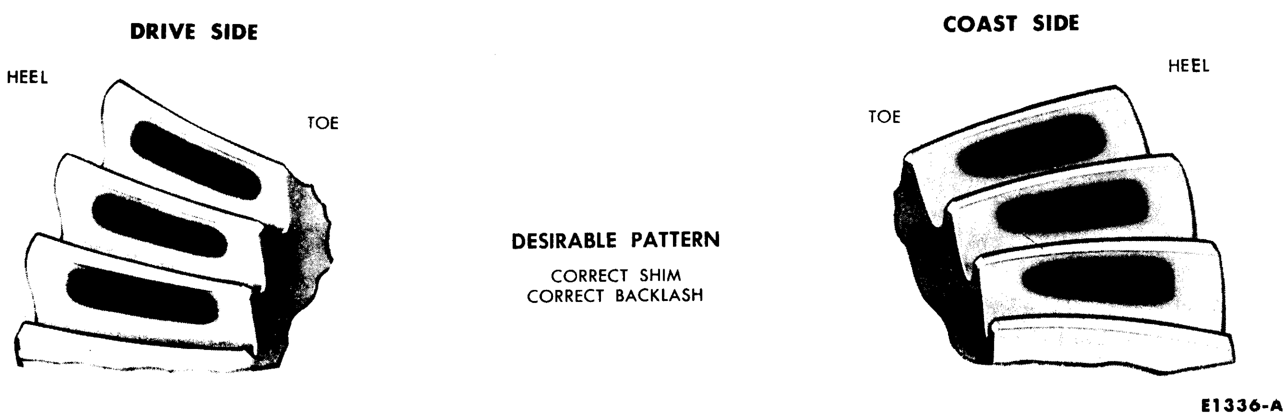


FIG. 2—The Ideal Tooth Pattern

GEAR TOOTH CONTACT PATTERN CHECK

Paint the gear teeth and roll a pattern as described under "Inspection Before Disassembly of Carrier" in Section 3. After diagnosing the tooth pattern as explained here, make the appropriate adjustments as outlined in Section 2.

In making a final gear tooth contact pattern check, it is necessary to recognize the fact that there are three different types of gear sets: hunting, non-hunting, and partial non-hunting. Each type is determined by the ratio and the number of teeth in the gears. Two ratios are available on the Thunderbird: 3.00:1 which is of the non-hunting type; and 3.50:1 which is of the partial non-hunting type. Both of these types can be identified by the paint "timing" marks on the pinion and ring gear teeth (Part 4-2, Fig. 35).

THE IDEAL TOOTH PATTERN

Fig. 2 shows the ideal tooth pattern. **This pattern is not a rigid standard but merely a general norm.**

In general, desirable tooth patterns should have the following characteristics:

1. The drive pattern should be fairly well centered on the tooth.

2. The coast pattern should be centered on the tooth but may be slightly toward the toe.

3. Some clearance between the pattern and the top of the tooth is desirable.

4. There should be no hard lines where the pressure is high.

The individual gear set need not conform exactly to the "ideal" pattern in order to be acceptable.

HUNTING GEAR SET

In a hunting-type gear set, any one pinion gear tooth comes into contact with all drive gear teeth. In this type, several revolutions of the drive gear are required to make all possible gear combinations.

Acceptable Pattern. The drive pattern shown in Fig. 3 was rolled on a hunting-type gear set. Since each pinion tooth came into contact with each drive gear tooth, the pattern is a result of the **combined** tooth contacts. Therefore, the pattern is uniform from tooth to tooth.

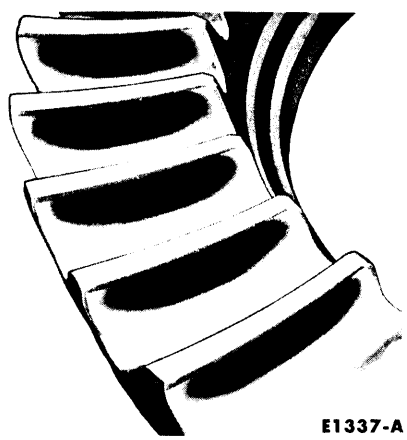


FIG. 3—Acceptable Hunting Gear Pattern

Unacceptable Pattern. An erratic tooth pattern on a hunting gear set indicates gear runout and possible need for gear replacement.

A pattern that is uniform, but off center indicates a change in shim or backlash (Fig. 8).

NON-HUNTING GEAR SET

In a non-hunting type gear set, any one pinion gear tooth comes into contact with only a few drive gear teeth. In this type, only one revolution of the drive gear is required to make all possible tooth contact combinations.

Acceptable Patterns. The drive patterns shown in Figs. 4 and 5 were rolled on two different non-hunting

FIG. 4—Acceptable Non-Hunting Pattern—Center-Toe-Center

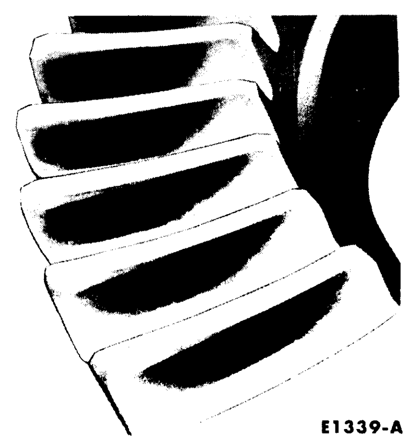


FIG. 5—Acceptable Non-Hunting Pattern—Center-Heel-Center

FIG. 6—Acceptable Non-Hunting Gear Set—Coast Pattern

type gear sets. The pattern in Fig. 4 runs from the tooth center toward the toe and then back to center. The pattern in Fig. 5 runs from the tooth center toward the heel and then back to center. These patterns are not unusual for non-hunting gear sets and are acceptable. The pattern on any one ring gear tooth was formed by only **one** pinion tooth coming into contact with it. Because of this limited tooth contact, the non-hunting pattern can be more erratic than the hunting pattern and still be acceptable. Likewise, the coast pattern on a non-hunting gear set is usually less uniform tooth to tooth than it would be in a hunting gear set (Fig. 6).

Fig. 7 shows a pattern rolled on another gear set. In this case, the pattern is fairly uniform from tooth to tooth.

Unacceptable Patterns. A non-hunting gear set should be checked for runout and possible replacement if the pattern runs from the tooth center toward the toe and back to center on some gear teeth (Fig. 4) while on other teeth of the same gear, the pattern runs from the tooth center toward the heel and back to center (Fig. 5).

A non-hunting gear set requires a change in shimming or backlash when its pattern tends to concentrate toward the heel or toe, top or bottom of **most** teeth (Fig. 8).

PARTIAL NON-HUNTING GEAR SET

In a partial non-hunting type gear set, any one pinion tooth comes into contact with only part of the drive gear teeth, but more than one revolution of the drive gear is required to make all possible gear tooth combinations.

Tooth to tooth pattern uniformity will usually be in between the hunting and the non-hunting patterns. Partial non-hunting gear set patterns will usually be less uniform than hunting gear set patterns, but more uniform than non-hunting gear set patterns.

SHIM AND BACKLASH CHANGES

The patterns shown in Fig. 8 are typical of gear sets that have either an incorrect backlash or an incorrect shim adjustment. Since each gear set rolls a characteristic pattern, the patterns in Fig. 8 should be considered as typical only and should be used as a guide rather than a rigid standard. The drive pattern is rolled on the convex side of the tooth, and the coast pattern is rolled on the concave side.

The movement of tooth contact patterns with changes in backlash and shimming can be summarized as follows:

1. Thicker shim with the backlash constant moves the pinion further from the ring 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. Thinner shim with the backlash constant moves the pinion closer to the ring gear.

a. Drive pattern moves deeper on the tooth (flank contact) and slightly toward the toe.

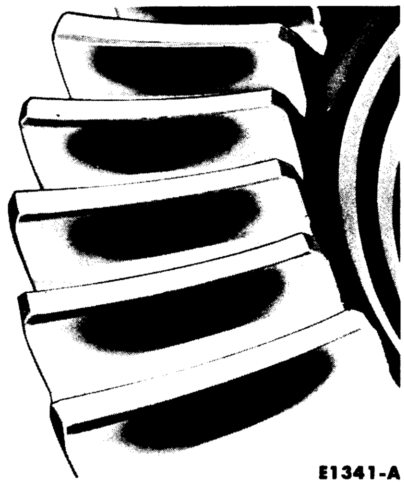


FIG. 7—Acceptable Non-Hunting Pattern—Uniform

b. Coast pattern moves deeper on the tooth and toward the heel.

3. Decreasing backlash moves the ring gear closer to the pinion.

a. Drive pattern moves slightly lower and toward the toe.

b. Coast pattern moves lower and toward the toe.

4. Increasing backlash moves the ring 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. The pinion need not be disassembled to change a shim. All that is required is to remove the pinion, bearing, and retainer assembly, and install a different shim. When reinstalling the pinion and retainer assembly, be sure that the marked tooth on the pinion indexes between the marked teeth on the ring gear (Fig. 35, Part 4-2). Refer to "Pinion and Ring Gear Tooth Contact Adjustment," Section 2.

2 COMMON ADJUSTMENTS AND REPAIRS

PINION AND RING GEAR TOOTH CONTACT ADJUSTMENT

Two separate adjustments affect pinion and ring gear tooth contact. They are pinion location and backlash (Fig. 9).

Individual differences in machining the carrier housing and the gear set require a shim between the pinion retainer and the carrier housing to locate the pinion for correct contact with the ring gear. The original factory installed shim is of the correct thickness for a given original carrier and gear set assembly. In service, shims should be added or removed from the original pack only as indicated by the tooth pattern check. Adding shims moves the pinion away from the ring gear; removing shims moves the pinion

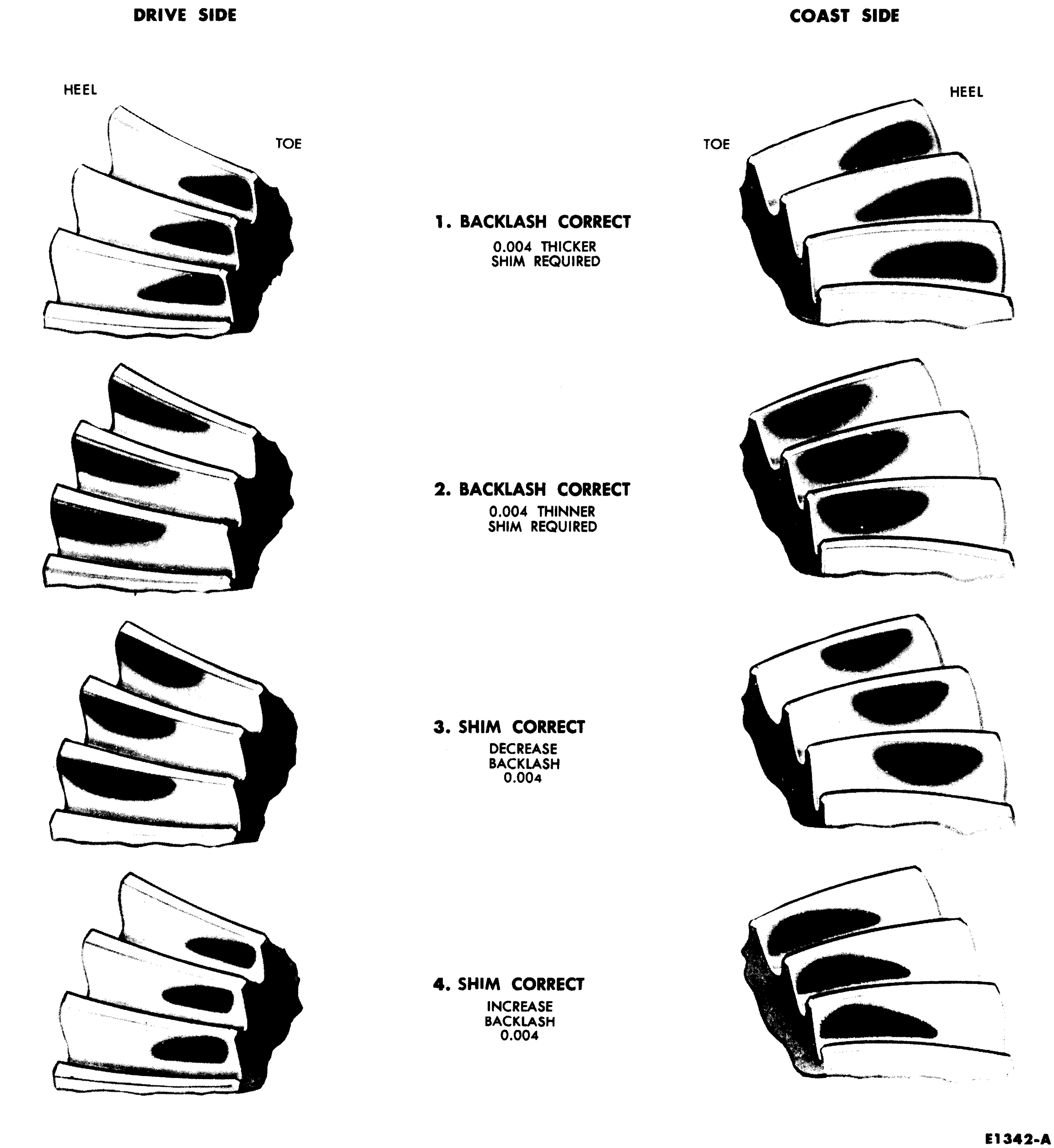


FIG. 8—Typical Gear Tooth Contact Patterns Indicating Shim or Backlash Change

toward the ring gear (Fig. 9).

The tooth pattern check also indicates whether the ring gear should be adjusted away from or toward the pinion to increase or decrease backlash between the gears.

If the tooth pattern check indicates a change in backlash only, follow the procedure under "Backlash Between Ring Gear and Pinion." If the tooth pattern indicates a change in shim thickness follow the procedure under "Pinion Location."

BACKLASH BETWEEN RING GEAR AND PINION

1. Remove the adjusting nut locks, loosen the differential bearing cap bolts. Then torque the bolts to 25 ft-lbs.

2. **The left adjusting nut is on the ring gear side of the carrier. The right nut is on the pinion side.** Loosen the right nut until it is away from the cup. Tighten the left nut until the ring gear is just forced into

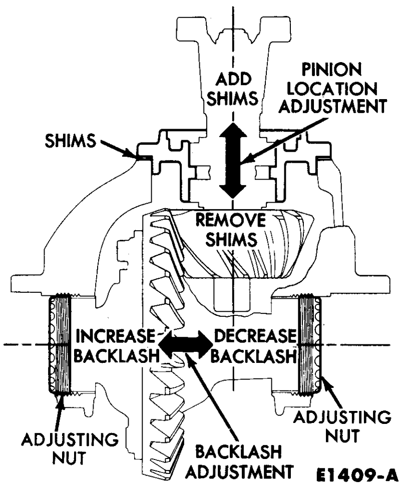


FIG. 9—Pinion and Ring Gear Tooth Contact Adjustment

the pinion with no backlash. (Recheck the right nut at this time to be sure that it is still loose.) **Tightening the left nut moves the ring gear into the pinion to decrease backlash, and tightening the right nut moves the ring gear away.**

3. Tighten the right nut two notches beyond the position where it first contacts the bearing cup. Rotate the ring gear several revolutions in each direction while the bearings are loaded to seat the bearings in their cups. **This step is important.**

4. Again loosen the right nut to release the preload. If there is any backlash between the gears, tighten the left nut just enough to remove this backlash. Carefully tighten the right nut until it just contacts the cup. Set preload of 2½ to 3 notches tight by the right nut. As preload is applied from the right side, the ring gear is forced away from the pinion and usually results in the correct backlash.

5. Torque the differential cap bolts to specification.

6. Measure the backlash as shown in Fig. 11. Measure the backlash on several teeth around the drive gear. If the measurements vary more than 0.003 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 nut had to be loosened one notch, loosen the nut two notches, and then tighten it one. This procedure makes it certain that the nut is contacting the bearing cup, and that the cup cannot shift after being put in service.**

7. Again check the tooth contact pattern. If the pattern is still incorrect, a change in pinion location (shim thickness) is indicated.

PINION LOCATION

1. Remove the retaining bolts and the pinion and bearing retainer assembly from the carrier.

2. Measure the original shim thickness with a micrometer. Increase or decrease the shim thickness as indicated by the tooth pattern check described in Section 1.

3. Clean the teeth on both the pinion and ring gear so that the timing marks are visible. Rotate the differential and ring gear assembly in the carrier until the marked teeth on the ring gear are opposite the pinion entry hole.

4. Replace the pinion retainer O-ring (Fig. 23, Part 4-2). Coat the O-ring with axle lubricant before installing. **Do not roll the O-ring into the groove. Snap it into position.**

5. Being careful not to pinch the O-ring, install the pinion and bearing retainer assembly in the carrier with the corrected shim pack. Place the assembly in the carrier so that the marked tooth on the pinion indexes between the marked teeth on the ring gear (Fig. 35, Part 4-2).

In almost every case of improper assembly (gears assembled out of time), the noise level and probability of failure will be higher than they would be with properly assembled gears.

6. Install the retainer - to - carrier mounting bolts and torque to specifications.

7. Adjust the backlash between the ring gear and pinion as outlined in the foregoing procedure.

8. Make a tooth pattern check as outlined in Section 1. If the pattern is still unsatisfactory, repeat this procedure changing the shim thickness each time until a satisfactory tooth pattern is obtained.

3 CLEANING AND INSPECTION

INSPECTION BEFORE DISASSEMBLY OF CARRIER

The differential carrier should be inspected before any parts are removed from it, and it should also be inspected as it is disassembled. These inspections can help to find the cause of the trouble and to determine the corrections needed.

Mount the carrier in the holding fixture shown in Fig. 10. 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 or abnormal wear.

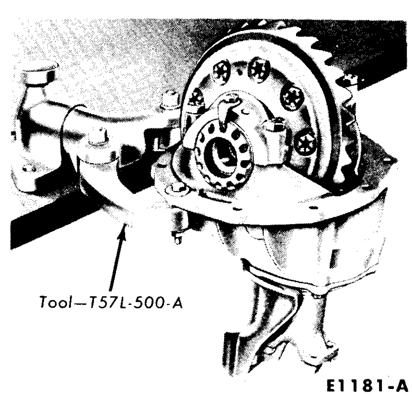


FIG. 10—Bench Fixture for Carrier Overhaul

Set up a dial indicator (Fig. 11) and check the backlash at several points around the ring gear. Backlash should be within specifications.

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. As shown in Fig. 12, wrap a cloth or rope around the drive pinion flange to act as a brake. Rotate the ring gear back and forth (use a

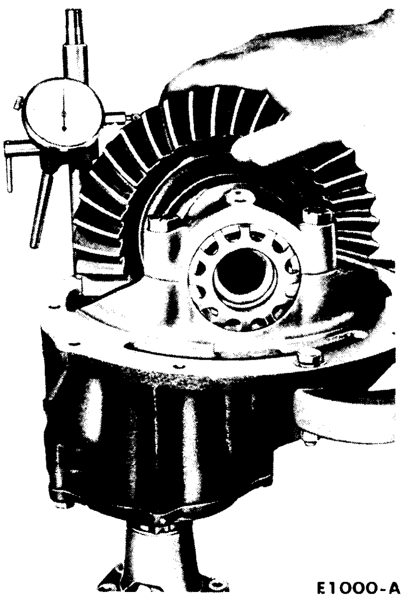


FIG. 11—Backlash Check

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 ring gear indicate incorrect adjustment. Noise caused by incorrect adjustment can often be corrected by readjusting the

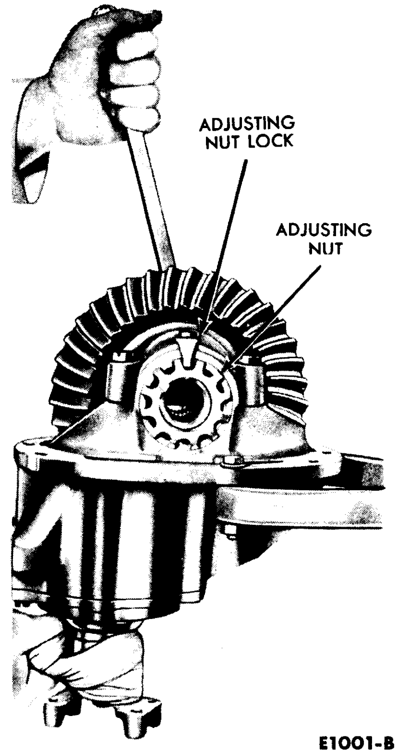


FIG. 12—Gear Tooth Contact Check

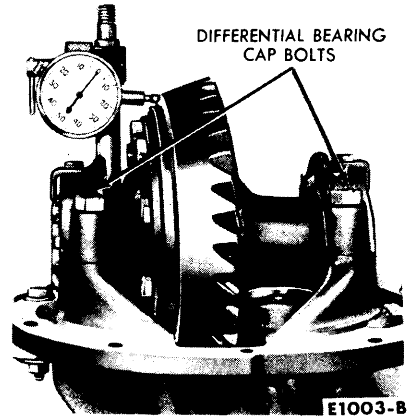


FIG. 13—Ring Gear Runout Check

gears. Typical patterns and the necessary corrections are explained under "Tooth Contact Pattern Check" in Section 1.

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 ring gear, as shown in Fig. 13. If this runout exceeds specifications, disassemble the carrier and replace necessary parts as indicated in Part 4-2, Section 4.

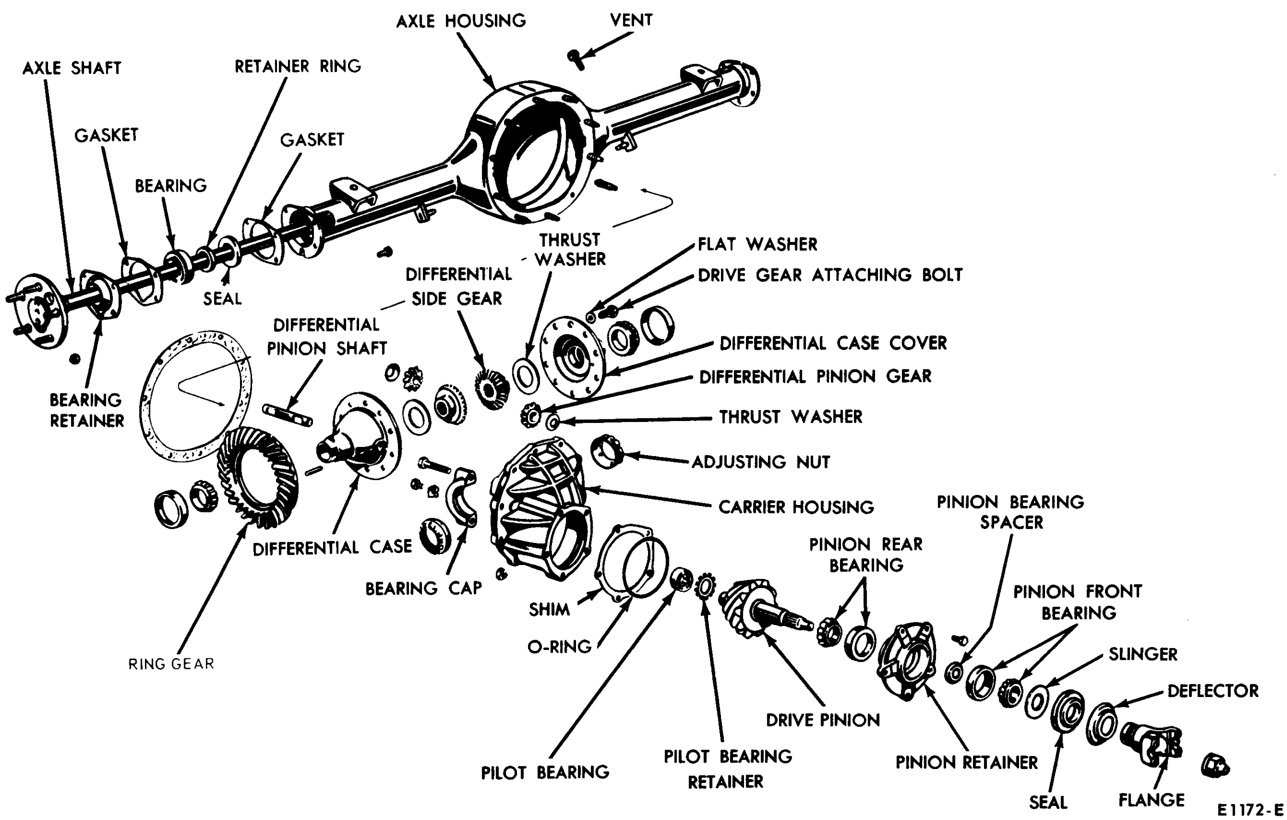


FIG. 14—Rear Axle Disassembled

Loosen the differential bearing cap bolts, and then torque to 25 ft-lbs. Remove the adjusting nut locks. Carefully loosen one of the adjusting nuts to determine if any differential bearing preload remains. If at least one notch of preload remains, the differential bearings may be re-used, provided they are not pitted or damaged.

INSPECTION AFTER DISASSEMBLY

Thoroughly clean all parts (Fig. 14). **Always use clean solvent when cleaning bearings.** Oil the bearings immediately after cleaning to prevent rusting. Inspect the parts for defects. Clean the inside of the carrier before rebuilding it. **When a scored gear set is replaced, the axle housing should be washed thoroughly and steam cleaned.** This can only be done effectively if the axle shafts and shaft seals are removed from the housing. Inspect individual parts as outlined below.

GEARS

Examine the pinion and ring gear teeth for scoring or excessive wear. **Extreme care must be taken not to damage the pilot bearing surface of the pinion.**

The pattern taken during disassembly should be helpful in judging if gears can be re-used. 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 re-used.

Examine the teeth and thrust surfaces of the differential gears. Wear on the hub of the differential 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 AND CONE AND ROLLER ASSEMBLIES

Check bearing cups for rings, scores, galling, or excessively worn wear patterns. Pinion cups must be solidly seated. Check by attempting to insert a 0.0015-inch feeler between these cups and the bottoms of their bores.

When operated in the cups, cone and roller assemblies 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.

If inspection reveals either a defective cup or a defective cone and roller assembly, **both parts** should be replaced to avoid early failure.

DIFFERENTIAL BEARING ADUSTING NUTS

Temporarily install the bearing caps and test the fit of the adjusting nuts in their threads. The nuts should turn easily when the caps are tightened to 25 ft-lbs. The faces of the nuts that contact the bearing cups must be smooth and square. Replace the nuts or examine the threads in the carrier if their fit is not proper. Be sure that the bearing caps and adjusting nuts are on the side they were machined to fit. Observe the punch marks and scribe marks made during disassembly.

U-JOINT 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 axle. The end of the flange that contacts the oil slinger as well as the flat surface of the pinion nut counterbore must be smooth. Polish these surfaces if necessary. Roughness aggravates backlash noises, and causes wear of the slinger and pinion nut with a resultant loss in pinion bearing preload.

PINION RETAINER

Be sure that the pinion bearing cups are seated. Remove any chips or burrs from the mounting flange. Clean the groove for the O-ring seal and all lubricant passages. If the cups are removed, examine the bores carefully. Any nicks or burrs in these bores must be removed to permit proper seating of the cups.

CARRIER HOUSING

Make sure that the differential bearing bores are smooth and the threads are not damaged. Remove any nicks or burrs from the mounting surfaces of the carrier housing.

DIFFERENTIAL CASE

Make sure that the hubs where the bearings mount are smooth. Carefully examine the differential case bearing shoulders, which may have been damaged when the bearings were removed. The bearing assemblies will fail if they do not seat firmly against the shoulders. Check the fit (free rotation) of the differential side gears in their counterbores. Be sure that the mating surfaces of the two parts of the case are smooth and free from nicks or burrs.

LOCKING DIFFERENTIAL PARTS

Inspect the clutch plates for uneven or extreme wear. The dog-eared clutch plates must be free from burrs, nicks, or scratches which could cause excessive or erratic wear to the bonding material of the internally splined clutch plates. The internally splined clutch plates should be inspected for condition of the bond, bonding material, and wear. Replace the bonded plates if their thickness is less than 0.085 inch or if the bonded material is scored or badly worn. Inspect the bonded plate internal teeth for wear. Replace them, if excessive wear is evident.

Examine all thrust surfaces and hubs for wear. Abnormal wear on these surfaces can contribute to a noisy axle. Bonded plates should be replaced as a set only.

Inspect the Belleville spring for proper free height of ¼ inch.

PART 4-2 REAR AXLE

1 DESCRIPTION AND OPERATION

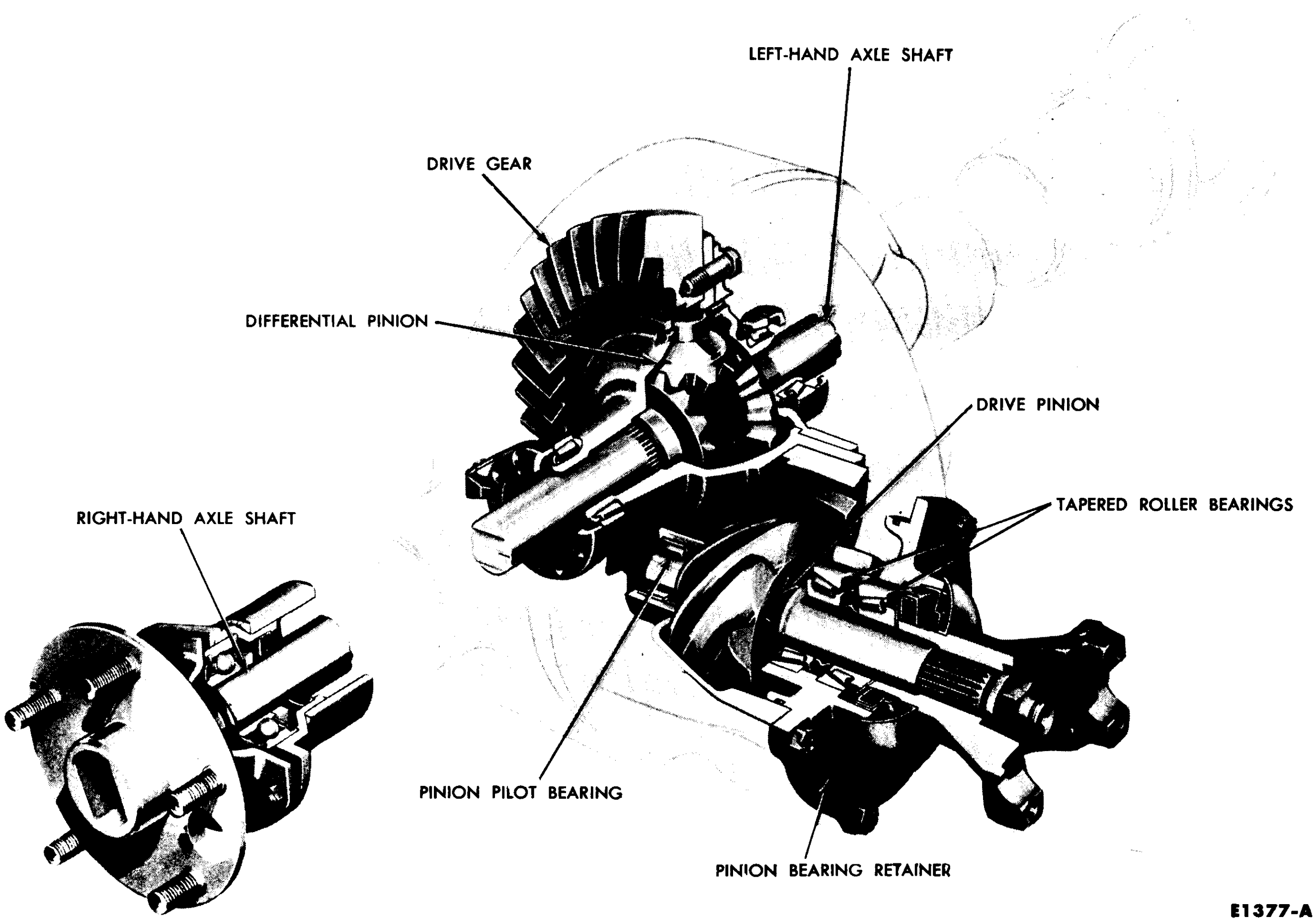


FIG. 1—Rear Axle Assembly

CONVENTIONAL AXLE

DESCRIPTION

The rear axle is of the banjo-housing, hypoid gear removable carrier type, in which the centerline of the pinion is mounted below the centerline of the ring gear (Fig. 1).

The integral pinion gear and shaft and the pinion bearings are assembled in a pinion retainer, which is bolted to the carrier. In this axle, the pinion is straddle mounted; that is, the pinion is supported by bearings both in front of and to the rear of the pinion gear. Two opposed tapered roller bearings support the pinion shaft in front of the pinion gear. A straight roller (pilot) bearing supports the pinion shaft at the rear of the pinion gear. Pinion and ring gear tooth contact is adjusted by shims between the pinion retainer and the carrier housing.

The differential assembly is mounted on two opposed tapered roller bearings, which are retained in the carrier by removable caps. The entire carrier assembly is bolted to the axle housing.

Ball bearing assemblies (rear wheel bearings) are pressed onto the outer ends of the axle shafts and set in the outer ends of the axle housing. These bearings support the semi-floating axle shafts at the outer ends. The inner ends of the shafts spline to the differential side gears. Bearing retainer plates hold the shafts in the housing. The left and right axle shafts are not interchangeable, because the left axle shaft is shorter than the right.

A metal tag stamped with the model designation and gear ratio is secured to the axle under one of the carrier-to-housing bolts. The first five spaces on the top line are reserved for the model designation. On the Thunderbird, for example, the designation WCD-E signifies a conventional axle with a 2-pinion differential, a 9-inch diameter ring gear, a 3:1 ratio, and large size wheel bearings. It is important, therefore, to use the model designation for obtaining the correct replacement parts.

OPERATION

The rear axle drive pinion receives its power from the engine through the transmission and drive shaft. The pinion gear rotates the differential case through engagement with the ring gear, which is bolted to the case outer flange. Inside the case, two differential pinion gears are mounted on the differential pinion shaft which is pinned to the case. These pinion gears are engaged with the side gears, to which the axle shafts are splined. Therefore, as the differential case turns, it rotates the axle shafts and rear wheels. When it is necessary for one wheel and axle shaft to rotate faster than the other, the faster turning side gear causes the pinions to roll on the slower turning side gear to allow differential action between the two axle shafts.

LOCKING DIFFERENTIAL AXLE

DESCRIPTION

The axle assembly, except for the differential case and its internal components, is identical to the conventional axle.

A constant-friction locking differential, which employs automatic transmission-type clutch plates to control differential action, is available as optional equipment(Fig. 2).

Four dog-eared steel clutch plates are locked into the differential cover. Three bronze, bonded clutch plates are splined to a clutch hub which, in turn, is splined to the left-hand axle shaft. A Belleville spring washer maintains a constant pressure between the steel and bonded clutch plates so that the clutch is always engaged.

OPERATION

The pressure between clutch plates opposes differential action at all times. When the car turns a corner the clutch "slips" allowing normal differential action to take place. Under adverse weather conditions, where one or both wheels may be on a low-traction surface such as snow, ice or mud, the friction between the clutch plates will transfer a portion of the usable torque to the wheel with the most traction. Thus, the wheel that is on ice or snow will not spin, but will have a tendency to operate with the opposite wheel in a combined driving effort.

When performing the following procedures, refer to Part 4-1, Section 3 for cleaning and inspection procedures.

2 IN-CAR ADJUSTMENT AND REPAIR

When performing the following procedures refer to Part 4-1, Section 2, for cleaning and inspection instructions.

REAR AXLE SHAFT, WHEEL BEARING, AND OIL SEAL REPLACEMENT

The rear axle shafts, wheel bearings, and oil seals can be replaced without removing the differential assembly from the axle housing.

1. Remove the wheel and tire from the brake drum.

2. 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. 3). **Install one nut to hold the brake carrier plate in place after the axle shaft is removed.**

4. If the rear wheel bearing is to be replaced, loosen the inner retainer by nicking it deeply with a cold chisel in several places. It will then slide off easily.

5. Remove the bearing from the axle shaft with the tool shown in Fig. 4.

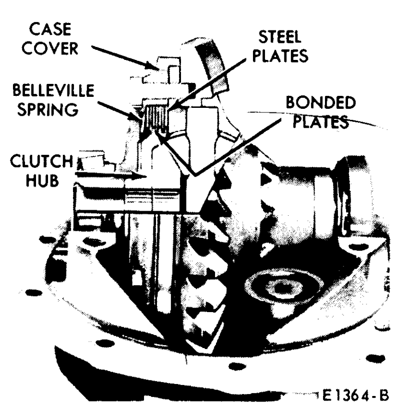


FIG. 2—Locking Differential

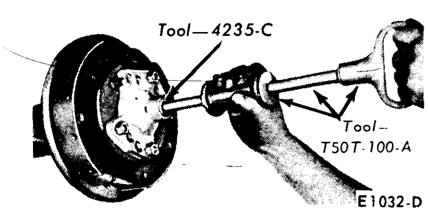


FIG. 3—Axle Shaft Removal

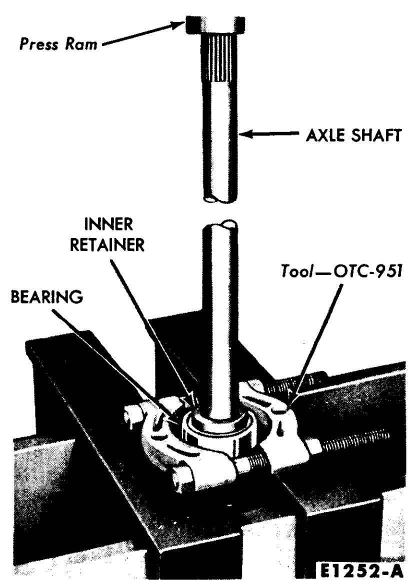


FIG. 4—Wheel Bearing Removal

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. Lightly coat the wheel bearing bores with ball joint grease.

8. Press a new rear wheel bearing on the axle shaft (Fig. 5). **Be sure that the inner race of the bearing is supported by the tool as the shaft is pressed through the bearing. The bearing should seat firmly against the shoulder on the shaft.**

9. Adjust the same tool to support the bearing inner retainer, and then press the shaft through the retainer until the retainer seats firmly against the bearing.

10. **Whenever a rear axle shaft is removed, the oil seal must be replaced.** Remove the seal with tool 1175AB. Soak new seals in SAE 10 oil for ½ hour before use. Install the new seal with tool 1177 or 4245-B. Wipe a small amount of an oil resistant sealer on the outer edge of the seal before it is installed. **Do not put sealer on the sealing lip.**

11. Remove the retaining nut and brake carrier plate, place a new gasket on each side of the brake carrier plate, and install the carrier plate again. Carefully slide the axle shaft into the housing so that the rough forging of the shaft will not damage the oil seal. Start the axle splines into the side gear, and push the shaft in until the bearing bottoms in the housing.

12. Install the bearing retainer and the nuts that secure it. Torque the nuts to specification.

13. Install the brake drum and the drum retaining nuts.

14. Install the wheel and tire on the drum.

DRIVE PINION OIL SEAL REPLACEMENT

The drive pinion oil seal can be replaced without removing the differential carrier assembly from the axle housing. Soak new seals in SAE 10 oil for ½ hour before use.

1. Make scribe marks on the drive shaft end yoke and the axle U-joint flange to insure proper position of the drive shaft at assembly (Fig. 6). Disconnect the drive shaft from the axle U-joint flange. **Be careful to avoid dropping the loose universal joint bearing cups.** Hold the cups on the spider with tape. Mark the cups so that they will be in their original position in relation to the flange when they are assembled. Remove the drive shaft from the transmission extension housing. Install tool T61L-7657-B in the transmission extension housing to prevent transmission leakage.

2. Make punch marks on the end of the pinion shaft, the pinion shaft nuts, and the U-joint flange inner surface for realignment. While holding the flange with the tool shown in Fig. 7, remove the integral pinion nut and washer.

3. Clean the pinion bearing retainer around the oil seal. Place a drain pan under the seal, or raise the front of the car higher than the rear.

4. Using the tool shown in Fig. 8, remove the U-joint flange.

5. Using the tool shown in Fig. 9, remove the drive pinion oil seal.

6. Clean the oil seal seat.

7. Coat the outer edge of the new seal with a small amount of oil resistant sealer. **Do not put any of the sealer on the sealing lip.** Install the seal in the retainer, using the tool shown in Fig. 32.

8. Align the U-joint flange spline mark with the pinion shaft spline mark and install the flange using the tool shown in Fig. 33.

9. Install the integral retaining nut and washer on the pinion shaft. Tighten the nut until the punch mark on the nut is aligned with the punch marks on the end of the pinion shaft and on the inner surface of the U-joint flange.

10. Tighten the nut an additional ¼ turn beyond the alignment marks. Hold the flange with the tool shown in Fig. 6 while the nut is being tightened.

11. Remove tool T61L-7657-B from the transmission extension housing. Install the front end of the drive shaft on the transmission output shaft.

12. Connect the rear end of the drive shaft to the axle U-joint flange, aligning the scribe marks made on the drive shaft end yoke and the axle U-joint flange (Fig. 6).

13. Check the lubricant level, and add whatever amount of specified lubricant is necessary.

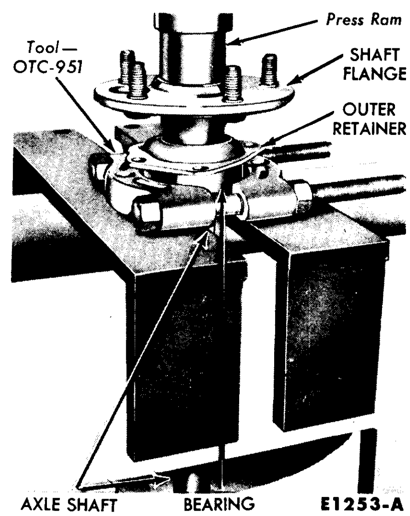


FIG. 5—Wheel Bearing Installation

3 REMOVAL AND INSTALLATION

CARRIER ASSEMBLY

REMOVAL

1. Raise the car on a hoist and remove the two rear wheel and tire assemblies.

2. Remove the two brake drums (3 tinnerman nuts at each drum) from the axle shaft flange studs. If difficulty is experienced in removing the drums, back off the brake shoes as explained in Part 2-2.

3. Working through the hole provided in each axle shaft flange, remove the nuts that secure the rear wheel bearing retainer. Pull each axle shaft assembly out of the axle housing (Fig. 3). Install a nut on one of the brake carrier plate retaining bolts to hold the plate to the axle housing after the shaft has been removed. **Whenever a rear axle shaft is removed the wheel bearing oil seal must be replaced.** Remove both

seals with tool 1175AB.

4. Make scribe marks on he drive shaft end yoke and the axle U-joint flange to insure proper position at assembly. Disconnect the drive shaft at the rear axle U-joint. Hold the cups on the spider with tape. Mark the cups so that they will be in their original position in relation to the flange when they are assembled. Remove the drive shaft from the transmission extension housing, and install tool T61L-7657-B in the housing.

5. Place a drain pan under the carrier and housing, remove the carrier retaining nuts, and drain the axle. Remove the carrier assembly from the axle housing.

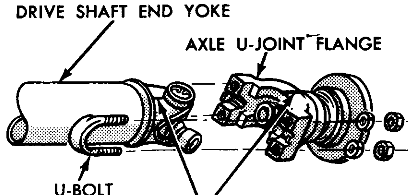


FIG. 6—Drive Shaft-to-Axle U-Joint Connection

INSTALLATION

1. Clean the axle housing and shafts using kerosene and swabs. To avoid contamination of the grease in the sealed ball bearings, do not allow any quantity of solvent directly on the wheel bearings. Clean the mating surfaces of the axle housing and carrier.

2. Position the differential carrier on the studs in the axle housing using a new gasket between carrier and housing. Install the carrier-to-housing retaining nuts, and torque to specifications.

3. Remove tool T61L-7657-B from the transmission extension housing. Position the drive shaft so that the front U-joint slip yoke splines to the transmission output shaft.

4. Connect the drive shaft to the axle U-joint flange, aligning the scribe marks made on the drive shaft end yoke and the axle U-joint flange during the removal procedure (Fig. 6). Install the U-bolts and nuts and torque to specifications.

5. Soak two new rear wheel bearing oil seals in SAE 10 oil for ½ hour before installation. Wipe a small amount of oil-resistant sealer on the outer edge of each seal before it is installed. **Do not put any of the sealer on the sealing lip.** Install the oil seals in the ends of the rear axle housing with tool 1177 or 4245-B.

6. Install the two axle shaft assemblies in the axle housing. The shorter shaft goes into the left side of the housing.

When installing an axle shaft, place a new gasket on each side of the brake carrier plate and carefully slide the axle shaft into the housing so that the rough forging of the shaft will not damage the oil seal. Start the axle splines into the differential side gear, and then push the shaft in until the bearing bottoms in the housing.

7. Install the bearing retainers on the attaching bolts on the axle housing flanges. Install the nuts on the bolts and torque to specifications.

8. Install the two rear brake drums and the drum retaining nuts.

9. Install the rear wheel and tire assemblies.

10. If the rear brake shoes were backed off, adjust the brakes as outlined in Part 2-2.

11. Fill the rear axle with specified lubricant.

AXLE HOUSING

REMOVAL

1. Remove the carrier assembly from the axle housing as outlined in the foregoing procedure.

2. Position safety stands under the rear frame members .

3. Disengage the brake line from the clips that retain the line to the axle housing.

4. Disconnect the vent tube from the rear axle housing.

5. At each rear spring, remove the anti-rattle (coil type) spring that retains the parking brake cable to the spring.

6. Remove the brake carrier plate assemblies from the axle housing, and support them with wire. Do not disconnect the brake line.

7. Disconnect each rear shock absorber from the spring clip plate and position out of the way.

8. Lower the rear axle slightly to reduce some of the spring tension. At each rear spring remove the spring clip (U-bolt) nuts, spring clips, and spring clip plate. Remove the spring lower insulator and retainer. See Part 3-2.

9. Remove the rear axle housing from under the car.

INSTALLATION

1. Install new rear wheel bearing oil seals in the ends of the rear axle housing with tool 1177 or 4245-B. New seals should be soaked in SAE 10 oil for ½ hour before use.

2. Position the rear axle housing on the rear springs. Position the spring upper insulators and retainers between the axle housing and springs with the retainer flange forward.

3. Install the lower insulators and insulator retainers (flange to the rear), and then install the spring clips (U-bolts), spring clip plate, and nuts. **Torque the spring clip nuts evenly to specifications. Make sure that the lower insulator retainer contacts the upper retainer.**

4. If a new axle housing is being installed, remove the bolts that retain the brake carrier plates and bearing retainer from the old housing flanges. Position the bolts in the new housing flanges to hold the brake carrier plates in position. Install the carrier plates with new gaskets to the axle housing flanges.

5. Connect the vent tube to the axle housing.

6. Position the brake line to the axle housing, and secure with the retaining clips.

7. Raise the rear axle housing and springs enough to allow connecting the rear shock absorbers to the spring clip plates. Connect the lower stud of each shock absorber to its 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 specified torque.**

8. Install the brake cable anti-rattle springs.

9. Install the carrier assembly, and the two axle shaft assemblies to the axle housing as outlined in this section.

10. Install the two rear brake drums and the drum retaining nuts.

11. Install the rear wheel and tire assemblies, and adjust the brakes.

4 MAJOR REPAIR OPERATIONS

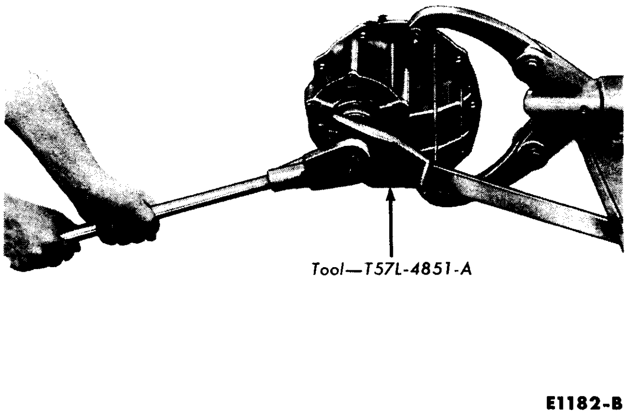


FIG. 7—Pinion Shaft Nut Removal

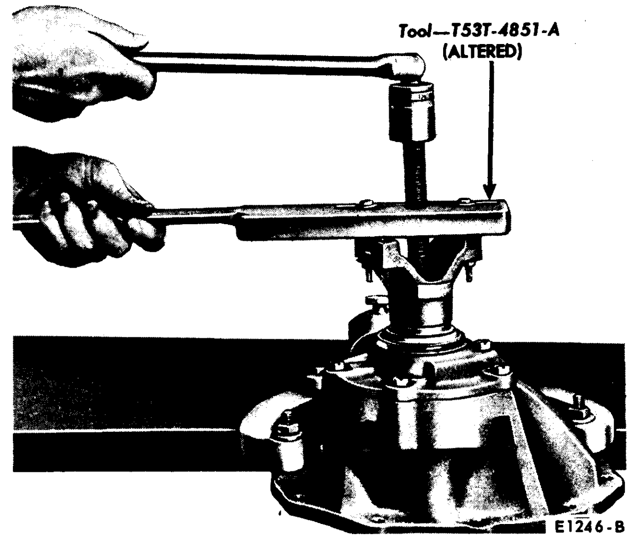


FIG. 8—U-Joint Flange Removal

DISASSEMBLY

Mount the carrier in a holding fixture, and perform the "Inspection Before Disassembly of Carrier" as explained in Part 4-1, Section 2. Then disassemble the carrier as outlined in the following procedures.

REMOVAL OF DIFFERENTIAL CASE AND DRIVE PINION FROM CARRIER

1. Mark the differential bearing cap and the mating bearing support with punch marks to help position the parts properly during assembly of the carrier. Also, mark one of the bearing adjusting nuts and the carrier with scribe marks for proper location during assembly.
2. Remove the adjusting nut locks, bearing caps, and adjusting nuts. Then lift the differential assembly out of the carrier.
3. Turn the carrier housing upright, and remove the pinion shaft nut (Fig. 7). Then remove the U-joint flange (Fig. 8).
4. Remove the seal (Fig. 9) and the slinger.
5. Remove the pinion, bearing and retainer assembly from the carrier housing. Measure the shim thickness with a micrometer. Record this original shim thickness. If a new gear set is installed during assembly, a new shim will have to be installed. The original shim thickness is one of the factors necessary in calculating the new shim thickness. **Extreme care must be taken not to damage the mounting surfaces of the retainer and carrier.**

DISASSEMBLY OF CONVENTIONAL DIFFERENTIAL CASE

1. If the differential bearings are to be removed, use the tool shown in Fig. 10.
2. Remove the bolts that attach the ring gear to the differential case. Press the ring gear from the case or tap it off with a soft-faced hammer.
3. With a drift, drive out the differential pinion shaft lock pin (Fig. 11), and separate the 2-piece differential case.
4. Drive out the pinion shaft (Fig. 25) with a brass drift. Remove the gears and thrust washers.

DISASSEMBLY OF LOCKING DIFFERENTIAL CASE

1. Remove the differential case from the carrier and remove the bearings as shown in Fig. 10.
2. Place the differential case in a hydraulic press, and apply about one ton pressure across the case bearing hubs while removing the ring gear attaching bolts. This procedure will contain the spring pressure between the differential case and cover until after the bolts are moved, and thereby prevent stripping of the threads.
3. Release the hydraulic press ram, and remove the differential case cover.
4. Remove the Belleville spring (Fig. 12).

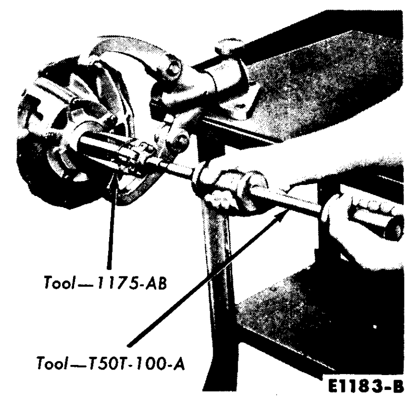


FIG. 9—Pinion Seal Removal

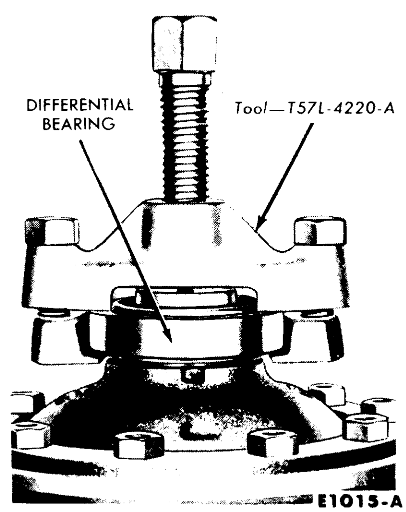


FIG. 10—Differential Bearing Removal

5. Remove the steel and the bonded clutch plates.

6. Remove the differential clutch hub, side gear, and thrust washer.

7. Remove the ring gear from the differential case.

8. Drive out the differential pinion shaft lock pin.

9. With a brass drift, drive out the differential pinion shaft. Then remove the pinion gears, the other side gear, and thrust washers.

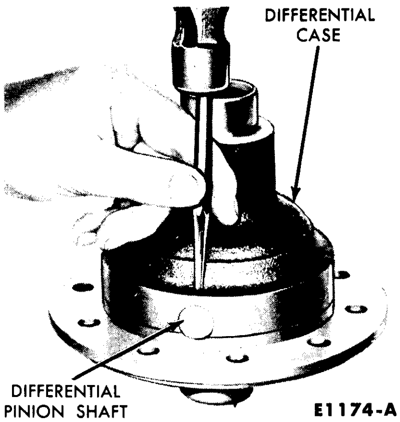


FIG. 11—Differential Pinion Shaft Lock Pin Removal

DISASSEMBLY OF DRIVE PINION AND BEARING RETAINER

1. Place a protective sleeve (hose) on the pinion pilot bearing surface. Press the pinion and rear bearing assembly out of the pinion front bearing cone and retainer (Fig. 13). Separate the front bearing cone from the retainer.

2. Press the pinion out of the rear bearing cone (Fig. 14).

PARTS REPAIR OR REPLACEMENT

Clean and inspect all the parts as outlined in Part 4-1, Section 2. Before assembling the carrier, repair or replace all parts as indicated by the inspection.

The principal replacement operations are covered in the following procedures. All other repair or replacement operations are performed during "Cleaning and Inspection" Part 4-1, Section 3, or during the "Assembly" in this section.

PILOT BEARING

1. Remove the pilot bearing as shown in Fig. 15. Drive out the pilot bearing and the bearing retainer together.

2. Drive the new bearing in until it bottoms (Fig. 16).

3. Using the same tool install a new pilot bearing retainer with the concave side up.

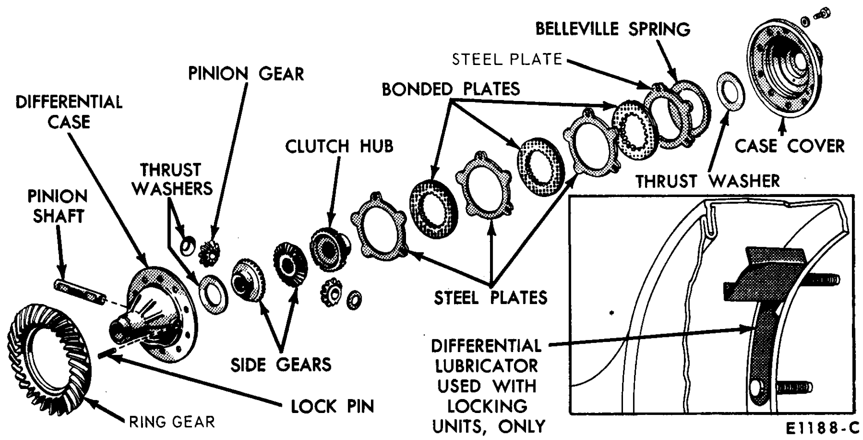


FIG. 12—Locking Differential Assembly

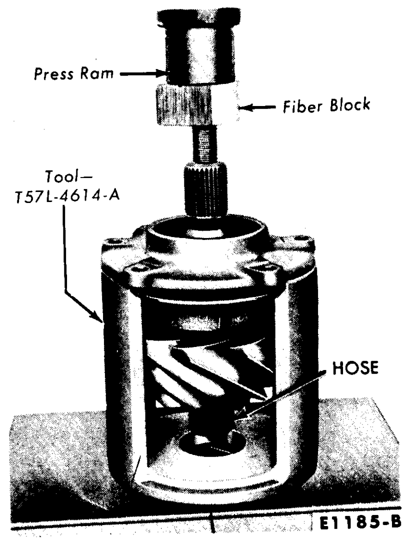


FIG. 13—Pinion Front Bearing Cone Removal

PINION BEARING CUPS

Do not remove the pinion bearing cups from the retainer unless the cups are worn or damaged. The flange and pilot of the retainer are machined during manufacture by locating on these cups after they are installed in their bores. If the cups are worn or damaged, they should be replaced. Remove the old cups as shown in Figs. 17 and 18.

Install the new cups as shown in Figs. 19 and 20.

After the new cups are installed, make sure they are seated in the retainer by trying to insert a 0.0015-inch feeler gauge between the cup and the bottom of the bore. Whenever the cups are replaced, the cone and roller assemblies should also be replaced.

DRIVE PINION AND GEAR SET

When replacing a ring gear and pinion note that the original factory installed shim is of the correct thickness to adjust for individual variations in both the carrier housing 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. Each pinion gear is marked with an adjustment number such as the +1 marking in Fig. 21.

3. Refer to specifications for the correct amount of shim thickness

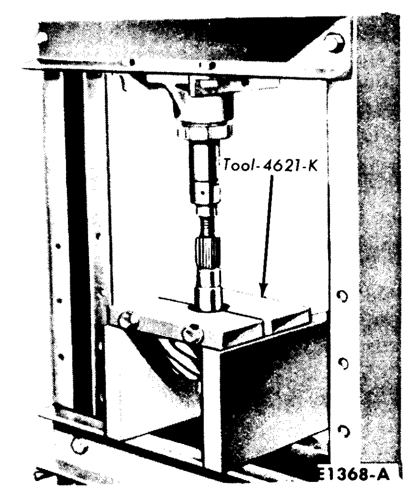


FIG. 14—Pinion Rear Bearing Cone Removal

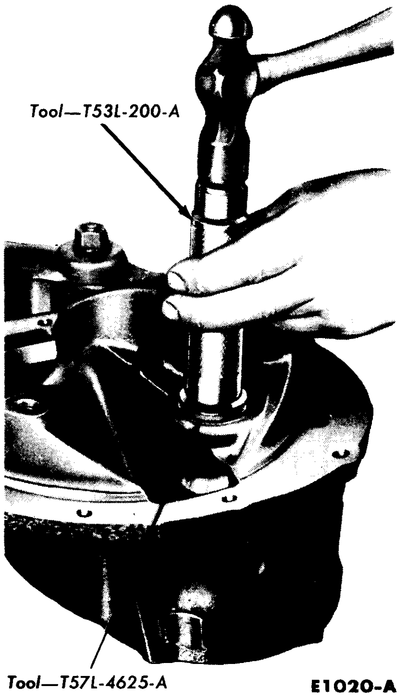


FIG. 15—Pilot Bearing Removal

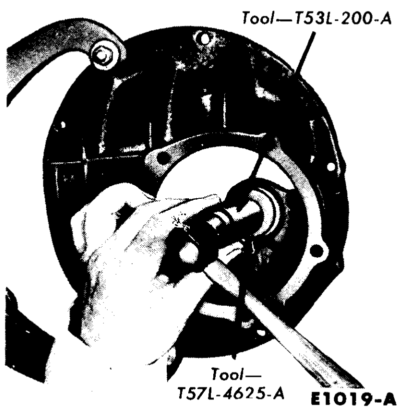


FIG. 16—Pilot Bearing Installation

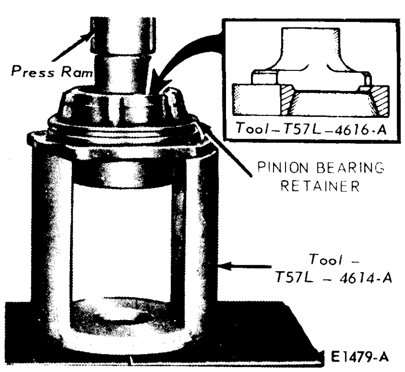


FIG. 17—Pinion Front Bearing Cup Removal

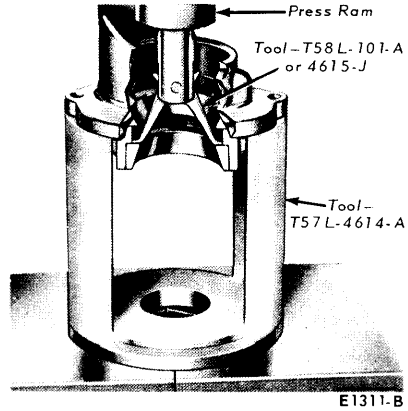


FIG. 18—Pinion Rear Bearing Cup Removal

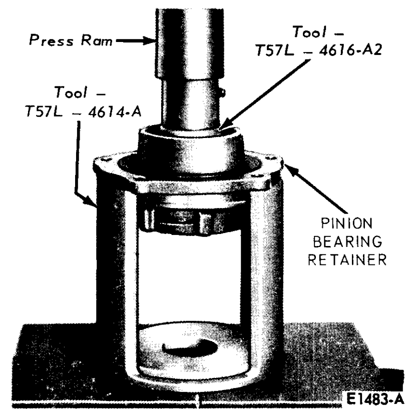


FIG. 19—Pinion Front Bearing Cup Installation

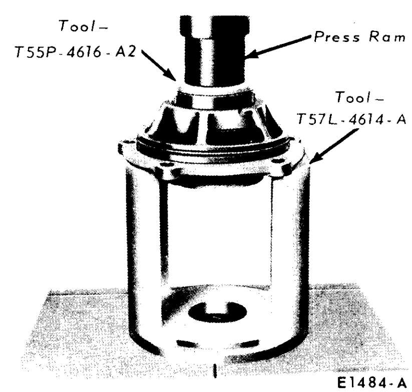


FIG. 20—Pinion Rear Bearing Cup Installation

change. The amount that is shown 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

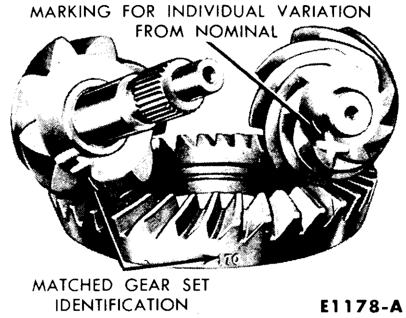


FIG. 21—Pinion and Ring Gear Markings

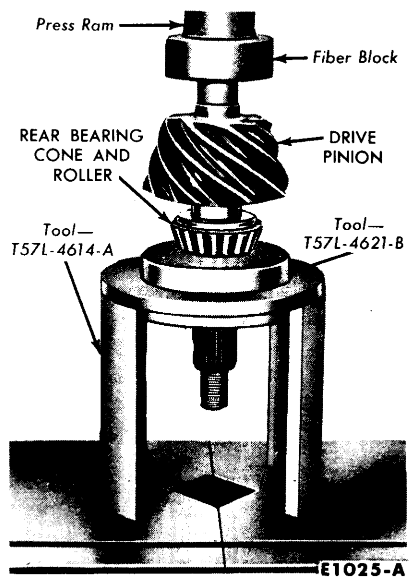


FIG. 22—Pinion Rear Bearing Cone Installation

marked −2, the table indicates that 0.006 inch of shim stock should be removed from the **original** shim pack.

If the **original** shim pack was lost or if a new carrier housing is being installed, substitute a **nominal** 0.020 inch shim for the **original,** and follow the foregoing procedure for a trail build-up. If any further shim change is necessary, it will be indicated in the tooth pattern check.

A new ring 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 ring gear.** Note the number "170" in Fig. 21.

4. After determining the correct shim thickness as explained in the foregoing steps, install the new pinion and ring gear as outlined under "Assembly."

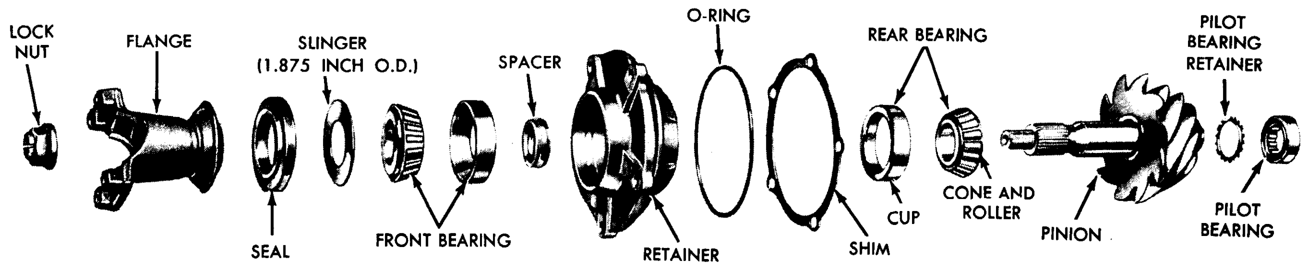


FIG. 23—Pinion and Bearing Retainer

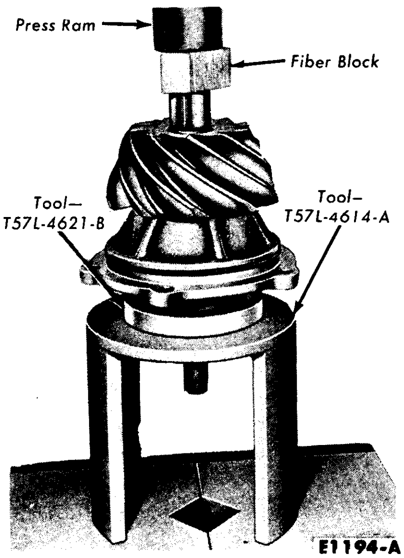


FIG. 24—Pinion Front Bearing Installation

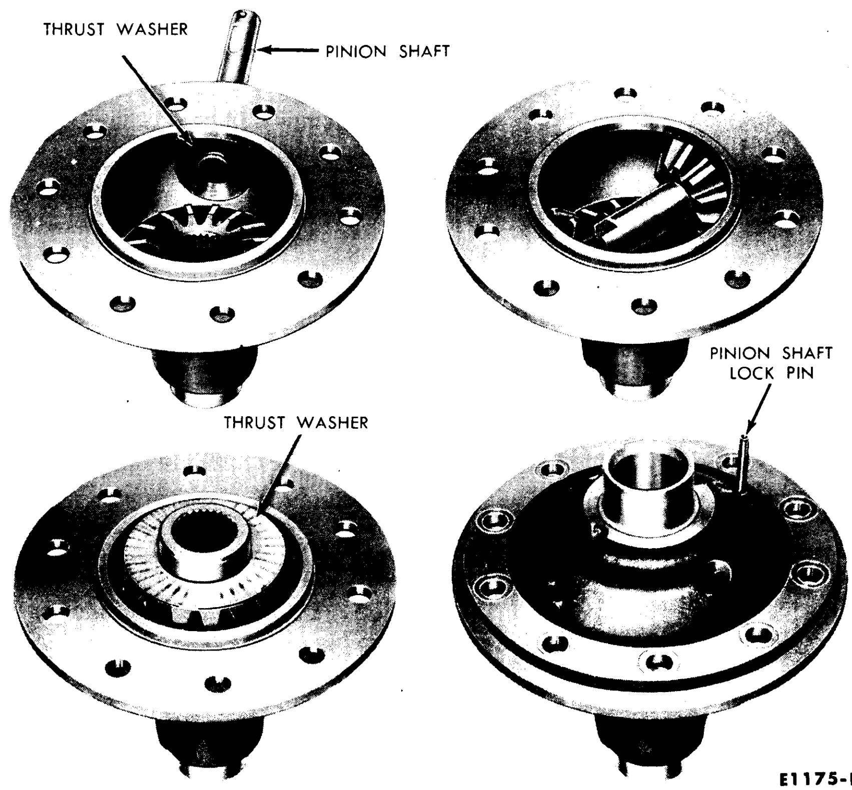


FIG. 25—Assembly of Differential Case

DIFFERENTIAL CASE, BEARINGS AND RING GEAR

If the ring gear runout check before disassembly exceeded specifications, the condition may be caused by a warped gear, a defective case, or by excessively worn differential bearings.

To determine the cause of excessive runout proceed as follows:

1. Assemble the two halves of the differential case together **without** the ring gear, and press the two differential side bearings on the case hubs.

2. Place the cups on the bearings and set the differential case in the carrier.

3. Install the bearing caps and adjusting nuts as outlined in steps 11 thru 14 under "Assembly of Drive Pinion and Differential Case to Carrier" in this section.

4. Tighten the right nut two notches beyond the position where it first contacts the bearing cup. Rotate the differential case several revolutions in each direction while the bearings are loaded to seat the bearings in their cups. **This step is important.**

5. Again loosen the right nut to release the preload. Check to see

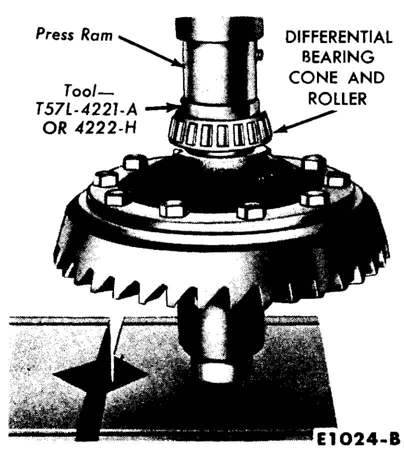


FIG. 26—Differential Bearing Installation

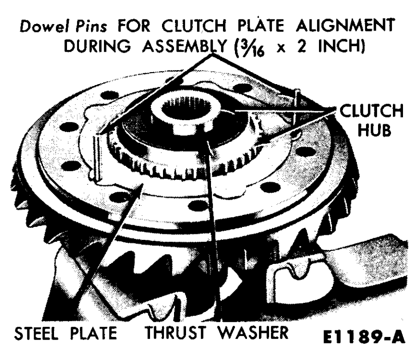


FIG. 27—Clutch Plate Installation

that the left nut contacts the bearing cup, and then set a preload of 2½ to 3 notches tight at the right-hand nut.

6. Check the runout of the differential case flange with a dial indicator. If the runout does **not now** exceed specifications, install a new ring gear. If the runout still exceeds specifications, the ring gear is true and the trouble is due to either a defective case or worn bearings. Continue with steps 7 through 9 which follow.

7. Remove the differential case from the carrier and remove the side bearings from the case.

8. Install **new** bearings on the case hubs, and again install the differential assembly in the carrier **without** the ring gear.

9. Check the case runout again with the new bearings. If the runout is **now** within limits, the old bearings were excessively worn. Use the new bearings for assembly. If the runout is still excessive, the case is defective and should be replaced.

ASSEMBLY

Perform the "Inspection After Disassembly" as explained in Part 4-1, Section 2. Repair or replace parts as indicated by the inspection, and assemble the carrier as outlined in the following procedures.

ASSEMBLY OF DRIVE PINION AND BEARING RETAINER

1. Install the drive pinion rear bearing cone and roller on the pinion shaft (Fig. 22). Place a new spacer on the pinion shaft (Fig. 23).

2. Place the bearing retainer on the pinion shaft, and install the front bearing cone and roller. Press the front bearing cone and roller into position as shown in Fig. 24. Be careful not to crush the bearing spacer.

3. Lubricate the O-ring with axle lubricant and install it in its groove in the pinion retainer. Be careful not to twist it. Snap the O-ring into position.

ASSEMBLY OF CONVENTIONAL DIFFERENTIAL CASE

1. Place a side gear and thrust washer in the differential case bore (Fig. 25). **Lubricate all differential parts liberally with axle lubricant during assembly.**

2. With a soft-face hammer, drive the pinion shaft into the case only far enough to retain a pinion thrust washer and pinion gear.

3. Place second pinion and thrust washer in position, and drive pinion shaft into place. **Carefully line up the pinion shaft lockpin holes.**

4. Place the side gear and thrust washer in position (Fig. 25), and install the cover of the differential case. Install the lockpin. A pinion or axle shaft spline can be inserted in the side gear spline to check for free rotation of the differential gears.

5. Insert two 7/16 (N.F.) bolts two inches long through the differential case flange, and thread them three or four turns into the ring gear as a guide in aligning the ring gear bolt holes. Press or tap the ring gear into position.

6. Install and tighten the ring gear bolts and washers evenly, and torque them alternately across the gear to specification.

7. If the differential bearings have been removed, press them on as shown in Fig. 26.

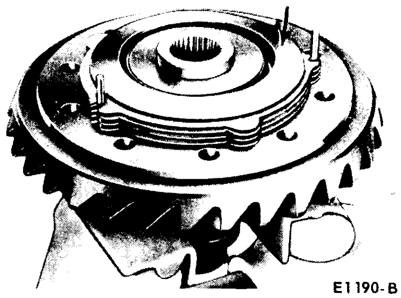


FIG. 28—Belleville Spring Installation

ASSEMBLY OF LOCKING DIFFERENTIAL CASE

1. Place the inner side gear and thrust washer in the differential case (Fig. 12). **Lubricate all parts liberally with axle lubricant during assembly.**

2. With a soft-faced hammer, drive the pinion shaft into the case only far enough to retain a pinion thrust washer and pinion gear.

3. Place the second pinion and thrust washer in position, and drive the pinion shaft into place. **Carefully line up the pinion shaft lock pin holes.**

4. Install the pinion shaft lock pin. **The lock pin must not extend beyond the surface of the case.**

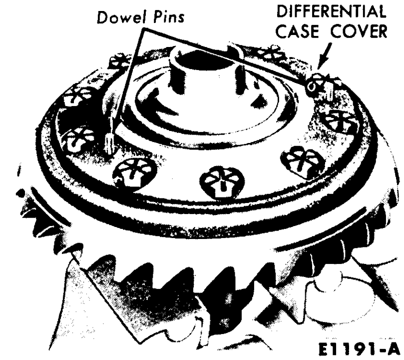


FIG. 29—Differential Cover Installation

5. Insert two 2-inch 7/16 (N.F.) bolts through the differential case flange, and thread them three or four turns into the ring gear as a guide in aligning the ring gear bolt holes. Press or tap the ring gear into position.

6. Clamp the differential case in a soft-jawed vise. Install the differential outer side gear on the differential pinion gears. Place the clutch hub on the side gear. Place the thrust washer on the hub (Fig. 27).

7. To align the clutch plates during assembly, insert two 3/16 x 2-inch dowel pins into the differential case. Place a steel plate on the differential case so that the slots in the locating tabs straddle the dowel pin (Fig. 27). **Lubricate all the locking differential parts with axle lubricant so that an accurate torque check can be made.**

8. Place a bonded plate on the steel plate. Make sure the bonded plate inner spline teeth properly engage the hub spline. Assemble the remaining plates: a steel plate, a bonded plate, a steel plate, a bonded plate, and lastly a steel plate.

9. Place the Belleville spring on the top steel plate. The Belleville spring is assembled with concave side down (Fig. 28). Carefully center the Belleville spring so that it will fit into the cover.

10. Place the differential case cover on the case (Fig. 29). Start the ring gear bolts.

11. Tighten the bolts evenly and alternately across the diameter of the ring gear. As the bolts are tightened the Belleville spring is compressed and the differential case and cover are pulled together.

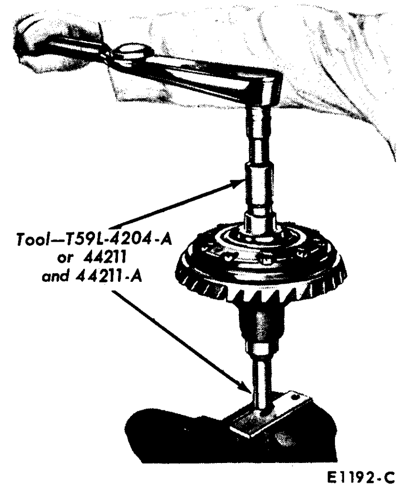


FIG. 30—Differential Torque Check

12. Remove the dowel pins.

13. Torque the case to ring gear bolts to specifications.

14. Check the torque required to rotate one side gear while the other side gear is held (Fig. 30). Ignore the torque required to start the side gear turning. The torque required to keep it moving steadily should be between 155 and 195 ft-lbs, if new clutch plates were installed. The torque should be over 75 ft-lbs, if the original clutch plates were installed. If the required torque is not within these limits, check for improper assembly.

15. Install the side bearings on the differential case as shown in Fig. 26.

ASSEMBLY OF DRIVE PINION AND DIFFERENTIAL CASE TO CARRIER

1. Place the proper shim on the carrier housing and install the pinion and retainer assembly, being careful not to pinch the O-ring (Fig. 31).

2. Install the pinion retainer bolts. Torque the bolts to specification.

3. Place the slinger over the pinion shaft and against the front bearing.

4. Coat the outside edge of a new oil seal with a small amount of oil resistant sealer. **Do not put sealer on the sealing lip.** Install the oil seal in the bearing retainer (Fig. 32). Soak new seals in SAE 10 oil for ½ hour before use.

5. Install the U-joint flange (Fig. 33).

6. Start a new integral nut and washer on the pinion shaft.

7. Hold the flange with the tool shown in Fig. 7, and torque the pinion shaft nut to 175 ft-lbs. **Do not exceed 175 ft-lbs at this time.**

8. Check the pinion bearing preload as shown in Fig. 34. Correct preload will be obtained when the torque required to rotate the pinion in the retainer is as specified in Part 4-3. If the torque required to rotate the pinion is less than specified, tighten the pinion shaft nut a little at a time until the proper preload is established. **Do not overtighten the nut.** If excessive preload is obtained as a result of overtightening, it will be necessary to replace the collapsible bearing spacer.

Do not back off the pinion shaft nut to establish pinion bearing preload. If the torque on the pinion shaft nut is less than 175 ft-lbs after bearing preload is established, a new collapsible spacer must be used.

9. Turn the carrier housing 180° around in the holding fixture and wipe a thin coating of lubricant on the differential bearing bores so that the differential bearing cups will move easily.

10. Place the cups on the differential bearings, and assemble the differential case and drive gear assembly in the carrier so that the marked tooth on the pinion indexes between the marked teeth on the drive gear as shown in Fig. 35.

In almost every case of improper assembly (gears assembled out of time), the noise level and probability of failure will be higher than they would be with properly assembled gears.

11. Slide the assembly along the bores until a slight amount of backlash is felt between the gear teeth.

12. Set the adjusting nuts in the

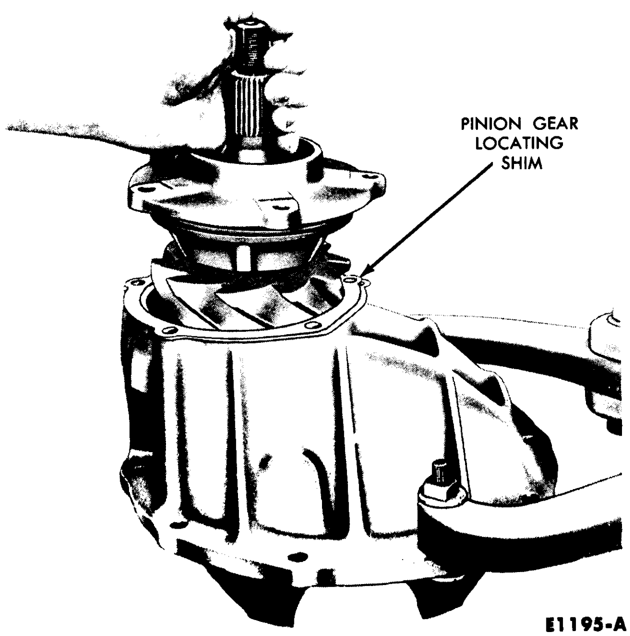


FIG. 31—Pinion and Retainer Installation

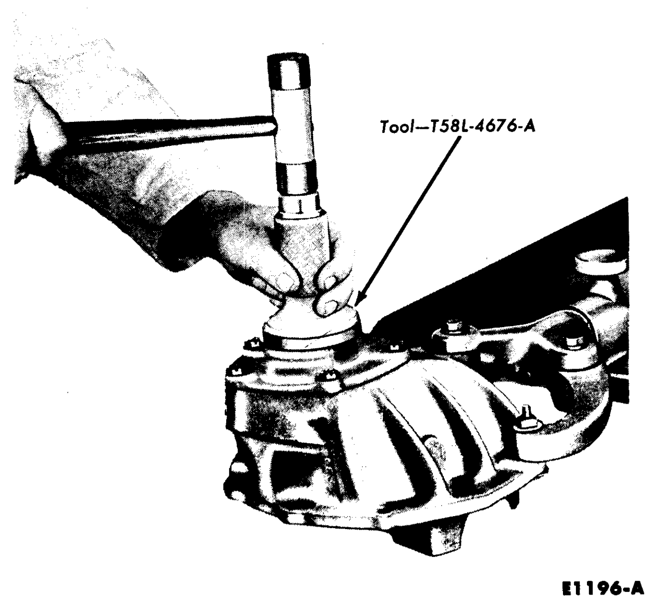


FIG. 32—Oil Seal Installation

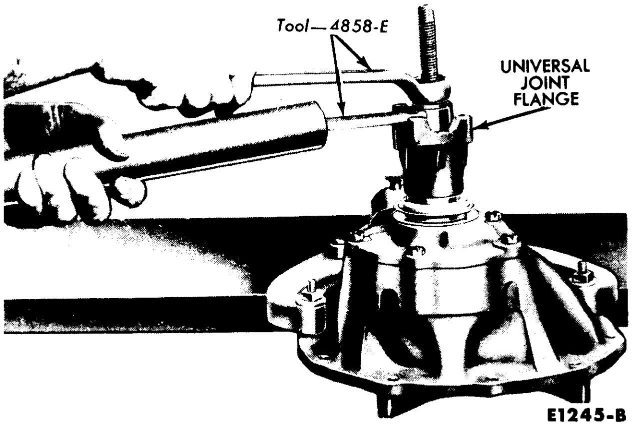


FIG. 33—U-Joint Flange Installation

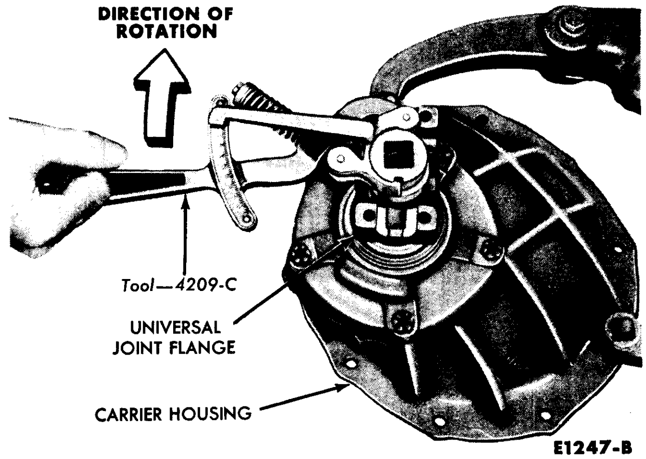


FIG. 34—Pinion Bearing Preload Check

bores so that they just contact the bearing cups. The nuts should be engaging about the same number of threads on each side.

13. Carefully position the bearing caps on the carrier. Match the marks made when the caps were removed.

14. Install the bearing cap bolts and alternately torque them to 70-80 ft-lbs.

15. 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 25 ft-lbs before making adjustments.

16. Adjust the backlash between the ring gear and pinion as outlined in Part 4-1, Section 2.

17. Be sure to make a final tooth pattern check before installing the carrier assembly in the axle housing.

FIG. 35—Gear Set Timing Marks

PART 4-3 SPECIFICATIONS

REAR AXLE RATIOS, GEAR AND CODE IDENTIFICATION

Identification Tag	Ring Gear Diameter (Inches)	Type of Differential	Axle Ratio	No. of Teeth		Type of Gear Set
				Ring Gear	Pinion	
WCD-E	9	Conventional	3.00:1	30	10	Non-Hunting
WDE-B	9	Locking				
WCD-F	9	Conventional	3.50:1	35	10	Partial Non-Hunting

LUBRICANT

Ford Specification	Ford Part No.	Capacity
M2C57-A*	C2AZ-19580-D	5 Pints (Approx.)

*For all cars equipped with Equa-Lock axles, regardless of engine size, use M-2C50-B, plus (1) ounce of M-2C58-A (C1AA-19B546-A) additive per pint of M-2C50-B (4 oz. for complete refill).

SAE 90 grade lubricants are recommended for all temperatures above —25° F. For temperatures below —25° F, the same type of lubricant, but of an SAE 80 grade, should be used.

REAR AXLES WITH LOCKING DIFFERENTIAL

TORQUE CHECK		
Minimum Torque Required to Turn Axle Shaft and Side Gear With One Wheel on the Ground		75 ft-lbs
Bench Check After Assembly	With New Clutch Plates	155-195 ft-lbs
	With Original Clutch Plates	75 ft-lbs Minimum

ADJUSTMENTS

Description	Inches
Backlash Between Drive Gear and Pinion	0.004-0.009
Maximum Backlash Variation Between Teeth	0.003
Maximum Runout of Backface of Drive Gear as Assembled	0.003
Differential Side Gear Thrust Washers Thickness	0.030-0.032
Differential Pinion Gear Thrust Washers Thickness	0.030-0.032
Nominal Pinion Locating Shim	0.020
Available Shims (In steps of 0.001 inch)	0.010-0.029

TORQUE LIMITS Ft-lbs

Differential Bearing Cap Bolts	70-85
Differential Bearing Adjusting Nut Lock Bolts	12-25
Carrier to Housing Stud Nuts	30-40
Pinion Retainer to Carrier Bolts	30-45
Drive Gear Attaching Bolts	65-80
Rear Axle Shaft Bearing Retainer Nuts	30-35
Rear Spring Clip (U-Bolt) Nuts	60-70
Shock Absorber-to-Spring Clip Plate	15-25
Minimum Torque Required to Tighten Pinion Nut to Obtain Correct Pinion Bearing Preload	175
Pinion Bearing Preload	New Bearings & New Seal 22-32 in-lbs Used Bearings & New Seal 10-14 in-lbs
Differential Bearing Preload	2½-3 Notches Tight

DRIVE PINION ADJUSTING SHIM THICKNESS CHANGES (Inches)

New Pinion Marking	Old 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

SPECIAL TOOLS

Ford Tool No.	Former No.	Description
T59L-4204-A	42211 or 42211-A	Locking Differential Check
T57L-500-A	6005-M or 6005-MS	Bench Fixture
T50T-100-A	B-160	Impact Hammer
Tool—4235-C	4235-C	Axle Shaft Remover
OTC-951		Rear Wheel Bearing Remover and Installer
Tool—1177	4245-B	Rear Wheel Bearing Oil Seal Installer
Tool—1175-AB	1175-AB	Rear Wheel Bearing Oil Seal Remover
T57L-4220-A		Differential Bearing Remover
Tool—4221-AE and Tool—4221-AF	4221-AF	Differential Bearing Remover
T57L-4851-A	4851-K	U-Joint Flange Holder
T53T-4851-A	4851-A, D	U-Joint Flange Remover
Tool—4858-D		U-Joint Flange Remover
T57L-4614-A	4614	Drive Pinion Retainer Support
Tool—4621-K	4621-K	Pinion Rear Bearing Cone Remover
T53L-200-A		Handle Adapter
T57L-4625-A	4625-K	Pinion Pilot Bearing Remover and Installer
T57L-4616-A-2 or Tool—4615-D		Pinion Front Bearing Cup Remover and Replacer
T58L-101-A		Pulley Attachment For Bearing Cup Removal
T55P-4616-A2		Pinion Rear Bearing Cup Remover and Replacer
T57L-4621-B or Tool—4621-L		Pinion Front and Rear Bearing Cone Installer
T58L-4676-A	4676-F	Drive Pinion Oil Seal Replacer
Tool—4858-E	4858-E	U-Joint Flange and Pinion Bearing Replacer
T57L-4221-A	4222-H	Differential Bearing Installer
Tool—4209-C	4209-C	Pinion Tension Scale with Socket—Bearing Preload

GROUP 5

PART 5-1 DRIVE LINE

1 TROUBLE DIAGNOSIS

DRIVE SHAFT TROUBLE DIAGNOSIS AND POSSIBLE CAUSES

DRIVE SHAFT VIBRATION	Undercoating or other foreign material on shaft. Universal joint U-bolts loose. Universal joints worn, or lack of lubricant. Drive shaft mis-aligned (drive line angle). Drive shaft and universal joints 180° out of phase.	Broken rear spring center bolt. Broken rear spring. Rear springs not matched (sagged to one side). Drive shaft damaged (bent) or out of balance (missing balance weights).
U-JOINT NOISE	Universal joint U-bolts loose. Lack of lubrication.	Worn U-joints.

2 DESCRIPTION AND OPERATION

The drive shaft is the means of transferring power from the engine to the differential in the rear axle and then to the rear wheels. The drive shaft incorporates two universal joints and a slip yoke. The universal joints (Fig. 1) are provided with a threaded plug which can be removed to lubricate them when necessary. The splines in the yoke and on the transmission output shaft permit the drive shaft to move forward and rearward as the axle moves up and down.

All drive shafts are balanced. If the car is to be undercoated, cover the drive shaft and universal joints to prevent application of the undercoating material.

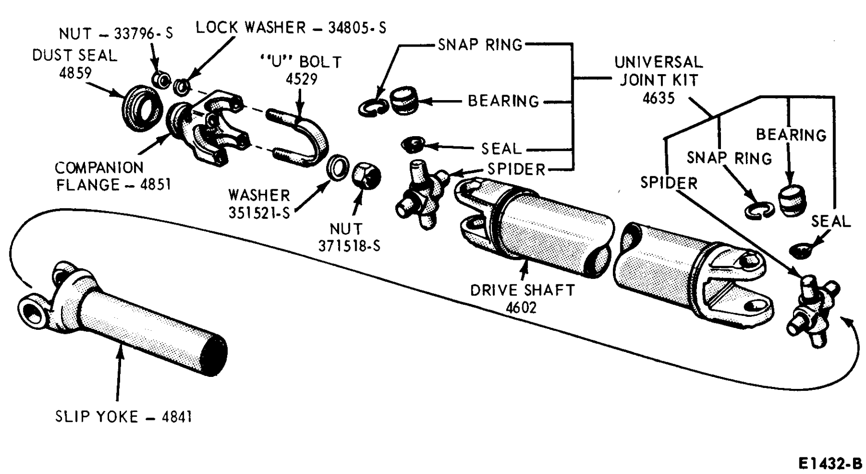


FIG. 1—Drive Shaft and Universal Joints Disassembled

3 REPLACEMENT

REMOVAL

1. To maintain drive line balance, mark the relationship of the slip yoke and the drive flange on the axle with the shaft so that they may be installed in their original positions.

2. Disconnect the rear U-joint from the drive pinion flange. Wrap tape around the loose bearing caps to prevent them from falling off the spider. Pull the drive shaft toward the rear of the car until the front U-joint yoke clears the transmission extension housing and the seal. Install tool T61L-7657-A or B, 7657-A or 7657-AB in the extension housing to prevent lubricant leakage.

3. Place the drive shaft in a vise being careful not to damage it.

4. Remove the snap rings that retain the bearings in the yoke and in the drive shaft.

5. Position the tool shown in Fig. 2 on the shaft and press the bearing out of the yoke. If the bearing cannot be pressed all the way out of the yoke, remove it with vise grip or channel lock pliers.

6. Reposition the tool to press on the spider to remove the bearing from the opposite side of the yoke.

7. Remove the yoke from the spider.

8. Remove the bearings and spider from the drive shaft in the same manner.

9. Clean all foreign matter from the yoke area at each end of the drive shaft.

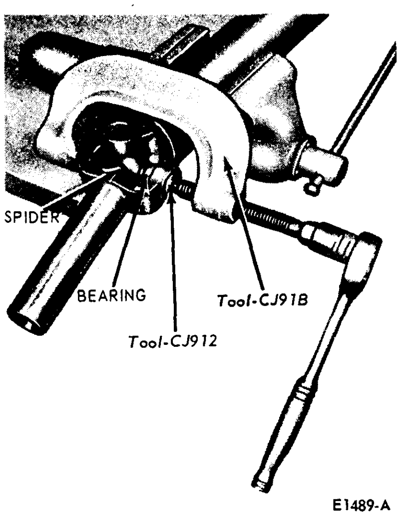


FIG. 2—Removing U-Joint

INSTALLATION

1. Start a new bearing into the yoke at the rear of the drive shaft.

2. Position the spider in the rear yoke and press the bearing ¼ inch below the surface (Fig. 3).

3. Remove the tool and install a new snap ring.

4. Start a new bearing into the opposite side of the yoke.

5. Install the tool and press on the bearing until the opposite bearing contacts the snap ring.

6. Remove the tool and install a new snap ring.

7. Reposition the drive shaft and install the new spider and two new bearings in the same manner as the rear yoke.

8. Position the yoke on the spider and install two new bearings and snap rings.

9. Check the joint for freedom of movement. If a bind has resulted from misalignment during the foregoing procedures, tap the ears of the drive shaft sharply to relieve the bind. Do not install the drive shaft unless the universal joints are free of bind.

10. If the rubber seal installed on the end of the transmission extension housing is damaged in any manner, install a new seal.

11. Lubricate the yoke spline with B8A-19589-A lubricant. This spline is sealed so that the transmission fluid does not "wash" away the spline lubricant (Fig. 4). Remove the tool from the extension housing. Install the yoke on the transmission output shaft.

12. Install the U-bolts and nuts that attach the U-joint to the drive pinion flange. Torque the U-bolt nuts to 15-20 ft-lbs.

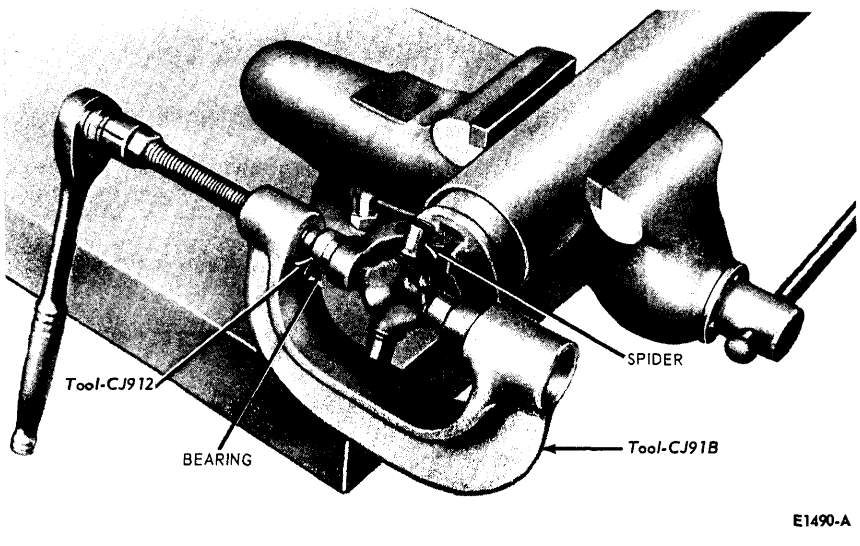


FIG. 3—Installing U-Joint Bearing

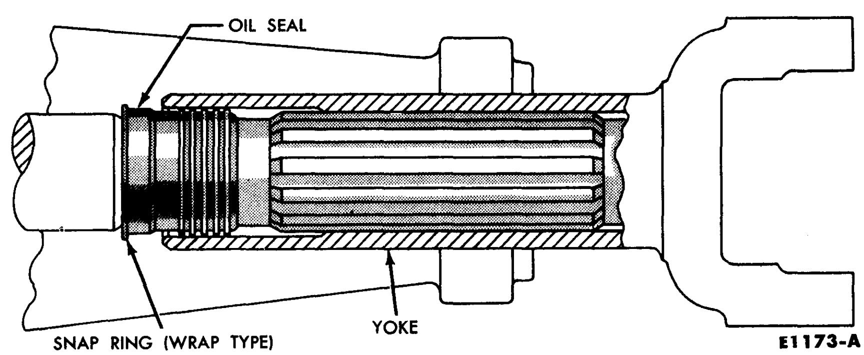


FIG. 4—Output Shaft Spline Seal

AUTOMATIC TRANSMISSION — GROUP 7

PART 7-1 GENERAL TRANSMISSION SERVICE

1 DIAGNOSIS AND TESTING

When diagnosing transmission problems, first refer to the diagnosis guide for the detail information on the items that could be causing the problem.

The following preliminary checks should be made before proceeding with other diagnosis checks.

TRANSMISSION FLUID LEVEL CHECK

Check the transmission fluid level. Low fluid level can affect the operation of the transmission, and may indicate fluid leaks that could cause transmission damage.

A fluid level that is too high will cause the fluid to become aerated. Aerated fluid will cause a low control pressure, and the aerated fluid may be forced out the vent.

TRANSMISSION FLUID LEAKAGE CHECKS

Check the speedometer cable connection at the transmission. Replace the rubber seal if necessary.

Inspect the governor inspection plate for leakage. Install a new gasket if needed.

Leakage at the oil pan gasket often can be stopped by tightening the attaching bolts to the proper torque. If necessary replace the gasket.

Check the fluid filler tube connection at the transmission oil pan.

If leakage is found here, tighten the fitting.

Check the fluid lines and fittings between the transmission and the cooler in the radiator tank for looseness, wear, or damage. If leakage cannot be stopped by tightening a fitting, replace the leaking parts.

Check the engine coolant in the radiator. If transmission fluid is present in the coolant, the cooler in the radiator tank is probably leaking.

The cooler can be further checked for leaks by disconnecting the lines at the cooler fittings and applying 5 psi air pressure to the fittings. If the cooler is leaking and will not hold this pressure, the radiator must be replaced. **The cooler cannot be replaced separately.**

If leakage is found at either the throttle lever shaft or the manual lever shaft, replace either or both seals.

Inspect the pipe plug on the left side of the transmission case at the front. If the plug shows leakage, torque the plug to specification. If tightening does not stop the leaks, replace the plug.

When converter drain plugs leak, remove the two drain plugs with a sixpoint wrench. Coat the threads with FoMoCo Perfect Seal Sealing Compound or its equivalent, and install the plugs. Torque the drain plugs to specification. **Fluid leakage from the converter housing may be caused by engine oil leaking past the rear main bearing or from oil gallery plugs, or power steering oil leakage from the steering system. Be sure to determine the exact cause of the leak before repair procedures are started.**

Oil-soluble aniline or fluorescent dyes premixed at the rate of ½ teaspoon of dye powder to ½ pint of transmission fluid have proved helpful in locating the source of the fluid leakage. Such dyes may be used to determine whether an engine oil or transmission fluid leak is present, or if the fluid in the oil cooler leaks into the engine coolant system. A black light, however, must be used with the fluorescent dye solution.

OIL LEAKAGE CONVERTER AREA

In diagnosis and correcting fluid leaks in the front pump and converter area, the following procedures are to be used to facilitate locating the exact cause of oil leakage. Leakage at the front of the transmisssion, as evidenced by oil around the converter housing may have several sources. By careful observation, it is possible, in many instances, to pinpoint the source of the leak before

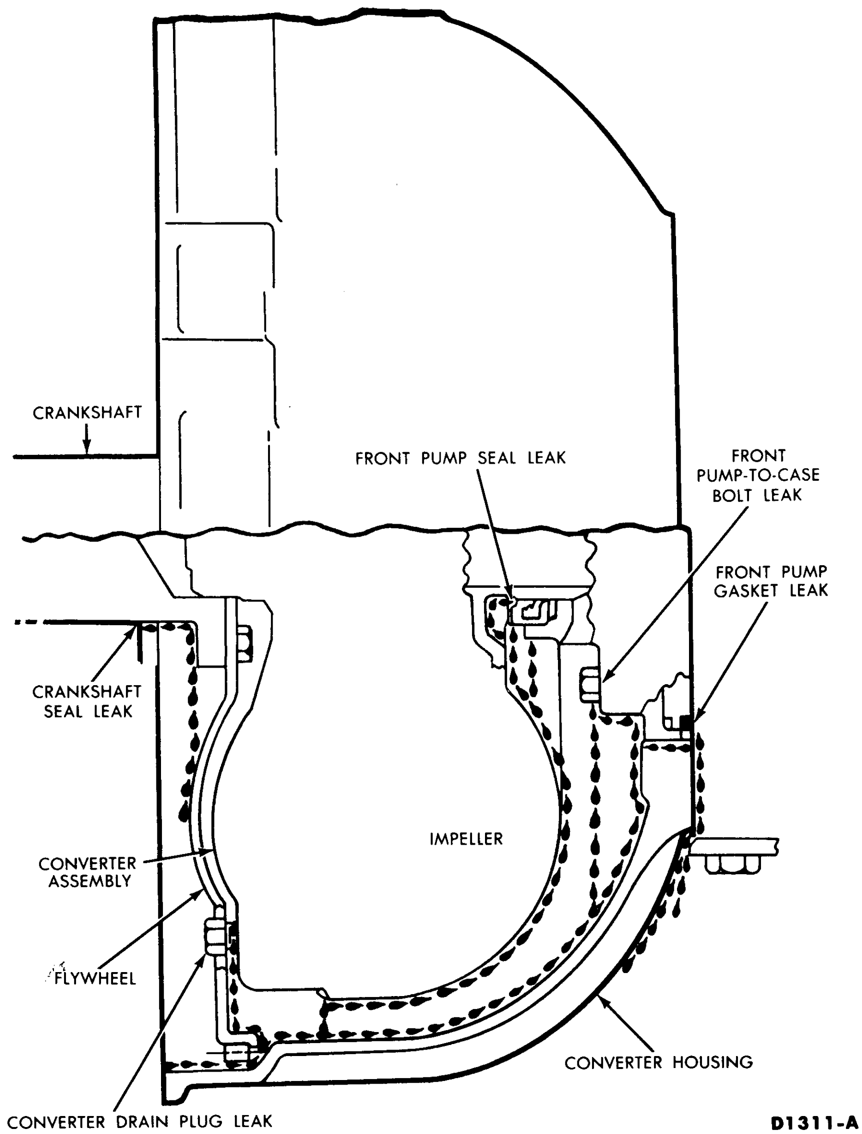


FIG. 1—Converter Area Oil Leakage Check

removing the transmission from the car. The paths the fluid takes to reach the bottom of the converter housing are shown in Fig. 1.

1. Fluid that leaks by the seal lip will tend to move along the drive hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the converter housing only, near the outside diameter of the housing.

2. Fluid leakage by the outside diameter of the seal and front pump body will follow the same path as leakage by the front pump seal.

3. Fluid that leaks by a front pump to case bolt will be deposited on the inside of the converter housing only. Fluid will not be deposited on the back of the converter.

4. Leakage by the front pump to case gasket may cause fluid to be deposited inside the converter housing, or it may seep down between the front of the case and converter housing. Fluid on the front of the case, above the pan gasket, is evidence that the front pump to case gasket could be leaking.

5. Fluid leakage from the converter drain plugs will appear at the outside diameter of the converter on the back face of the flywheel, and in the converter housing only, near the flywheel.

6. Engine leaks are sometimes improperly diagnosed as front pump seal leaks.

The following engine leakage areas should also be checked to determine if engine oil leakage is causing the problem.

1. Leakage at the rocker arm cover (valley cover) may allow oil to flow over the converter housing or seep down between the converter housing and engine block causing oil to be present in or at the bottom of the converter housing.

2. Oil gallery plug leaks will allow oil to flow down the rear face of the block to the bottom of the converter housing.

3. Leakage by the crankshaft seal will work back to the flywheel, and from there into the converter housing.

Oil leakage from other areas forward of the transmission, such as the power steering system, could cause oil to be present around the converter housing due to blow back or road draft.

The following procedure should be used to determine what is causing the oil leakage before any repairs are made.

1. Remove the transmission dipstick and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transmission. Unless a considerable amount of "make-up" fluid has been added or the fluid has been changed, the red color should assist in pinpointing the leak. Fluid used in the power steering system is also dyed red. This source of leakage should be eliminated, if present, before performing work on the transmission since road draft may cause power steering fluid to be present on the transmission.

2. Remove the lower converter housing cover. Clean off any fluid from the top and bottom of the converter housing, front of the transmission case, and rear face of the engine and engine oil pan. Clean by washing with suitable non-flammable solvent, and blow dry with compressed air.

3. Wash out the converter housing, the front of the flywheel, and the converter drain plugs. The converter housing may be washed out using cleaning solvent and a squirt-type oil can. Blow all washed areas dry with compressed air.

4. Start and run the engine until the transmission reaches operating temperature. Observe the back of the block and top of the converter housing for evidence of oil leakage. Raise the car on a hoist and run the engine at fast idle, then at engine idle, and occasionally shifting to the drive and reverse ranges to increase pressures within the transmission. Observe the front of the flywheel, back of the block (in as far as possible), and inside the converter housing and front of the transmission case. Run the engine until oil leakage is evident and the probable source of leakage can be determined.

CONVERTER LEAKAGE CHECK

If there are indications that the welds on the torque converter housing are leaking, the converter will have to be removed and the following check should be made before the unit is replaced. A leak checking tool (Fig. 2) can be made from standard parts.

1. Install the plug in the converter (Fig. 3) 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.

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.

ENGINE IDLE SPEED CHECK

Check and, if necessary, adjust the engine idle speed, using the procedure given in Group 10.

If the idle speed is too low, the engine will run roughly. An idle speed that is too high will cause the car to creep when the transmission is shifted out of neutral.

ANTI-STALL DASHPOT CLEARANCE CHECK

After the engine idle speed has been properly adjusted, check the anti-stall dashpot clearance. Follow the procedure given in Group 10 for checking and adjusting this clearance.

MANUAL LINKAGE CHECKS

Correct manual linkage adjustment is necessary to position the manual valve for proper fluid pressure direction to the different transmission components. Improperly adjusted manual linkage may cause cross-leakage and subsequent transmission failure. Refer to "Manual Linkage Adjustments," Part 7-2, for detailed manual linkage adjustment procedures.

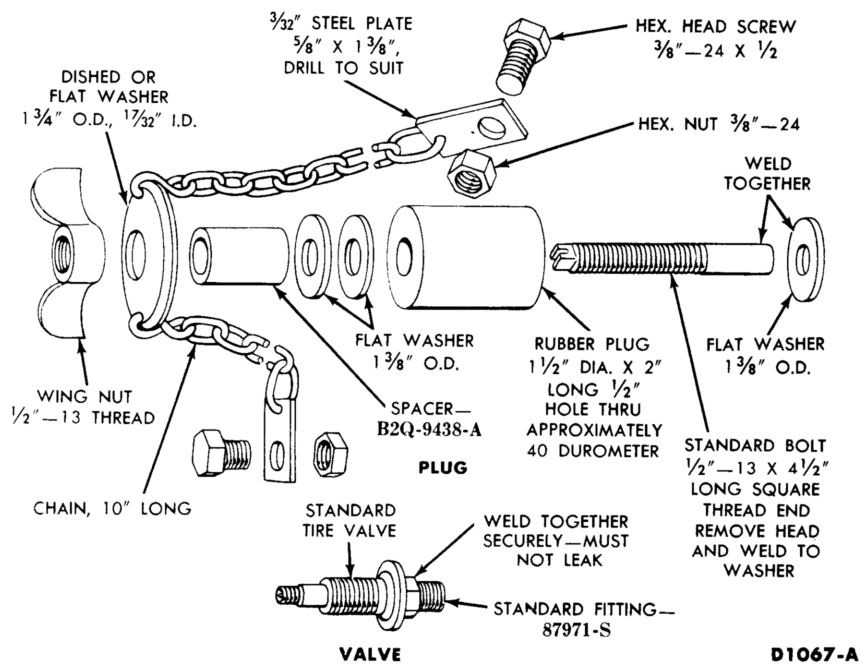


FIG. 2—Converter Leak Checking Tool

CONTROL PRESSURE, AUTOMATIC SHIFTS, VACUUM DIAPHRAGM UNIT CHECKS

When the vacuum diaphragm unit (Fig. 4)) is operating properly and the downshift linkage is adjusted properly, all the transmission shifts (automatic and kickdown) should occur within the road speed limits given in Part 7-3.

If the automatic shifts do not occur within limits, the following checking procedure is suggested to separate engine, transmission, linkage, and diaphragm unit troubles. The results of these checks should agree with the specifications outlined in Table 1.

1. Attach a tachometer to the engine and vacuum gauge to the transmission vacuum line, at the transmission vacuum unit.

2. Attach a pressure gauge to the control pressure outlet at the rear of the transmission (Fig. 4).

3. Firmly apply the service brakes and start the engine. During this test, the parking brake can not be used, because the brake automatically releases when the transmission selector lever is moved to a drive position.

4. Adjust engine idle speed to the specified rpm in D1 or D2. If engine idle speed cannot be brought within limits by adjustment at the carburetor idle adjustment screw, check the throttle and downshift linkage for binding condition. If the linkage is satisfactory, check for vacuum leaks in the transmission diaphragm unit and its connecting tubes and hoses. Check all other vacuum oper-

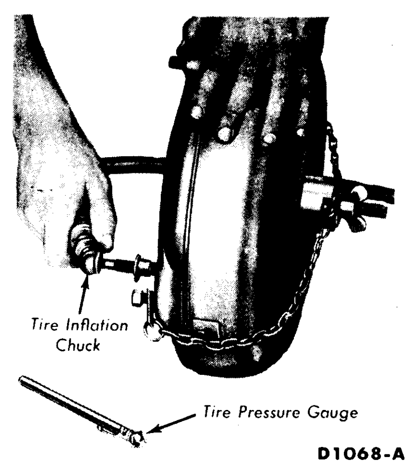


FIG. 3—Converter Leak Checking Tool Installation

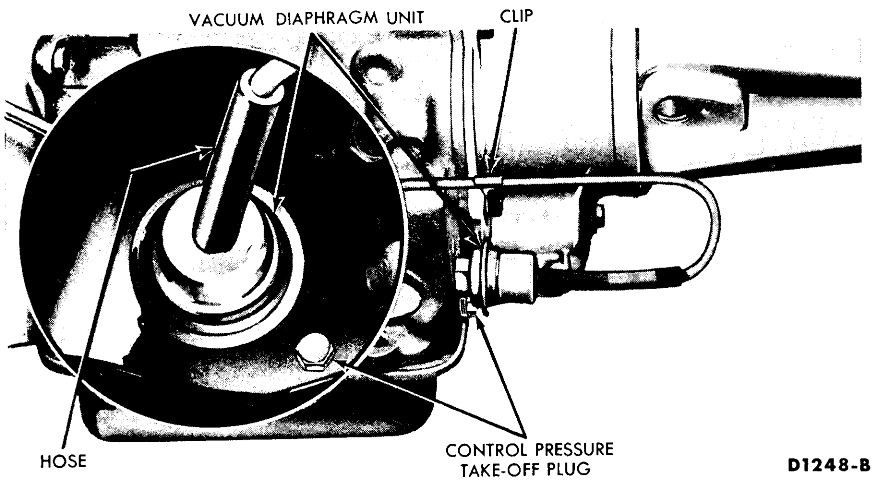


FIG. 4—Vacuum Diaphragm and Control Pressure Connecting Point

TABLE 1—Control Pressure Ranges

Test No.	Manifold Vacuum HG (inches)	Engine Speed RPM	Transmission Selector Position	Gauge Reading PSI
1	18	Idle	P-L-N-D1-D2	57-77
	Minimum		R	71-106
2	16 to 13.7	As Required	D1-D2 L-R	Pressure Starts Rising
3	1.5	Stall	D1-D2-L	151-176
	or Less	1800-2000	R	201-213

ated units (such as the power brake and distributor vacuum advance) for vacuum leaks.

5. At engine idle speed, read the engine vacuum gauge and the transmission control pressure gauge.

The engine vacuum gauge should read a minimum of 18.0 inches. If the vacuum gauge reading is lower than 18.0 inches, an engine problem is indicated. Repair as necessary.

TEST NUMBER 1

The transmission control pressure should agree with the control pressures as outlined in Table 1 for test number one. If transmission control pressure is within limits, shift the transmission into D1 or D2 or L.

TEST NUMBER 2

Advance the throttle until the engine vacuum gauge reading falls below 16-13.7 inches. As the vacuum gauge reading passes through the 16-13.7 inches range, transmission control pressure should start to rise and continue to rise with throttle opening, until maximum control pressure for stall is obtained. If the vacuum and pressure gauge readings follow the pattern described above, the diaphragm unit and transmission control pressure regulation system are operating properly.

TEST NUMBER 3

To perform test number 3, place the selector lever in each required position, and completely open the throttle to obtain less than 1.5 inches of vacuum. The control pressure should be within the limits as outlined in Table 1. **While making this test, do not hold the throttle open for more than five seconds in each detent position. Then move the selector lever to N and run the engine at 1000 RPM to cool the transmission.**

If transmission control pressure is too low, too high, fails to rise with throttle opening, or is extremely erratic, follow the procedure given under the following appropriate heading.

CONTROL PRESSURE IS LOW —TEST NUMBER 1

If control pressure at engine idle is low in all selector lever positions, trouble other than the diaphragm unit is indicated.

When control pressure at engine idle is low in all ranges, check for excessive leakage in the front oil pump, case, and control valve body.

CONTROL PRESSURE IS HIGH —TEST NUMBER 1

If transmission control pressure at engine idle is too high in P, N, D1, D2, L or R (Table 1), the trouble may be in the diaphragm unit or its connecting tubes and hoses.

With the engine idling, disconnect the hose from the diaphragm unit (Fig. 4) and check the engine manifold vacuum. Hold a thumb over the end of the hose and check for vacuum. If the engine speeds up when the hose is disconnected and slows down as the thumb is held against the end of the hose, the vacuum source is satisfactory.

Stop the engine, and remove the diaphragm unit and the diaphragm unit push rod. Inspect the push rod for a bent condition and for corrosion. Install the diaphragm unit in the case to prevent fluid loss, but leave the push rod out. With the push rod removed, the diaphragm unit cannot affect transmission control pressure. Start the engine and check control pressure at engine idle in P, N, D1 and D2. If control pressure is still too high, the trouble is in the transmission control system. If the pressure is now within limits, the diaphragm unit was not operating properly and should be checked.

To check the vacuum unit for diaphragm leakage, remove the vacuum unit from the transmission. Use a distributor tester equipped with a vacuum pump (Fig. 5). Set the regulator knob so the vacuum gauge reads 18 inches with the end of the vacuum hose blocked to obtain a maximum vacuum reading 18 in. Hg.

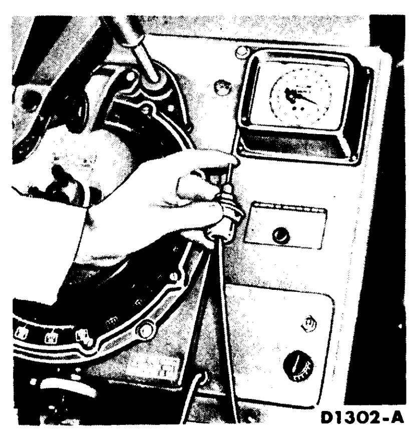


FIG. 5—Testing Transmission Vacuum Unit For Leakage

Then, connect the vacuum hose to the transmission vacuum unit. If the vacuum gauge still reads 18 inches, the vacuum unit diaphragm is not leaking. As the hose is removed from the transmission vacuum unit, hold your finger over the end of the control rod. When the hose is removed, the internal spring of the vacuum unit should push the control rod outward.

CONTROL PRESSURE DOES NOT RISE WITH THROTTLE OPENING—TEST NUMBER 2

If transmission control pressure does not rise in D1, D2 and L as engine vacuum falls below 16-13.7 inches, check the transmission's pressure rise capacity by shifting to R. In this position, control pressure should be higher than the other detent positions.

If pressure rise is normal in R, remove the hose from the diaphragm unit and check the hoses and tubes as given above. If the vacuum reading at the diaphragm end of the hose is 18 in. Hg or greater, check the diaphragm unit and again check for presure rise with throttle opening in D1, D2, L and R. If control pressure does not rise now, the trouble is in the transmission, hydraulic circuits to clutches or servos.

Control Pressure Not Within Limits—Stall Test Number 9. If idle pressure and pressure point increase are within specifications but stall pressures are not within specification in all ranges, excessive leakage, low pump capacity or restricted oil pan screen is indicated.

If stall pressures are not within specifications for specific ranges only, this indicates excessive leakage in the clutch or servo circuits used in those ranges.

CONTROL PRESSURE IS EXTREMELY ERRATIC

If transmission control pressure is extremely erratic in L, N, D1 and D2, check the diaphragm unit tubes, hoses, and diaphragm push rod as given above under **Control Pressure Is High.** If the vacuum source is satisfactory, replace the diaphragm unit and repeat the tests for transmission control pressure. If control pressure is still extremely erratic, the trouble is in the transmission. Clean and inspect the control valve body and pressure regulator.

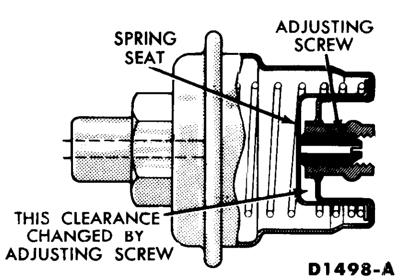


FIG. 6—Adjustable Vacuum Unit

TABLE 2—Control Pressure Check

Test No.	Engine Speed and Manifold Vacuum	Throttle Position	Selector Lever Position	Control Pressure PSI
1	Idle/Above 16.7 Inches	Closed	P, N, D1, D2, L R	57-77 64-106
2	As Required 13.7 Inches to 16.7 Inches	Open As Required	D1, D2, L	Start of pressure build up
3	10 Inches	As Required	D1, D2, L	97-113
4	Stall: Below 1.5 Inches	To and thru Detent	D1, D2, L R	145-176 196-213

ADJUSTING CONTROL PRESSURE

To correct transmission problems causing a soft or harsh automatic shift condition, an adjustable vacuum diaphragm assembly is released as a service part. There is an adjustment screw in the vacuum connecting tube (Fig. 6). By turning the screw the control pressure can be increased or decreased to correct the shift condition.

Before installing an adjustable diaphragm, a pressure and vacuum check should be made with the original non-adjustable diaphragm, to insure that pressures are within specifications and that the cause of the problem is not due to other items within the transmission or vacuum connecting lines.

CHECKING CONTROL PRESSURE

1. With engine idling (throttle closed), manifold vacuum should be above 16 inches at sea level. Select each range and note pressure gauge reading. Pressure should be within specifications as outlined in Table 2.

2. Position selector lever in Drive range with engine idling. Open throttle gradually while observing pressure gauge. Pressure should remain within idle limits until vacuum drops to between 16.7 and 13.7 inches and then the pressure should start to increase.

3. Place selector in Drive range (D1, D2, or L), open throttle until vacuum reading is 10 inches, and check transmission control pressure.

4. Open throttle until vacuum reading is below 1.5 inches and check pressure gauge reading.

5. Shift transmission to reverse and open throttle until vacuum reading is below 1.5 inches and check the pressure gauge reading.

Adjustable diaphragm may be installed when pressures are within specification. An initial adjustment should be made to provide 105 psi line pressure at 10 inches of vacuum. Once the initial adjustment has been made, further adjustments may be made in an effort to overcome shift feel problems.

If shifts are harsh, an adjustment should be made to reduce line pressure. If shifts are soft, an adjustment should be made to increase line pressure. To increase control pressure, turn the adjusting screw in (clockwise). To decrease control line pressure, back the adjusting screw out (counterclockwise).

After the vacuum unit has been adjusted re-check the control pressure as outlined in Table 2. **All tests must be within specifications. The adjustable vacuum unit can not be used to allow for adjusting control pressures that are out of specifications.** If control pressures are found to be out of specification, the cause must be determined and corrected before making an adjustment.

KICKDOWN SHIFTS

With the linkage adjusted as outlined, the transmission still might not downshift when it is road-tested because of bent or otherwise defective downshift control rod. Check this rod as follows:

1. With the engine off, depress the accelerator pedal to the floor, and hold it there.

2. Disconnect the downshift rod at the accelerator downshift lever and firmly push the rod all the way down.

3. Rotate the accelerator downshift lever clockwise against its stop and, **while holding the downshift rod all the way down,** try to connect the rod. If the connection cannot be made, the rod is too short and should be replaced.

STALL TEST

The stall test is made in D2, D1, L, or R (at full throttle only) to determine if the bands and clutches are holding properly. **While making this test, do not hold the throttle open for more than five seconds at a time.** Then move the selector lever to N and run the engine at 1000 rpm for about one minute to cool the converter before making the next test.

Connect a tachometer, and start the engine to allow it to reach its normal temperature. **Apply the service brakes firmly. The parking brake, due to the vacuum release operation, will not hold in R, D1, D2 or L.**

With the selector lever at D2, press the accelerator to the floor. Note the engine speed. Stall speeds are given in Part 7-3.

In D1 (car standing still), the front clutch and the one-way clutch are engaged at all accelerator pedal positions.

In D2 (car standing still), the front clutch and front band are engaged at all accelerator pedal positions. If the front band slips, the one-way clutch will hold, but operation will be for first gear.

In L, the front clutch and rear band are applied.

In R, the rear clutch and rear band are applied.

Perform the converter tests described in "Cleaning and Inspection" to determine if the stator clutch is defective.

If the engine speed exceeds the maximum limits, release the accelerator immediately because clutch or band slippage is indicated.

The band or clutch that is causing the slippage can be found by testing in another selector lever position. For example, should the transmission slip in R but not in D2, D1 or L, the probable cause is the rear clutch.

PERFORMANCE CHECKS

Performance checks should be made only after all preliminary checks have been completed. If an unsatisfactory operating condition is found during these checks, stop the checks and proceed to final diagnosis and correction of trouble.

INITIAL ENGAGEMENT CHECKS

Initial engagement checks are made to determine if initial band and clutch engagements are smooth.

Run the engine until the normal operating temperature is reached. **With the engine at the correct idle speed**, shift the selector lever from N to D2, and from N to D1. Observe the initial band and clutch engagements. Band and clutch engagements should be smooth in all positions. Rough initial engagements in D1, D2, L or R are caused by high engine idle speed, high control pressure, faulty operation of the pressure regulator valve or of the main control valve.

SHIFT POINT CHECKS

Check the light throttle upshifts in D1. The transmission should start in first gear and shift to second and then shift to third within the shift points as oulined in Part 7-3.

While the transmission is in third gear, depress the accelerator pedal through the detent (to the floor). The transmission should shift from third to second or third to first, depending on the car speed.

Check the closed throttle downshift from third to first by coasting down from about 30 mph in third gear. The shift should occur within the limits given in Part 7-3. A 3-2-1 shift may be experienced under the above conditions.

Partial-throttle downshifts in D1 may be checked by using the service brakes as a load. With the transmission in third gear, D1, and car speed at about 30 mph, depress and hold the accelerator at a half-throttle position. At the same time, apply the service brakes to the point that road speed is slowly reduced. The third to second and then second to first shifts should occur as road speed decreases.

When the selector lever is at D2, the transmission can operate only in second and third gears. Shift points for second to third and third to second are the same in both D2 and D1.

If the transmission is in third gear and road speed is above about 28 mph, the transmission should shift to second gear when the selector lever is moved from D2 or D1 to L. When the same manual shift is made below about 25 mph, the transmission will shift from second or third to first. This check will determine if the governor pressure and shift control valves are functioning properly.

CONVERTER CHECK

When the stall test speeds are low and the engine is properly tuned, converter stator clutch problems are indicated. A road test must be performed to determine the exact cause of the trouble.

If the stall test speeds are 300 to 400 rpm below the values shown in the specifications, Part 7-3, and the car cruises properly but has very poor acceleration, the stator clutch is slipping.

Remove the converter and check the stator clutch as described in "Cleaning and Inspection".

If the stall test speeds are 300 to 400 rpm below specifications and the car drags at cruising speeds and acceleration is poor, the stator clutch is installed backwards.

When the stall test shows normal speeds, the acceleration is good, but the car drags at cruising speeds, the difficulty is due to a seized stator assembly. If the stator is defective, replace the converter.

AIR PRESSURE CHECKS

A "NO DRIVE" condition can exist, even with correct transmission fluid pressure, because of inoperative clutches or bands. 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 D2, D1 or L a "NO DRIVE" condition may be caused by an inoperative front clutch. When there is no drive in only L range, the difficulty could be caused by improper functioning

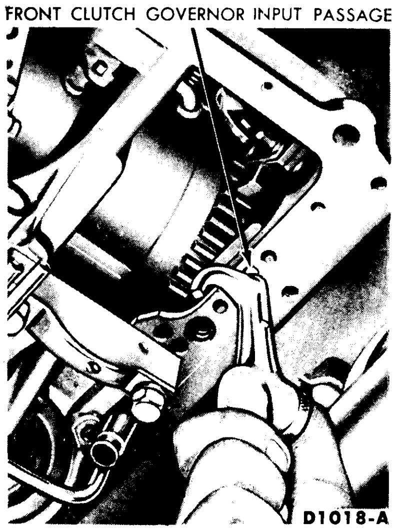


FIG. 7—Typical Front Clutch Air Check

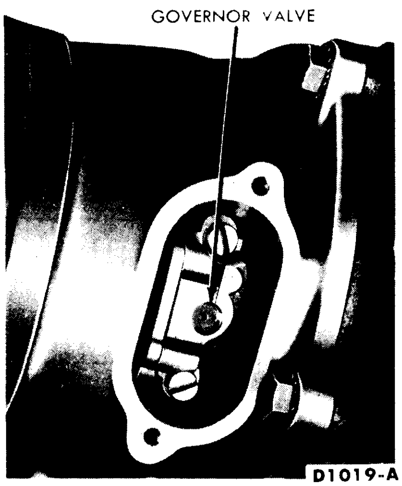


FIG. 8—Governor Valve

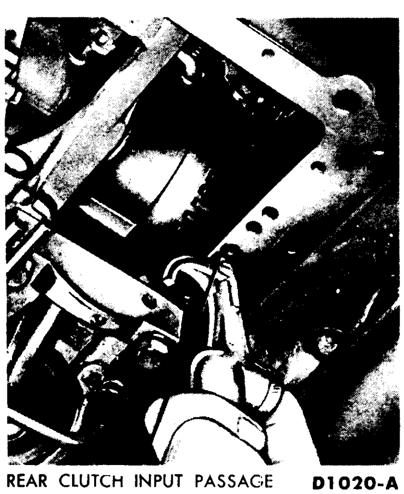


FIG. 9—Typical Rear Clutch Air Check

FIG. 10—Typical Rear Servo Air Check

of the planet one-way clutch. Failure to drive in reverse range could be caused by a malfunction of the rear clutch or rear band. Erratic shifts could be caused by a malfunction of the governor.

To make the air pressure checks, drain the transmission fluid, and then remove the oil pan and the control valve assembly.

The inoperative units can be located by introducing air pressure into the transmission case passages leading to the clutches, rear servo, and governor, and into the front servo apply and release tubes.

FRONT CLUTCH

Apply air pressure to the transmission case front clutch passage (Fig. 7). A dull thud can be heard when the clutch piston is applied. If no noise is heard, place the finger tips on the drum and again apply air pressure to the front clutch passage. Movement of the piston can be felt as the clutch is applied.

GOVERNOR

Remove the governor inspection cover from the extension housing. Apply air pressure to the front clutch passage, listen for a sharp click, and watch to see if the governor weight snaps inward (Fig. 8). Inward weight movement indicates correct governor valve operation.

REAR CLUTCH

Apply air pressure to the rear clutch passage (Fig. 9). A dull thud indicates that the rear clutch piston has moved to the applied position. If no noise is heard, place the finger tips on the rear drum and again apply air pressure to detect movement of the piston.

FRONT SERVO

Hold the air nozzle in the front servo apply tube. Operation of the front servo is indicated by a tightening of the front band around the drum. Continue to apply air pressure to the front servo apply tube, and introduce air pressure into the front servo release tube. **Hold a cloth over the release tube while applying the servo to catch the spray from the release tube.** The front servo should release the band against the apply pressure.

REAR SERVO

Apply air pressure to the rear servo apply passage (Fig. 10). The rear band should tighten around the drum if the rear servo is operating properly.

If either servo is inoperative, remove the inoperative unit and apply air pressure directly to its passages. Proper operation of the servos indi-

(Continued on page 7-9)

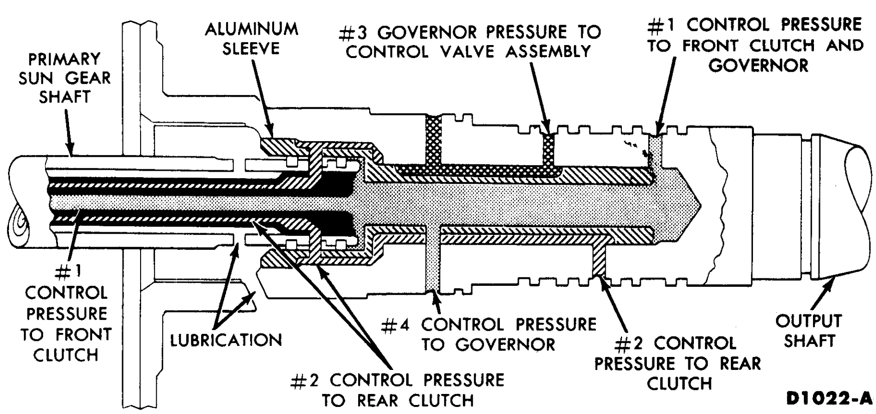


FIG. 11—Output and Primary Sun Gear Fluid Passages

DIAGNOSIS GUIDE—CRUISE-O-MATIC TRANSMISSION

The Cruise-O-Matic Diagnosis Guide lists the most common trouble symptoms that may be found and gives the items that should be checked to find the cause of the trouble.

The items to check are arranged in a logical sequence which should be followed for quickest results. The letter symbols for each item are explained in the key. If items A, B, C, K, and the stall test have already been checked during preliminary checks and adjustments, they need not be repeated.

CRUISE-O-MATIC DIAGNOSIS GUIDE

Trouble Symptom	Items to Check	
	Transmission in car	Transmission out of car
Rough Initial Engagement in D1 or D2	K B W F E G	
1-2 or 2-3 Shift Points Incorrect	A B C D W E L	
Rough 2-3 Shift	B G F E J	
Engine Overspeeds on 2-3 Shift	B G E F	r
No 1-2 or 2-3 Shift	B D E C G J	b c f
No 3-1 Shift	K B E	
No Forced Downshifts	L W E	
Runaway Engine on Forced Downshift	G F E J B	c
Rough 3-2 or 3-1 Shift at Closed Throttle	K B E	
Creeps Excessively in D1 or D2	K	
Slips or Chatters in First Gear, D1	A B W F E	a c f i
Slips or Chatters in Second Gear	A B G W F E J	a c
Slips or Chatters in R	A H W F E I B	b c f
No Drive in D1	C E	i
No Drive in D2	E R C	a c f
No Drive in L	E R	c f
No Drive in R	H I E R C	b c f
No Drive in Any Selector Lever Position	A C W F E R	c
Lockup in D1	C I J	b g c
Lockup in D2	C H I	b g c i
Lockup in L	G J E	b g c
Lockup in R	G J	a g c
Parking Lock Binds or Does Not Hold	C	g
Engine Does Not Start by Pushing Car	A C F E	e c
Transmission Overheats	O F	n
Maximum Speed Too Low, Poor Acceleration		n
Transmission Noisy in N	F	a d
Transmission Noisy in First, Second, Third, or Reverse Gear	F	h a b d
Transmission Noisy in P	F	d
Transmission Noisy During Coast at 30-20 mph in N, Engine Stopped		e
Fluid Leak	MNOPQSTUVX	j m p

Probable Trouble Sources
A. Fluid Level
B. Vacuum Diaphragm Unit or Tubes
C. Manual Linkage
D. Governor
E. Valve Body
F. Pressure Regulator
G. Front Band
H. Rear Band
I. Rear Servo
J. Front Servo
K. Engine Idle Speed
L. Downshift Linkage
M. Converter Drain Plugs
N. Oil Pan Gasket, Drain Plug or Tube
O. Oil Cooler and Connections
P. Manual or Throttle Lever Shaft Seal
Q. ⅛-inch Pipe Plug in Side of Case
R. Perform Air-Pressure Check
S. Extension Housing to Case Gaskets and Lockwashers
T. Center Support Bolt Lockwashers
U. Extension Housing Rear Oil Seal
V. Governor Inspection Cover Gasket
W. Perform Control Pressure Check
X. Speedometer Driven Gear Adapter Seal
a. Front Clutch
b. Rear Clutch
c. Leakage in Hydraulic System
d. Front Pump
e. Rear Pump
f. Fluid Distributor Sleeve in Output Shaft
g. Parking Linkage
h. Planetary Assembly
i. Planetary One-Way Clutch
j. Engine Rear Oil Seal
m. Front Pump Oil Seal
n. Converter One-Way Clutch
p. Front Pump to Case Gasket
r. Rear Clutch Piston Air Bleed Valve

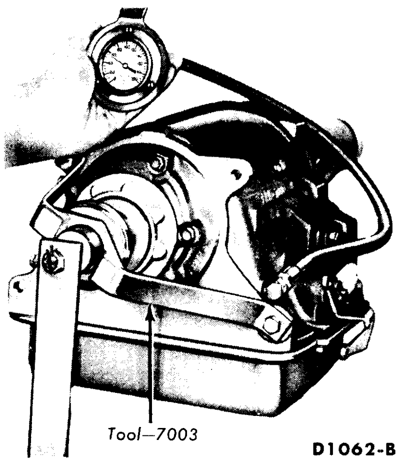


FIG. 12—Bench Testing Tool Installation—Typical

cates that the trouble is in the case passages. If the servo does not operate, disassemble, clean and inspect it to locate the source of the trouble.

If air pressure applied to either of the clutch passages fails to operate a clutch or operates both clutches at once, remove and, with air pressure, check the fluid passages at the output shaft aluminum sleeve for correct indexing with the shaft holes. Check the primary sun gear shaft assembly passages with air pressure to detect obstructions (Fig. 11).

If the output shaft and primary sun gear shaft passages are clear, remove the clutch assemblies, and clean and inspect the malfunctioning clutch to locate the trouble.

HYDRAULIC SYSTEM BENCH TESTS

After the transmission has been assembled and is ready for installation in the car, check the hydraulic system to make sure it is operating properly. These hydraulic tests can be made on the bench so that most malfunctions of the system can be corrected before the transmission is installed in the car.

TESTING TOOL INSTALLATION

1. Install a plug in the filler tube hole in the oil pan, and pour about 4 quarts of transmisssion fluid into the transmission through the speedometer gear opening.

2. Remove the vacuum diaphragm unit and the diaphragm unit push rod and install the vacuum unit, if these parts had been previously installed.

3. Install the bench testing tool on the transmission.

4. Remove the ⅛-inch pipe plug at the transmission case. Turn the front pump in a clockwise direction at 75-100 rpm until a regular flow of transmission fluid leaves the hole in the transmission case. This operation "bleeds" the air from the pump.

5. Install the pressure gauge (77820 or T57L-77820-A) as shown in Fig. 12.

PRESSURE TESTS

Turn the front pump at 75-100 rpm and note the gauge readings. The pressure readings on the bench test must be within the limits as outlined in Table 1 for test number one.

If pressure gauge readings are within limits in all selector lever positions, install the vacuum diaphragm push rod unit.

2 COMMON ADJUSTMENTS AND REPAIRS

TRANSMISSION FLUID LEVEL CHECK

The transmission fluid level should be checked using the following procedure.

1. Make sure that the car is standing level. 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.

3. Shift the selector lever through all positions, and place the lever at P. Do not turn off the engine during the fluid level checks.

4. Clean all dirt from the transmission fluid dipstick cap before removing the dipstick from the filler tube.

5. Remove the dipstick from 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 enough fluid to the transmission through the filler tube to raise the fluid level to the F (Full) mark on the dipstick. **Do not overfill the transmission.**

TRANSMISSION FLUID DRAIN AND REFILL

Normal maintenance and lubrication requirements do not necessitate periodic automatic transmission fluid changes.

If a major failure has occurred within the transmission such as a clutch, band, bearing, etc., the transmission will have to be removed for service. At this time the converter must be thoroughly flushed to remove any dirt.

When filling a dry transmission and converter, install 6 quarts of fluid. Start the engine, shift the selector lever as in step 7 below, check and add fluid as necessary.

Following is the procedure for partial drain and refill due to front band adjustment or minor repair.

1. Disconnect the fluid filler tube from the transmission oil pan.

2. When the fluid has stopped draining from the transmission and converter, remove and thoroughly clean the oil pan. The filter-type screen cannot be cleaned. Discard the oil pan gasket.

3. Place a new gasket on the oil pan, and install the filter-type screen and pan on the transmission.

4. Connect the filler tube to the oil pan, and tighten the fitting securely.

5. Add 3 quarts of fluid to the transmission through the filler tube.

6. Run the engine at idle speed for about 2 minutes. Then run the engine at fast idle speed (about 1200 rpm) until it reaches its normal operating temperature. **Do not race the engine.**

7. 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.**

OIL COOLER FLUSHING PROCEDURE

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 rear of the transmission.

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 from 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 to the cooler, and the pressure line to the transmission.

5. Start the engine and check the fluid flow. If the fluid flows freely, connect the return line to 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.**

6. 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.**

3 CLEANING AND INSPECTION

Clean all parts with suitable solvent and use moisture free air to dry off all parts and clean out oil passages.

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. 13 in the converter. Expand the bushing in the turbine spline. Rotate the tool to circulate the fluid in the converter.

4. Remove both drain plugs and thoroughly drain the converter.

Repeat steps 2, 3, and 4 as required to clean the converter. Replace the drain plugs.

TURBINE AND STATOR END PLAY CHECK

1. Insert the tool into the converter pump drive hub until it bottoms (Fig. 13).

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 spline.

4. Attach a dial indicator to the tool (Fig. 13). 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 the limits as outlined in the specifications, Part 7-3, replace the converter unit.

STATOR ONE-WAY CLUTCH CHECK

1. Loosen the adjusting nut to free the split bushing, and then remove the tool from the converter.

2. Install the stator outer race holding tool in one of the four holes provided in the stator (Fig 13).

3. Insert the tool in the converter pump drive hub. As the tool enters the converter, the pins will engage the stator clutch inner race spline.

4. Place a torque wrench on the tool (Fig. 13). The tool (and stator inner race) should turn freely clockwise (from the pump drive hub side of the converter). It should lock up and hold a 10 ft-lb pull when the wrench is turned counterclockwise. Try the clutch for lockup and hold in at least 5 different locations around the converter.

5. If the clutch fails to lock up and hold a 10 ft-lb torque, replace the converter unit.

STATOR TO IMPELLER INTERFERENCE CHECK

1. Position the front pump assembly on a bench with the spline end of the stator shaft pointing up (Fig. 14).

2. Mount a converter on the pump so that the splines on the one-way clutch inner race engage the mating splines of the stator support, and the converter hub engages the pump drive gear.

3. While holding the pump stationary, try to rotate the converter counterclockwise. The converter should rotate freely without any signs of inteference or scraping within the converter assembly.

4. If there is an indication of scraping, the trailing edges of the stator blades may be interfering with the leading edges of the impeller blades. In such cases, replace the converter.

STATOR TO TURBINE INTERFERENCE CHECK

1. Position the converter on the bench front side down.

2. Install a front pump assembly to engage the mating splines of the stator support and stator, and pump drive gear lugs.

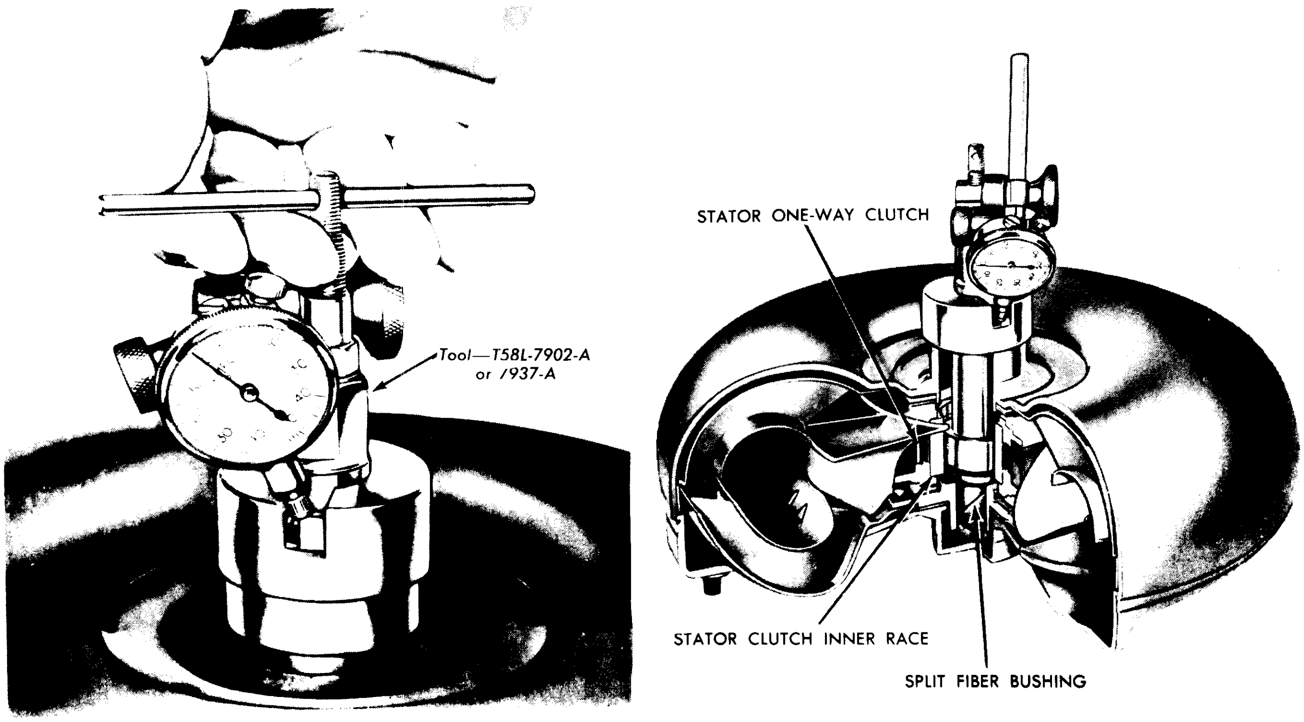
3. Install the input shaft, engaging the splines with the turbine hub (Fig. 15).

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.

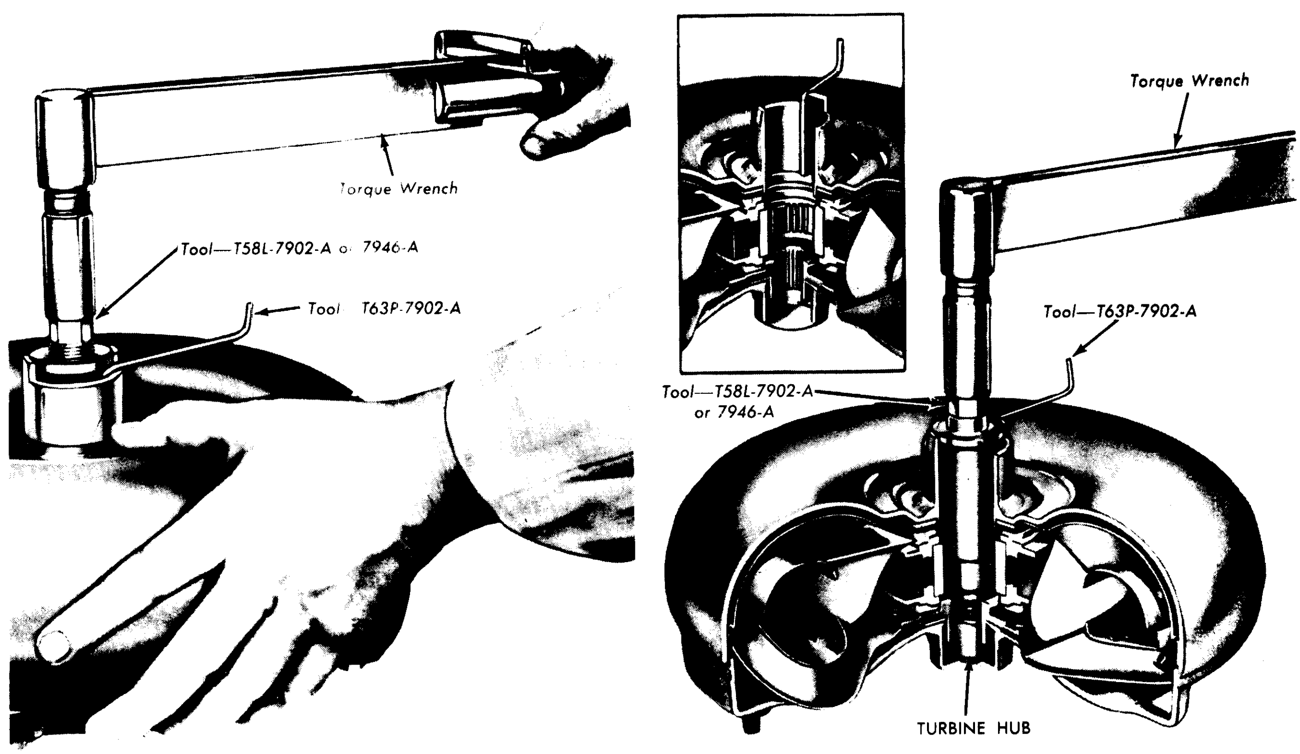
5. If interference exists, the stator front thrust washer may be worn, allowing the stator to hit the turbine. In such cases, the converter must be replaced.

OUTPUT SHAFT AND PRIMARY SUN GEAR SHAFT

1. Inspect the thrust surfaces and journals for scores. Inspect the internal gear for broken or worn teeth.



END PLAY CHECK



STATOR CLUTCH CHECK

D1064-B

FIG. 13—Typical Converter Checking Tool

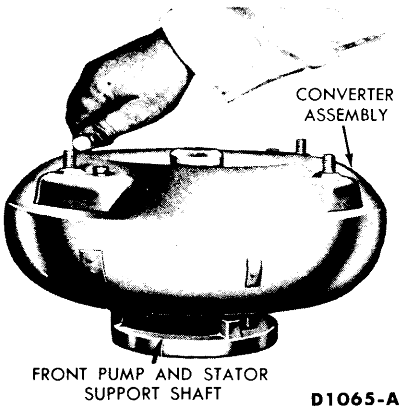


FIG. 14—Stator To Impeller Interference Check

2. Inspect the aluminum sleeve for scores or leakage. Inspect the ring grooves for burrs.

3. Inspect the keyway and drive ball pocket for wear, and inspect the splines for burrs or wear.

4. Inspect the output shaft sleeve for alignment with the governor drive ball (Fig. 16).

5. Inspect the external parking gear teeth for damage and the speedometer drive gear teeth for burrs.

6. If either the output shaft or ring gear has been replaced, place the assembled unit with the gear face down on the bench, push the shaft downward, and check the clearance between the top of the snap ring and its groove (Fig. 17). If this clearance exceeds 0.002 inch, replace the snap ring with a thicker ring to reduce the clearance to less than 0.002 inch. Selective snap rings are available in several thicknesses for this purpose.

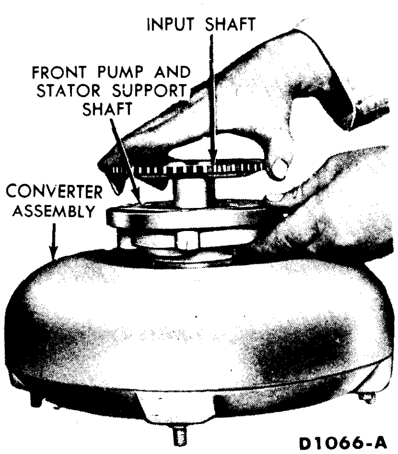


FIG. 15—Stator To Turbine Interference Check

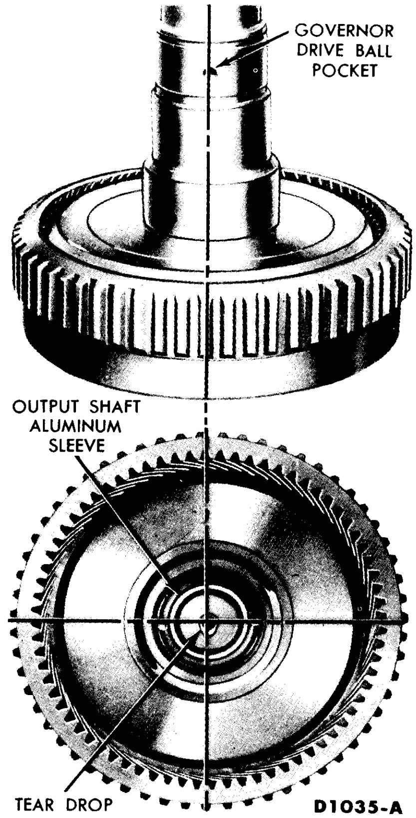


FIG. 16—Correct Position of Output Shaft Sleeve

7. Inspect the rubber seal and stop ring at the front of the output shaft spline. If wear or damage is evident, replace the parts.

8. Inspect the primary sun gear for broken or worn teeth. Inspect all thrust surfaces and journals for scores. Check all fluid passages (Fig. 18) for obstructions and leakage. Inspect the seal ring grooves for burrs.

9. Inspect the sun gear shaft splines for burrs and wear.

10. Check the fit of the seal rings in the grooves of the sun gear shaft. The rings should enter the grooves freely without bind.

11. Check the fit of the sun gear seal rings in their respective bores. A clearance of 0.002-0.009 inch should exist between the ends of the rings.

12. Install the seal rings on the sun gear shaft, and check for free movement in the grooves.

DISTRIBUTOR SLEEVE

1. Inspect the distributor sleeve for scores or excessive ring wear.

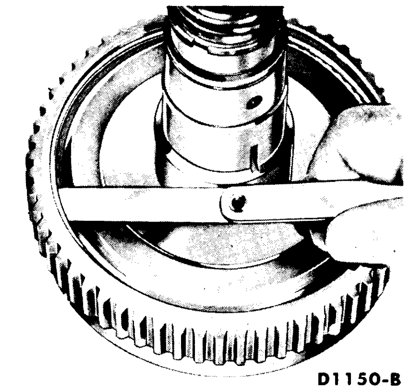


FIG. 17—Checking Output Shaft Snap Ring Clearance

Inspect the distributor sleeve passages for obstructions.

2. Check the fit of the fluid tubes in the distributor.

PINION CARRIER, ONE-WAY CLUTCH AND CENTER SUPPORT

1. Inspect the clutch outer race, inner race, band surface, pinion gears, bearings, and thrust washer for roughness.

2. Inspect the center support bushings for roughness.

3. Inspect the one-way clutch cage rollers and springs for excessive wear or damage.

EXTENSION HOUSING

1. Inspect the housing for cracks. Inspect the gasket surface for burrs or warpage. Check for leakage around the governor inspection cover and gasket. If leakage is found, install a new gasket.

2. Inspect the bushing for scores or wear.

3. Inspect the rear seal for hardness, cracks, or wear. If the seal shows wear or deterioration replace the seal.

Inspect the seal counterbore and remove all burrs and scores with crocus cloth.

REAR CLUTCH

1. Inspect the drum band surface, the bushings, and thrust surfaces for scores. Minor scores may be removed with crocus cloth. Do not smooth out the surface of the drum below a 63 micro finish. **Badly scored parts must be replaced.**

2. Inspect the needle bearing for worn rollers. Inspect the clutch

piston bore and the piston inner and outer bearing surfaces for scores.

Check the air bleed ball valve in the clutch piston for free movement. Check the orifice to make sure it is not plugged.

3. Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.

4. Inspect the clutch plates for scores, and check the plates for fit on the clutch hub serrations. Replace all plates that are badly scored or do not fit freely in the hub serrations. **Front clutch plates differ in friction characteristics from rear clutch plates and are not interchangeable.**

5. Inspect the clutch pressure plate for scores on the clutch plate bearing surface. Check the clutch release spring for distortion. Position the steel plates on a flat surface. Check the coning with a feeler gauge (Fig. 19). The plates are coned 0.010 inch.

FRONT CLUTCH

1. Inspect the clutch cylinder thrust surfaces, piston bore, and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with crocus cloth. Replace the clutch cylinder if it is badly scored or damaged.

2. Check the fluid passage in the clutch cylinder for obstructions. Clean out all fluid passages. Inspect the clutch piston for scores and replace if necessary.

Inspect the piston check ball for freedom of movement and proper seating.

3. Check the clutch release spring for distortion and cracks. Replace the spring if it is distorted or cracked.

4. Inspect the bronze composition and the steel clutch plates and the clutch pressure plate for scored bearing surfaces. Replace all parts that are deeply scored.

5. Check the clutch plates for flatness and fit on the clutch hub serrations. Discard any plate that does not slide freely on the serrations or that is not flat. **Front clutch plates differ in friction characteristics from the rear clutch plates and are not interchangeable.**

6. Check the clutch hub thrust surfaces for scores and the clutch hub splines for wear.

7. Inspect the turbine shaft bearing surfaces for scores. If excessive clearance or scores are found, discard the unit.

8. Check the splines on the turbine shaft for wear and replace the shaft if the splines are excessively worn. Inspect the bushing in the turbine shaft for scores.

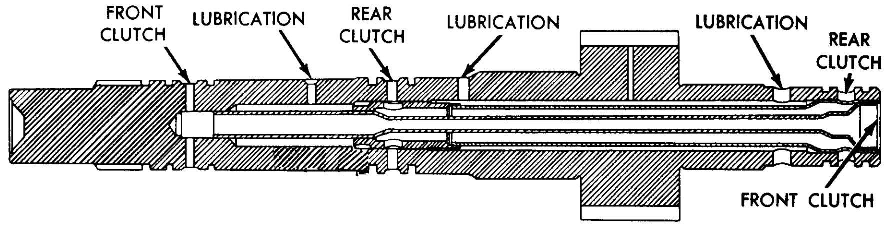


FIG. 18—Cross Section of Primary Sun Gear Shaft

FRONT PUMP

1. Inspect the mating surfaces of the pump body and cover for burrs.

2. Inspect the drive and driven gear bearing surface for scores, and check the gear teeth for burrs. Inspect the stator support splines for burrs and wear.

3. Check the fluid passages for obstructions.

4. If any parts other than the stator support are found defective, replace the pump as a unit. Minor burrs and scores may be removed with crocus cloth. The stator support is serviced separately.

REAR PUMP

1. Remove the drive and driven gears from the pump body.

2. Inspect the gear pockets and the crescent of the pump body for scores or pitting.

3. Inspect the inner bushing and the drive and driven gear bearing surfaces for scores.

4. Check all fluid passages for obstructions, and check mating surfaces and gasket surfaces of the pump body and cover for burrs.

5. Inspect the pump cover bearing surface for scores. Minor burrs or scores may be removed with crocus cloth.

6. If any pump parts, other than the pump cover, are defective, replace the pump as a unit. The pump cover can be replaced separately.

PRESSURE REGULATOR

1. Inspect the regulator body and cover mating surface for burrs.

2. Check all fluid passages for obstructions.

3. Inspect the control pressure and converter pressure valves and bores for burrs and scores. Remove all burrs carefully with crocus cloth.

4. Check free movement of the valves in their bores. The valves should fall freely into the bores when both the valve and bore are dry.

5. Inspect the valve springs and spacers for distortion.

VALVE BODY

1. Clean all parts thoroughly in clean solvent, and then blow them dry with moisture-free compressed air.

2. Inspect all valve and plug bores for scores. Check all fluid passages for obstructions. Inspect the check valve 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.

4. Roll the manual valve on a flat surface to check it for a bent condition.

GOVERNOR

1. Inspect the governor valve and bore for scores. Minor scores may be removed with crocus cloth. Replace the governor if the valve or body is deeply scored.

2. Check for free movement of the valve in the bore. Inspect fluid passages in the valve body and counterweight for obstructions. **All fluid passages must be clean.**

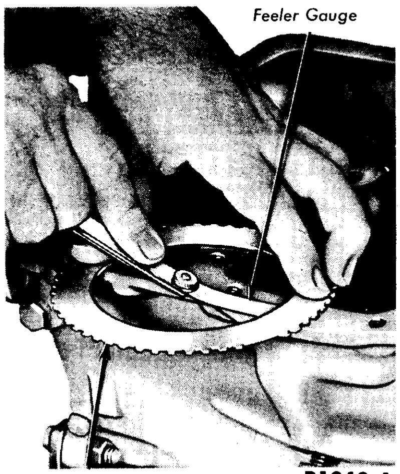


FIG. 19—Check Rear Clutch Steel Plate Coning

3. Inspect the mating surfaces of the governor body and counterweight for burrs and distortion. Mating surfaces must be smooth and flat.

FRONT SERVO

1. Inspect the servo body for cracks and the piston bore and the servo piston stem for scores. Check fluid passages for obstructions.

2. Check the actuating lever for free movement, and inspect it for wear. If necessary to replace the actuating lever or shaft, remove the retaining pin and push the shaft out of the bracket.

Inspect the adjusting screw threads and the threads in the lever.

3. Check the servo spring and servo band strut for distortion.

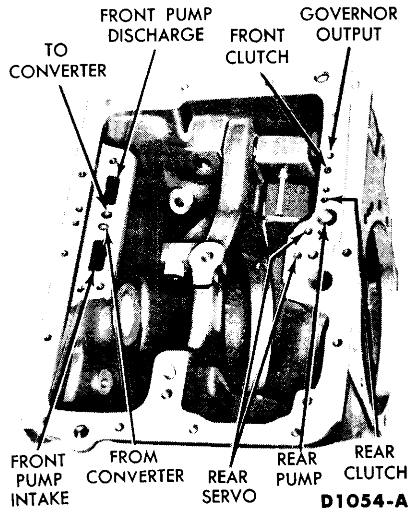


FIG. 20—Transmission Case Fluid Passages

REAR SERVO

1. Inspect the servo body for cracks and the piston bore for scores. Inspect the servo body to transmission case mating surface for burrs.

2. Check the fluid passages for obstructions. Inspect the fluid passage plugs for tightness in the body. Check the orifice in the servo piston for dirt. Inspect the check valve in the servo piston for freedom of movement and proper seating.

3. Inspect the actuating lever socket for scores and wear. Check the actuating lever and shaft for wear.

4. Inspect the band and the struts for distortion. Inspect the band ends for cracks.

5. Inspect the servo spring for distortion.

6. Inspect the servo band lining for excessive wear and bonding to the metal band. **The band should be replaced if worn to a point where grooves are not clearly evident.**

CASE

Inspect the case for cracks and stripped threads. Inspect the gasket surfaces and mating surfaces for burrs. Check the vent for obstructions, and check all fluid passages for obstructions and leakage (Fig. 20).

Inspect the case bushing and center support bushing for scores. Inspect the torsion lever pin for wear.

Check all parking linkage parts for wear or damage.

PART 7-2 CRUISE-O-MATIC TRANSMISSION

1 DESCRIPTION AND OPERATION

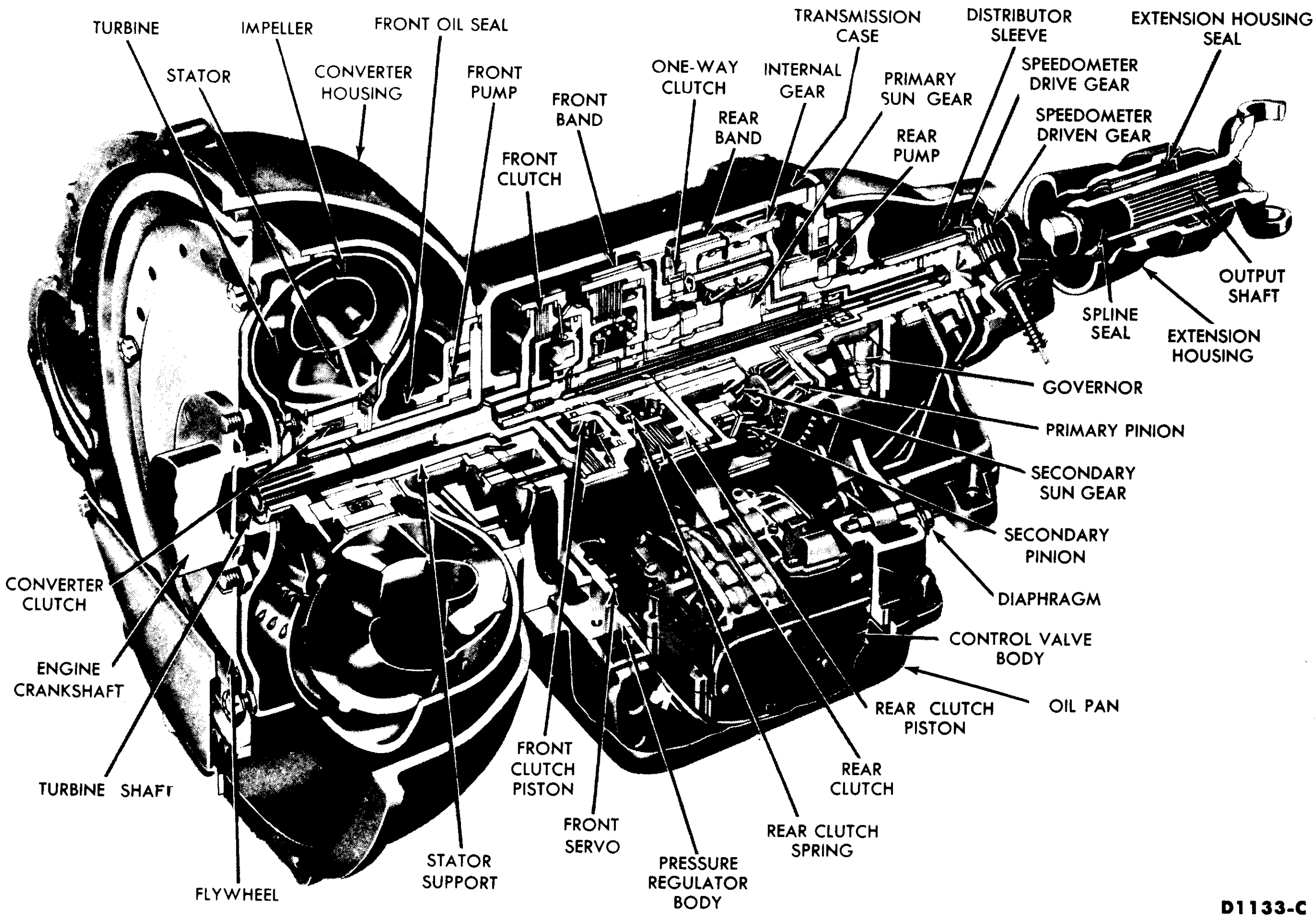


FIG. 1—Typical Cruise-O-Matic Transmission

DESCRIPTION

The Cruise-O-Matic transmission consists of a hydraulic torque converter (Fig. 1) and a planetary gear train along with a hydraulic control system. The various driving ranges are selected by the driver by positioning the shift lever on the steering column in the desired range. The hydraulic control system regulates transmission pressures and automatically selects or changes the gear ratios in relation to the position of the shift lever and speed of the car.

IDENTIFICATION

An identification tag (Fig. 2) attached to the side of the transmission, includes the model prefix and suffix, as well as a service identification number and serial number. The service identification number indicates changes to service details which affect interchangeability **when the transmission model is not changed.** For interpretation of this number, see the Master Parts Catalog.

The tag must be kept with the individual transmission it was originally installed on. If the tag was removed during disassembly, reinstall it on the same unit.

TORQUE CONVERTER

The hydraulic torque converter (Fig. 3) consists of an impeller (pump), a turbine, and a stator. All these parts are enclosed and operate in a fluid-filled housing.

When the engine is running, the fluid in the torque converter flows from the impeller to the turbine and back to the impeller through the

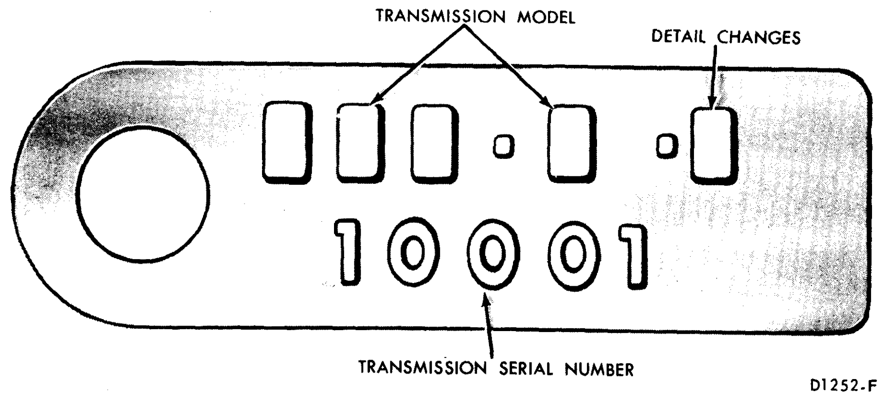


FIG. 2—Transmission Identification Tag

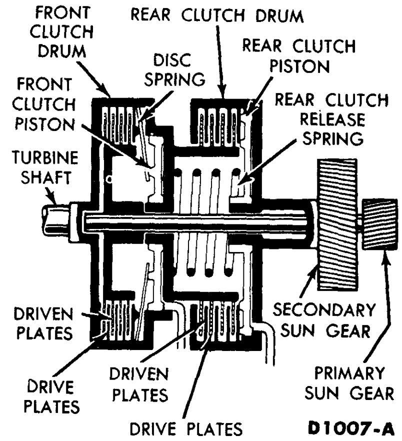


FIG. 5—Front and Rear Clutches

stator. This flow produces a maximum torque increase of about 2 to 1 when the turbine is stalled. When enough torque is developed by the impeller, the turbine begins to rotate, turning the turbine shaft.

The converter torque multiplication gradually tapers off as turbine speed approaches impeller speed, and it becomes 1 to 1 when the turbine is being driven at 9/10 impeller speed. This is known as the "coupling point."

When the turbine is rotating at less than 9/10 impeller speed, the converter is multiplying torque. The fluid leaving the turbine blades strikes the front face of the stator blades. These blades are held stationary by the action of a one-way clutch (Fig. 3) as long as the fluid is directed against the front face of the blades.

When the turbine rotates faster than 9/10 impeller speed, the converter no longer multiplies torque. The fluid is directed against the back face of the stator blades. As the one-way clutch permits the stator to rotate only in the direction of impeller rotation, the stator begins to turn with the impeller and turbine. The converter operates as an efficient fluid coupling as long as the turbine speed remains greater than 9/10 impeller speed.

A constant flow of fluid into and out of the converter is maintained. Some of the fluid coming out of the converter is forced through a cooler located in the radiator tank.

OPERATION OF PLANETARY GEAR TRAIN, CLUTCHES, BANDS, AND SERVOS

PLANETARY GEAR TRAIN

The planetary gear train consists of a primary sun gear, secondary sun gear, primary and secondary pinions which are held in a common carrier, and an internal gear to which the transmission output shaft is attached (Fig. 4).

FRONT CLUTCH

The front clutch drive plates (Fig. 5) are connected to the turbine shaft through the front clutch drum. The driven plates are connected to the primary sun gear shaft.

The front clutch is operated by fluid pressure against the clutch piston. The piston moves against a disc spring which acts as a lever to lock the drive and driven plates together. When the clutch is applied, the primary sun gear is locked to and driven by the turbine shaft. The piston is returned to the release position by the

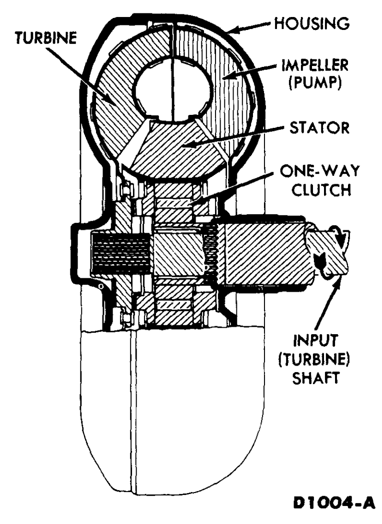


FIG. 3—Cross-Section of Typical Torque Converter

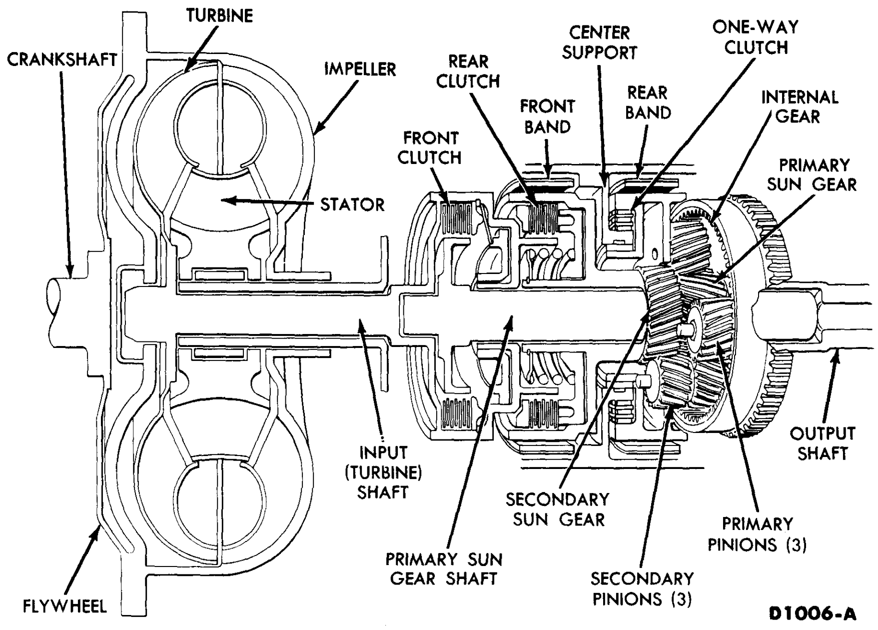


FIG. 4—Planetary Gear Train

disc spring when the fluid pressure is removed (Fig. 5). A check ball is installed in the front clutch piston to permit fluid exhaust when the piston is in its released position.

In neutral, the front clutch drum and steel plates are being driven while the bronze plates are stationary. In reverse, the clutch is not applied, since the steel and bronze plates must rotate in opposite directions.

REAR CLUTCH

The rear clutch (Fig. 5) is operated by fluid pressure against the clutch piston. Movement of the piston compresses the release spring and locks the multiple-disc clutch. The rear clutch drive plates are splined to the front clutch drum and the driven plates are connected to the rear clutch drum and secondary sun gear. When the rear clutch is applied (in the reverse and third gear ratios) the secondary sun gear is driven. The piston is returned to the released position by the release spring (Fig. 5).

In neutral, the rear clutch bronze plates are being driven while the steel plates are free. In second gear, the bronze plates are driven, but the steel plates are held stationary. In first gear, the bronze plates are driven clockwise at engine speed while the steel plates are driven counterclockwise.

FRONT BAND AND SERVO

One end of the front band, which encircles the rear clutch drum, is anchored to the transmission case, and the other end is connected to the front servo (Fig. 6).

Fluid pressure moves the front servo piston against the inner end of the front servo acuating lever. Force is transmitted through a strut between the outer end of the lever and the end of the band to tighten the band around the rear clutch drum. Under certain conditions, the servo is released by directing fluid pressure to the opposite end of the piston, assisted by release spring force.

REAR BAND AND SERVO

The rear band fits around the planetary gear drum. One end of the band contacts the end of the band adjusting screw, and the other end connects to the rear servo.

Two rear servo pistons apply the rear band (Fig. 7). The small (fast acting) piston, which is in direct contact with the servo lever, is located inside the large piston.

Fluid pressure against the large piston flows through a check valve to work against the small piston, which has low pressure resistance from the spring force of the rear band and whatever friction is in the servo lever and band struts. At a low apply pressure and small volume of fluid flow, the small piston moves and tightens the rear band on the pinion carrier.

When the apply pressure builds up to about 10 psi, the large piston moves against its return spring, allowing the check valve to close. When the check valve closes, the fluid in the small piston is trapped, and the apply force of the large piston is added to that of the small piston.

POWER FLOWS

Table 1 lists the ratios obtained through the various power flows.

POWER FLOW–NEUTRAL

When the transmission is in neutral (Fig. 8), no gears are held or driven, and no power is transmitted to the output shaft.

POWER FLOW–FIRST GEAR, L

In first gear when the selector lever is at L, the primary sun gear is driven and the pinion carrier is held by the rear band (Fig. 8). Power is transmitted to the primary pinions, the secondary pinions, and the internal gear, driving the internal gear in the same direction as the primary sun gear. The secondary sun gear turns free in the reverse direction and has no effect on the gear train.

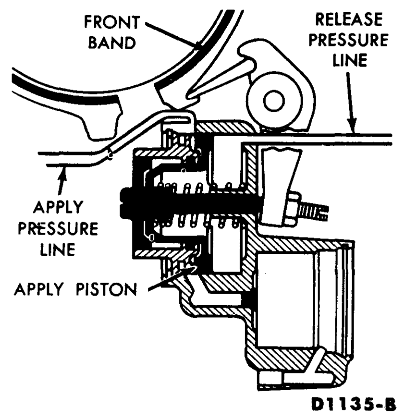


FIG. 6–Typical Front Servo

POWER FLOW–FIRST GEAR, D1

In first gear at the D1 selector lever position (large dot on selector indicator), the pinion carrier is held against rotation by the one-way clutch instead of by the rear band (Fig. 8). First gear in D1 is the only gear that uses the one-way clutch.

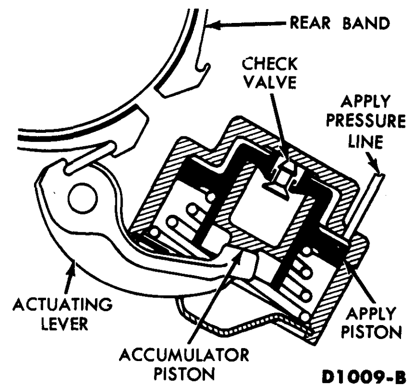


FIG. 7–Typical Rear Band and Servo

Table 1–Cruise-O-Matic Gear Ratios

Gear	Selector Lever Position	Clutch Applied	Band Applied	Gear Ratio
Neutral	N	None	None	–
First	D1 or L	Front	Rear*	2.40:1
Second	D1 or D2	Front	Front	1.47:1
Third	D1 or D2	Front and Rear	None	1.00:1
Reverse	R	Rear	Rear	2.00:1

*In first gear D1, the planet carrier is held against rotation by the one-way clutch.

POWER FLOW—SECOND GEAR

Second gear ratio is obtained by driving the primary sun gear and holding the secondary sun gear (Fig. 8). The primary pinions drive the secondary pinions, causing them to "walk" around the secondary sun gear and to carry the internal gear and output shaft around with them.

POWER FLOW—THIRD GEAR

In third gear, the primary and secondary sun gears are locked together and driven as a unit (Fig. 8). Therefore, the pinions cannot rotate and the entire planetary train revolves as a unit, which causes the output shaft to rotate at the same speed as the turbine shaft.

POWER FLOW—REVERSE

Reverse gear is obtained by driving the secondary sun gear and holding the pinion carrier (Fig. 8). The secondary pinions drive the internal gear in the reverse direction. The primary sun gear and the primary pinions rotate freely and have no effect on the gear train.

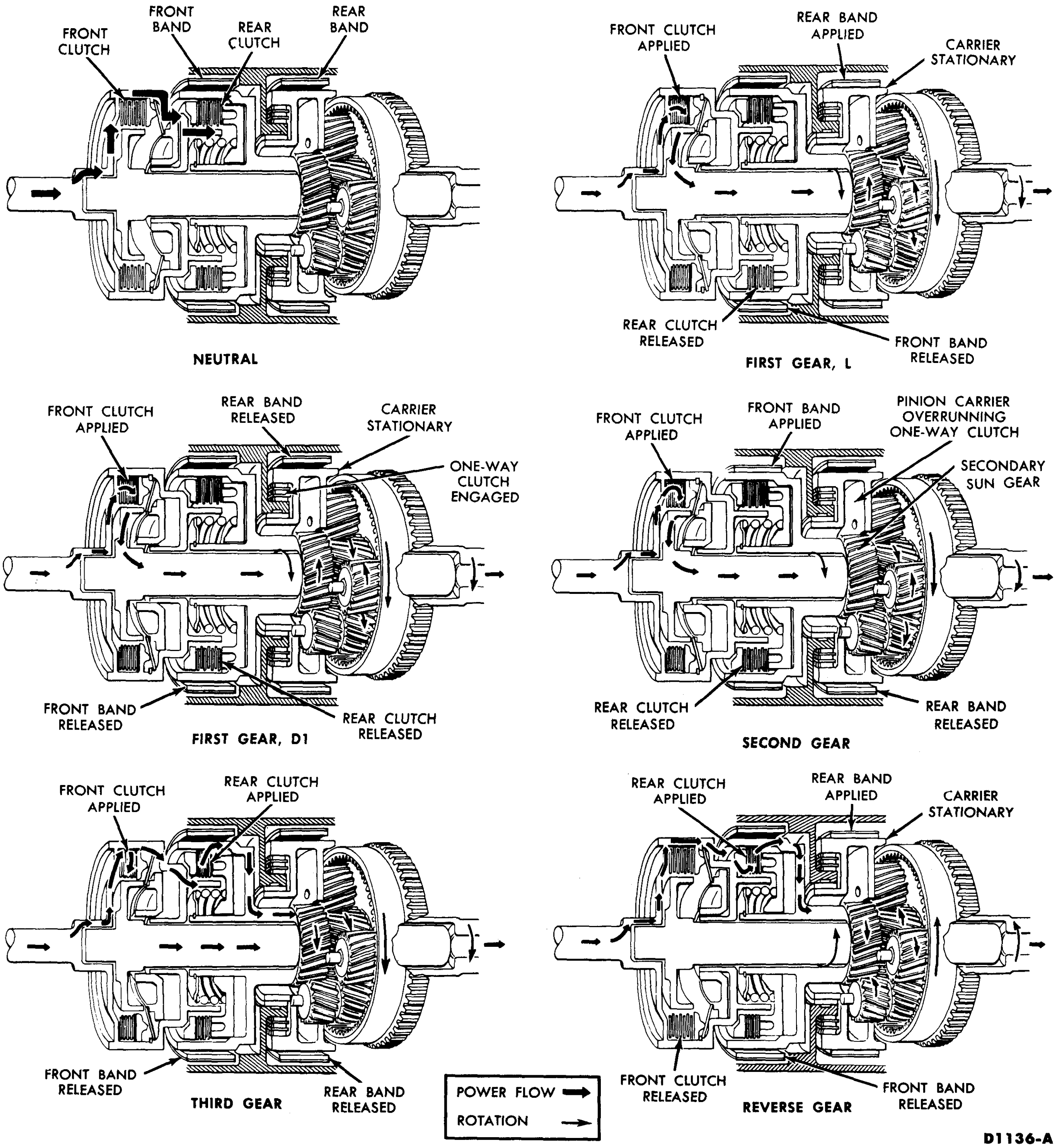


FIG. 8—Power Flow

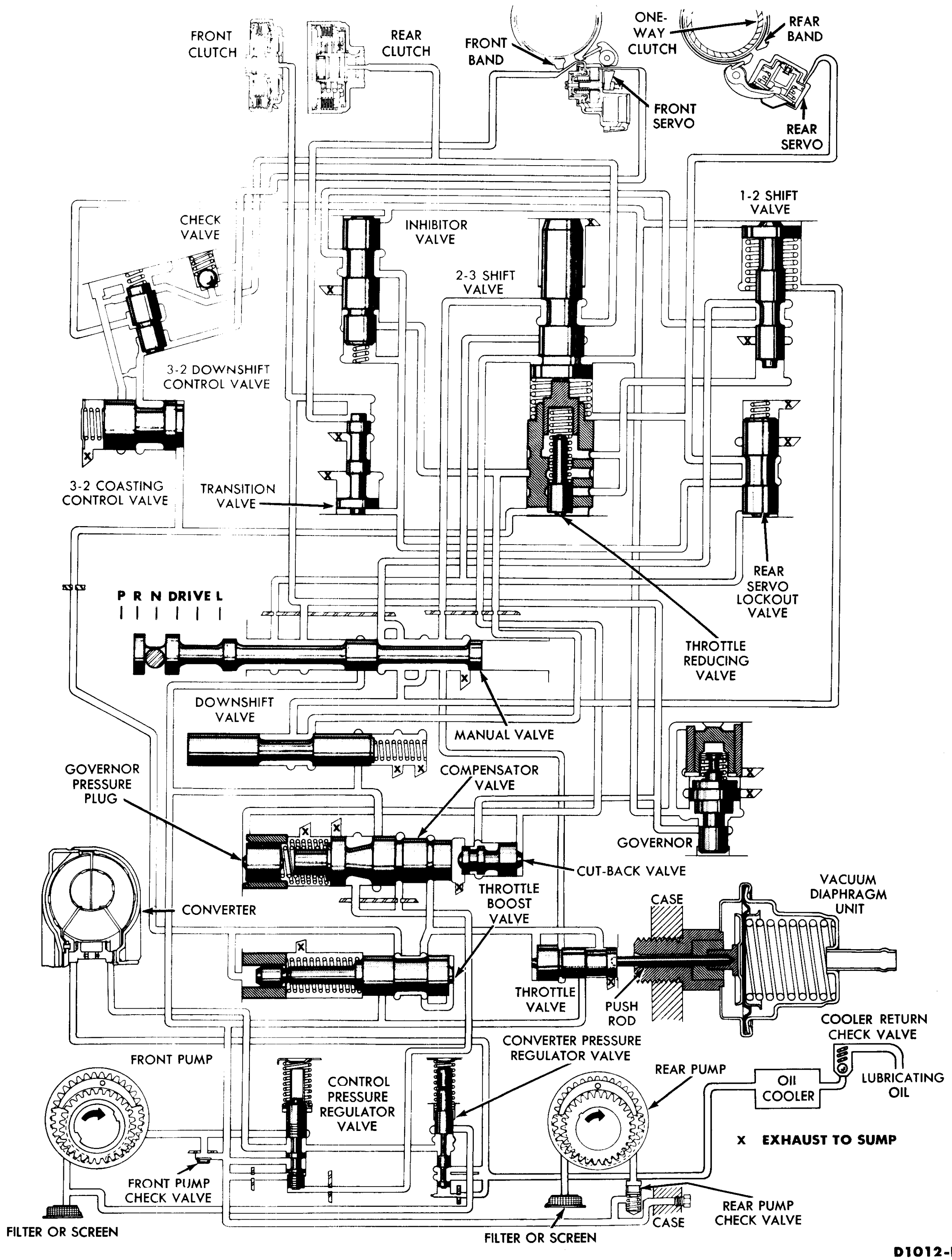


FIG. 9–Hydraulic Control System–Neutral Position

POWER FLOW—PARK POSITION

When the selector lever is in the P (park) position, the parking pawl engages the external teeth on the internal gear to lock the internal gear and output shaft to the case. This locks the rear wheels to prevent movement of the car.

HYDRAULIC CONTROL SYSTEM OPERATION

PRESSURE PUMPS

The front pump, driven by the converter impeller, delivers fluid pressure to the hydraulic control system whenever the engine is running. The rear pump, driven by the transmission output shaft, delivers fluid pressure to the control system when the car moves forward.

Both pumps deliver fluid pressure to the control pressure regulator and control valve body. A regulated control pressure is available at the control valve body whenever the engine is running.

CONTROL PRESSURE AND COMPENSATOR PRESSURE

Control pressure is regulated by the spring-loaded control pressure regulator valve (Fig. 9). It is 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.

CONVERTER PRESSURE

Like control pressure, converter pressure is regulated by the converter pressure regulator valve spring and is adjusted to driving conditions by compensator pressure and selector lever positions.

THROTTLE PRESSURE

Throttle pressure adjusts the transmission operation to engine torque. Throttle pressure is produced from control pressure by the throttle valve (Fig. 9). The throttle valve is controlled by a spring-loaded vacuum diaphragm unit mounted on the rear of the transmission case.

The vacuum diaphragm is actuated by the engine intake manifold vacuum, working against spring pressure. When the vacuum is higher than 16" Hg the diaphragm moves against spring pressure and moves the push rod away from the throttle valve to cut off the throttle pressure regulation. As the engine throttle is advanced, manifold vacuum will fall below 16" Hg. As the vacuum drops, the spring-loaded diaphragm moves the push rod to open the throttle valve and increase the throttle pressure.

THROTTLE PRESSURE BOOST VALVE

To compensate for the slight manifold vacuum changes with throttle movements beyond about 50° carburetor valve opening, a throttle pressure boost valve comes into operation. At 51 psi throttle pressure, the spring-loaded boost valve (Fig. 9) comes into balance. Throttle pressure below 51 psi cannot move the boost valve against spring force plus throttle pressure force acting at the boost valve plug. Below 51 psi, therefore, throttle pressure will flow through the boost valve without interference.

Throttle pressure above 51 psi will move the boost valve to the left (Fig. 9). This movement will first cut off throttle pressure flow to the shift valves and coasting control valve and it will then open a passage to permit the new boosted throttle pressure to flow to the shift valves and the coasting control valve. Throttle pressure will continue to work against the right-hand end of the boost valve. For each pound of increase in throttle pressure (above 51 psi), the boosted throttle pressure will increase about three pounds.

GOVERNOR PRESSURE

Governor pressure is produced from front clutch control pressure by the valve in the governor body which rotates at output shaft speed.

The governor valve is a balanced valve. It is balanced between centrifugal force acting on the governor valve plus governor spring force and governor pressure force (Fig. 9). Governor pressure is, therefore, proportional to road speed.

TRANSITION VALVE

The transition valve controls the front servo apply pressure flow.

In the D1 range, the transition valve blocks front servo apply pressure flow, until the 1-2 valve is closed by governor pressure.

In the D2 range (small dot to the right of N), the transition valve permits front servo apply pressure to flow through it at all times.

1-2 SHIFT VALVE

The 1-2 shift valve controls the 1-2 upshift in the D1 range. On the 2-1 downshift, either manual (shift to L) or kickdown, the 1-2 shift valve controls the shift only within the road speed range permitted by the inhibitor valve.

The 1-2 valve is held in its rest (open) position by a spring. It is closed by governor pressure. Under various driving conditions, governor pressure is opposed by spring force plus reduced throttle and reduced boosted throttle pressures, and control pressure.

REAR SERVO LOCKOUT VALVE

The rear servo lockout valve blocks control pressure flow to the rear servo (rear servo apply pressure) in the D1 and D2 ranges.

THROTTLE REDUCING VALVE

Before throttle pressure or boosted throttle pressure is admitted to the front face of the 2-3 shift valve, it must open a passage past the spring-loaded throttle reducing valve.

Approximately 20 psi throttle pressure is required to move the plug against its spring far enough to open the passage. Once past the valve, throttle pressure will work on the spring end of the valve and exert a force to cut off throttle pressure flow past the valve. In this case, the valve becomes balanced between throttle pressure force on the one end and spring force plus throttle pressure force on the other end. The pressure past the valve will, therefore, be reduced.

2-3 SHIFT VALVE

The 2-3 shift valve controls the 2-3 upshift and the 3-2 downshift. The valve is held in its rest (closed) position by springs. It is opened by governor pressure. Under various driving conditions, governor pressure is opposed by spring force plus throttle or boosted throttle pressures, and control pressure.

INHIBITOR VALVE

The inhibitor valve prevents a 2-1 downshift, either manual or kickdown, at excessive road speeds.

The inhibitor valve is held in its rest (open) position by a spring, and is closed by governor pressure. Under various driving conditions, governor pressure is opposed by spring force plus control pressure.

3-2 COASTING CONTROL VALVE

The 3-2 coasting control valve operates in the front servo release passage.

During a 3-2 closed-throttle downshift in D2 range, the valve is positioned by its spring so that front servo release pressure must exhaust slowly through an orifice. This slow exhaust of release pressure provides a slow front band application.

During a partial-to-full-throttle 3-2 downshift, the 3-2 coasting control valve is positioned by throttle pressure or boosted throttle pressure so that front servo release pressure can exhaust rapidly to provide a rapid front band application.

DOWNSHIFT VALVE

The downshift valve is in the control valve upper body. The inner downshift lever contacts one end of the spring-loaded down-shift valve.

Control pressure is directed to a land of the valve. Linkage is connected between the accelerator pedal and downshift lever. The downshift valve is moved to open a passage to direct control pressure to the shift valves and the inhibitor valve, when the acclerator pedal is depressd through the detent (Fig. 9).

3-2 DOWNSHIFT CONTROL VALVE

The 3-2 downshift control valve operates in the front servo release pressure passage between the 2-3 valve and the front servo. A check valve is installed parallel with the downshift valve in the same passage so that release pressure flow to the servo by-passes it.

The downshift valve controls the rate of front servo release pressure exhaust (flow from the servo), and thereby the rate of front band application.

The 3-2 downshift control valve eliminates the possibility of a runaway condition in the transmission during a 3-2 kickdown at low car speeds (about 25 mph). It also eliminates the possibility of a tie-up during the same shift at higher speeds (50 mph and more).

HYDRAULIC CONTROL SYSTEM—NEUTRAL

The manual valve at N selector lever position blocks the fluid flow to both clutches and both bands (Fig. 9). With no fluid pressure in the clutches or servos, the clutches and bands are released by spring pressure, preventing power being transmitted to the transmission ouput shaft.

Neutral operation of the transmission keeps control pressure up to its proper value, maintains a full torque converter, lubricates the transmission, and maintains a flow of fluid through the cooling system.

HYDRAULIC CONTROL SYSTEM—D1, FIRST GEAR

When the selector lever is moved from N to D1, the manual valve opens three passages to control pressure. From left to right, the first passage admits control pressure to supply the 2-3 valve and close the rear servo lockout valve. The second passage admits control pressure to apply the front clutch, supply the governor and transition valve. The third passage admits control pressure to flow through the 1-2 and inhibitor valves and close the transition valve.

With the front clutch applied, the primary sun gear tries to drive the pinion carrier in a counterclockwise direction. Counterclockwise rotation at the pinion carrier is prevented by the one-way clutch. With the front clutch applied and the pinion carrier held, the transmission is in first gear.

HYDRAULIC CONTROL SYSTEM — D1, SECOND GEAR

The 1-2 shift occurs when governor pressure force on the 1-2 shift valve overcomes shift plug pressure and spring forces. The 1-2 valve moves inward, exhausting the fluid which holds the transition valve closed. The transition valve opens and admits control pressure to apply the front band.

The front clutch remains on, and the front band applies to put the transmission in second gear.

HYDRAULIC CONTROL SYSTEM — D1, THIRD GEAR

The 2-3 shift occurs when governor pressure force overcomes spring and shift plug pressure force at the 2-3 shift valve. When the shift valve opens, control pressure flows through it to apply the rear clutch and release the front band. With both clutches applied, the transmission is in third gear.

HYDRAULIC CONTROL SYSTEM — D2, SECOND GEAR

When the manual valve is at the D2 selector lever position, control pressure to the 1-2 shift valve is cut off. This condition permits control pressure to flow through the transition valve to apply the front band.

With the front clutch and the front band applied the transmission operates in second gear.

HYDRAULIC CONTROL SYSTEM — D2, THIRD GEAR

Operation in D2 range, third gear is the same as in D1 range, third gear except that the closed throttle downshift is from third to second in D2 instead of from third to first as in D1.

HYDRAULIC CONTROL SYSTEM—D1 AND D2 RANGES, 3-2 KICKDOWN

When the accelerator pedal is depressed through the detent, the downshift valve opens a passage that admits control pressure behind the 2-3 shift throttle reducing valve to oppose governor pressure. If the transmission is in high and road speed is below 47-69 mph, the 2-3 valve will be forced closed against governor pressure. When the 2-3 valve closes, control pressure which has been applying the rear clutch and releasing the front band is exhausted. The apply pressure that was in the front servo in third gear is now free to apply the front band. As soon as the front band applies, the transmission is in second gear.

HYDRAULIC CONTROL SYSTEM — L, FIRST GEAR

In L range, first gear, control pressure is directed by the manual valve to apply the front clutch and rear band. Control pressure is also directed by the manual valve to lock the 1-2 and 2-3 shift valves in their closed

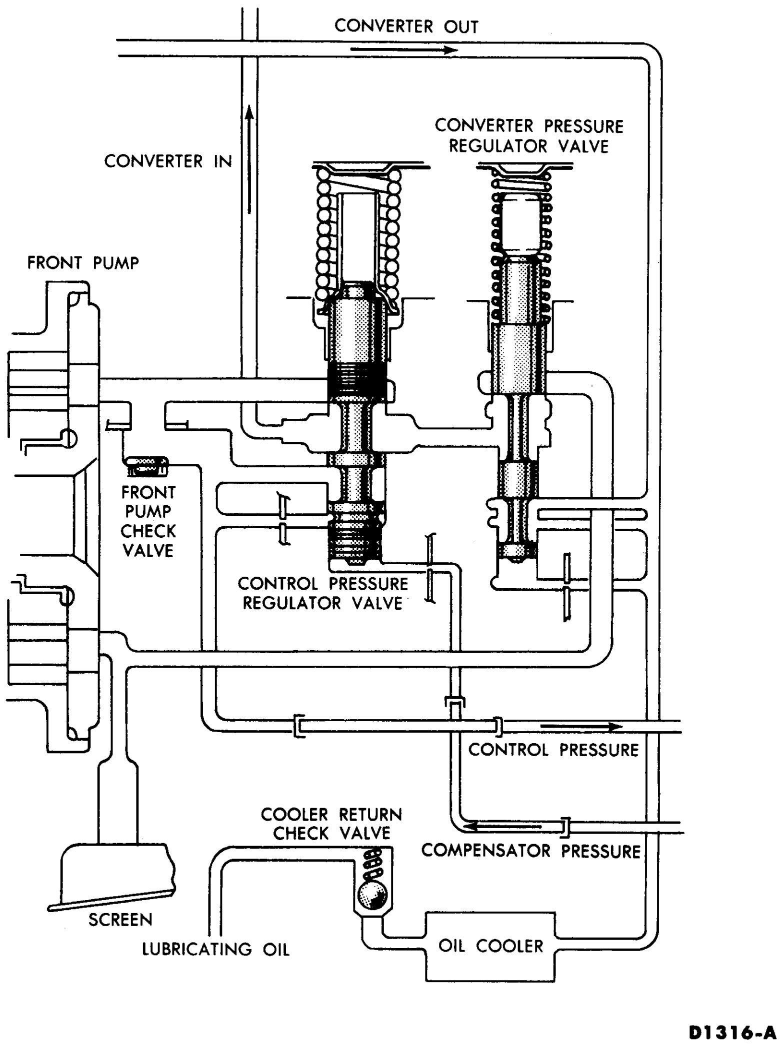


FIG. 10—Series Cooling Pressure Regulator Circuit

positions. Since neither shift valve can move, the transmission will stay in first gear regardless of throttle position or road speed.

HYDRAULIC CONTROL SYSTEM—REVERSE

When the manual valve is shifted into reverse, control pressure is directed to apply the rear clutch and rear band. Governor supply pressure is cut off by the manual valve; hence, the transmission cannot shift automatically. Rear clutch pressure is also directed to the throttle valve to regulate throttle pressure to obtain the correct line pressure for the reverse circuit.

OIL COOLING AND LUBRICATING SYSTEM

Figure 10 shows the transmission series cooling circuit that is used. The converter out circuit is directed through the oil cooler, then the cooled oil is used in the transmission lubricating circuit. Compensator pressure is replaced by converter out pressure at the end of the converter pressure regulator valve.

A spring-loaded check valve is used in the circuit to maintain about 3-5 psi in the converter out circuit. When the converter out circuit exceeds 3-5 psi the check ball opens against spring pressure and cooled oil is directed to lubricate the various parts of the transmission gear train.

2 IN-CAR ADJUSTMENTS AND REPAIRS

The transmission control linkage adjustments should be performed in the order in which they appear in this section of the manual.

THROTTLE AND DOWNSHIFT LINKAGE ADJUSTMENT

1. Apply the parking brake, and place the selector lever in 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 specified idle rpm with the transmission selector in D1 or D2. Due to the vacuum release operation, the parking brake will not hold in D1 or D2. Keep the service brake applied.

The carburetor throttle lever must be against the idle adjusting screw (Fig. 11), at specified idle rpm in D1 or D2.

5. After the engine idle speed has been properly adjusted, stop the engine and adjust the anti-stall dashpot clearance.

Check the clearance between the dashpot plunger and the throttle lever. Bottom the dashpot plunger against its spring, and then adjust the clearance between the bottomed plunger and the throttle lever to specification. Check the position of the fast idle cam. It must be in the hot position.

6. Adjust the accelerator pedal height (Fig. 11) by disconnecting the carburetor connecting link from the carburetor and turning in or out as necessary.

7. Position the speed nut on the downshift lever rod 1¼ inches from the forward face of the bushing in the downshift lever (Fig. 11).

MANUAL LINKAGE ADJUSTMENT

1. With the engine stopped, loosen the nut at the lower end of the manual shift rod on the transmission shift lever.

2. With the steering column in the

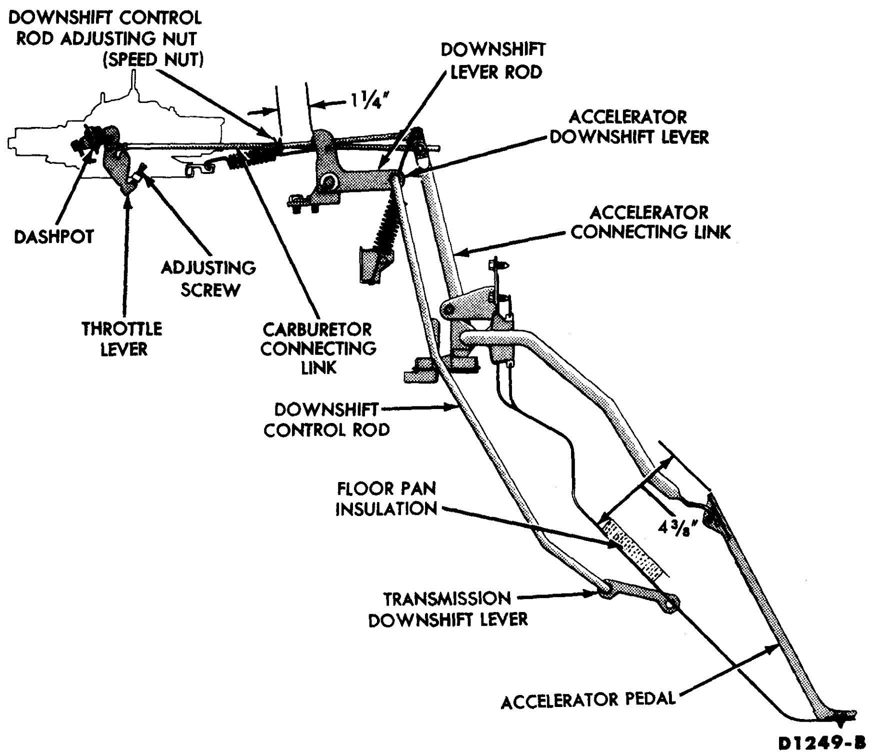


FIG. 11—Throttle Linkage

straight ahead (locked in place) position, move the manual selector lever so that the pointer is down against the steering column stop in the D1 position. **The large green dot on the shift selector indicator is the D1 position (Fig. 12).**

3. Move the shift lever on the transmission to the D1 detent position (second from the bottom).

4. Tighten the nut on the shift rod and shift lever.

5. Check the pointer alignment for all positions of the selector lever and reset if necessary. **Check and if necessary adjust the neutral start switch.**

STARTER NEUTRAL SWITCH ADJUSTMENT

1. With the manual linkage properly adjusted, check the starter engagement circuit in all transmission selector lever positions. The circuit must be open in all drive positions and closed only in park and neutral. (The starter should engage only in park or neutral.)

2. To adjust the switch, loosen the retaining screws that locate the switch on the steering column (Fig. 13).

3. Place the transmission selector lever firmly against the stop of the neutral detent position.

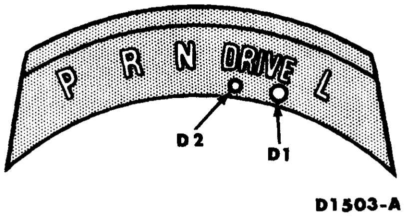


FIG. 12—Selector Lever Positions

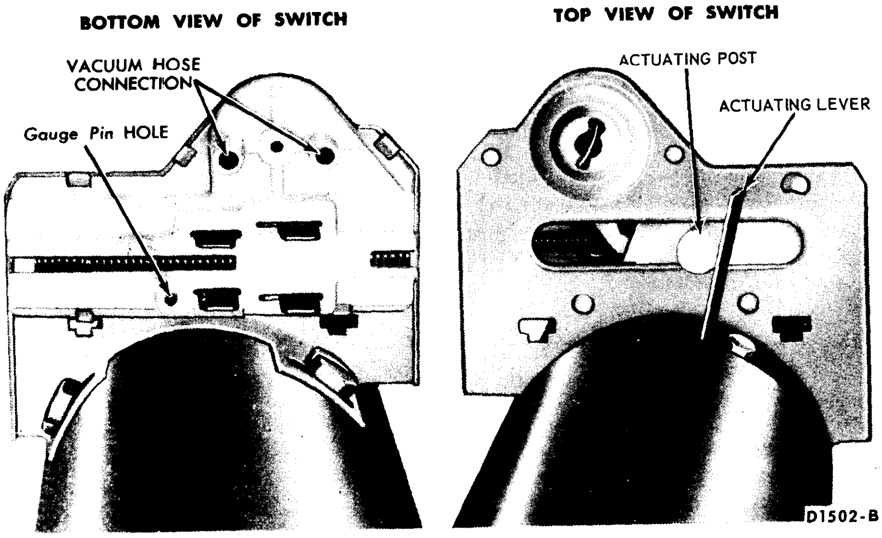


FIG. 13—Starter Neutral Switch

4. Rotate the switch actuating lever until the gauge pin (No. 43 drill shank end) can be inserted into the gauge pin holes (Fig. 13).

5. Tighten the 2 switch retaining screws and remove the gauge pin.

6. Check the operation of the switch in each selector lever position. **The starter should engage in only the neutral and park detent positions. Whenever the manual linkage is adjusted the starter neutral switch should be re-set.**

FRONT BAND ADJUSTMENT

1. Disconnect the fluid filler tube from the oil pan, and drain the fluid from the transmission. **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. Make sure that the container is clean. Re-use the fluid only if it is in good condition.**

2. Remove and thoroughly clean the oil pan. **Do not attempt to clean the filter. If dirty, install a new one.** Discard the oil pan gasket.

3. Loosen the front servo adjusting screw locknut two full turns with a 9/16-inch wrench. Check the adjusting screw for free rotation in the actuating lever after the locknut is loosened, and free the screw if necessary.

4. Pull the adjusting screw end of the actuating lever away from the servo body, and insert the adjusting tool gauge block (Fig. 14) between

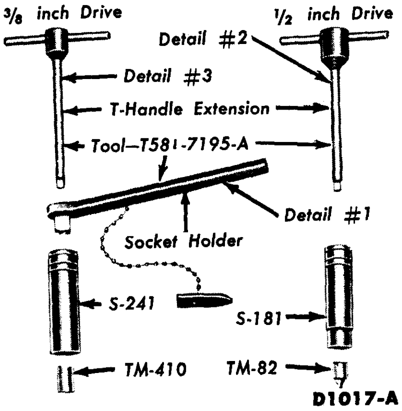


FIG. 14—Front and Rear Band Adjusting Tool

the servo piston stem and the adjusting screw.

5. Install the socket handle on the 9/16-inch socket. Insert the T-handle extension through the socket handle and socket, and install the screwdriver socket on the T-handle extension. Place the tool on the adjusting screw so that the screwdriver socket engages the screw and the 9/16-inch socket engages the locknut. With a torque wrench on the T-handle extension, tighten the adjusting screw to 10 in-lbs torque, and then back off the screw exactly one full turn. **Severe damage may result to the transmission if the adjusting screw is not backed off exactly one full turn.**

6. Hold the adjusting screw stationary, and torque the locknut to specification.

7. Remove the gauge block from the transmission.

8. Place a new gasket on the oil pan; install the filter and pan on the transmission.

9. Connect the filler tube to the oil pan and torque the retaining nut to specifications.

10. Add 3 quarts of transmission fluid. Run the engine for 2 minutes. Place selector lever in P position and check fluid level. Add fluid if necessary.

REAR BAND ADJUSTMENT

1. Working from under the right side of the instrument panel, lift enough carpet away from the console to gain access to the rear band adjustment opening.

2. Remove the plastic plug from the floor pan.

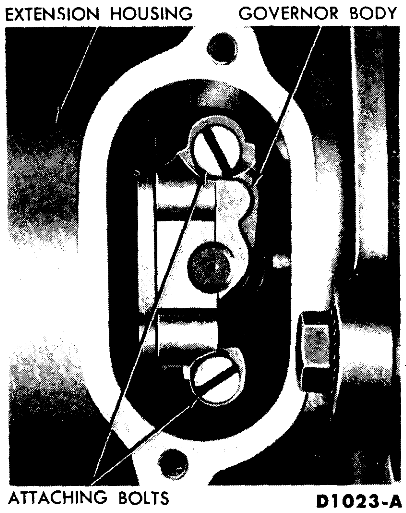


FIG. 15—Governor In Extension Housing

3. Wipe all dirt from the rear band adjusting screw threads, and oil the threads.

4. Place the socket holder on the 3/4-inch socket (Fig. 14). Insert the T-handle extension through the handle and socket. Place the 5/16-inch 8-point socket on the extension. Place a torque wrench on the T-handle extension.

5. Insert the assembled tool in the access hole so that it engages the adjusting screw and the locknut.

6. Loosen the adjusting screw locknut.

7. Torque the adjusting screw to specification.

8. Remove the torque wrench from the T-handle extension and back off the adjusting screw exactly 1½ turns. **Severe damage may result to the transmission if the adjusting screw is not backed off exactly 1½ turns.**

9. Hold the adjusting screw stationary, and torque the locknut to specification.

10. Install the plastic plug in the floor pan.

11. Fit the carpet into place on the console.

GOVERNOR REPLACEMENT

1. Raise the car so that the transmission extension housing is accessible.

2. Remove the governor inspection cover from the extension housing.

3. Rotate the drive shaft until the governor is in line with the inspection hole (Fig. 15).

4. Remove the governor valve body from the counterweight. **Do not drop the attaching bolts or the valve parts into the extension housing.**

5. Lubricate the new governor valve parts with transmission fluid. **The valve must move freely in the valve body bore.**

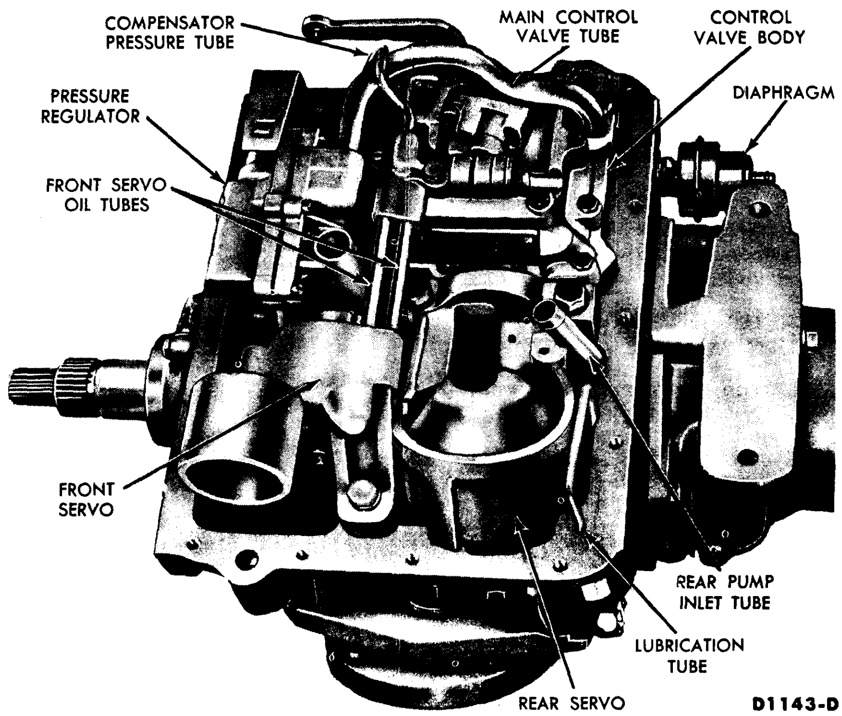


FIG. 16—Typical Hydraulic Control System Parts

6. Install the governor valve body on the counterweight so that the valve body cover is facing rearward. Tighten the two attaching bolts securely.

7. Install the governor inspection cover and a new gasket on the extension housing. Torque the attaching screws to specifications.

OIL PAN AND CONTROL VALVE BODY REPLACEMENT

1. Raise the car so that the transmission oil pan is accessible.

2. Disconnect the fluid filler tube from the oil pan, and drain the fluid from the transmission. **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. Disconnect the hose from the vacuum diaphragm unit. Remove the diaphragm unit using tool FCO-24. **Do not use any tools such as pliers, pipe wrenches, etc., on the diaphragm housing. Do not allow solvents to enter the diaphragm unit.** Remove the push rod.

4. Remove the oil pan and gasket, and discard the gasket.

5. Remove the fluid filter-type screen retaining clip and the screen.

6. Remove the two tubes which connect to the pressure regulator and the control valve body (Fig. 16).

7. Loosen the front servo attaching bolts three turns.

8. Remove the three control valve body attaching bolts, and lower the valve body while pulling it off the front servo oil tubes (Fig. 16). **Be careful not to damage the valve body or the tubes.**

9. Before installing the control valve body, check for a bent manual valve. This is done by rolling the valve on a flat surface.

10. Install the control valve body by aligning the front servo oil tubes with the holes in the valve body. Shift the manual lever to the L detent, and place the inner downshift lever between the downshift lever stop and the downshift valve. **The manual valve must engage the actuating pin in the manual detent lever.**

11. Install, but do not tighten the control valve body attaching bolts.

12. Install the tubes to the pressure regulator and the control valve body.

13. Move the control valve body toward the center of the case as far as the attaching bolts will permit. This movement is made to take up clearance between the manual valve and the actuating pin on the manual detent lever.

14. Torque the attaching bolts to specification.

15. Turn the manual valve one full turn in each manual lever detent position. If the manual valve binds against the actuating pin in any detent position, loosen the valve body attaching bolts and move the body away from the center of the case. Move the valve body only enough to relieve the binding. Torque the attaching bolts and re-check the manual valve for binding.

16. Position the push rod in the bore of the vacuum diaphragm unit. Using the diaphragm unit as a guide, insert the push rod into the threaded opening of the case. Torque the diaphragm unit to specification. Connect the vacuum hose.

17. Torque the front servo attaching bolts to specification.

18. Adjust the front band.

19. Install the fluid filter-type screen and the screen retaining clip.

20. Position a new oil pan gasket on the bottom of the transmission case, and install the oil pan. Torque the oil pan screws to specification.

21. Connect the fluid filter tube to the oil pan, and tighten the fittings securely.

22. Fill the transmission with fluid. **If the fluid that was drained from the transmission is to be used again, filter the fluid through a 100-mesh screen as it is poured back into the transmission. Re-use the fluid only if it is in good condition.**

PRESSURE REGULATOR REPLACEMENT

1. Drain the fluid from the transmission, and remove the oil pan and filter-type screen.

2. Remove the small compensator pressure tube and the large control pressure tube from the control valve body and the pressure regulator (Fig. 16).

3. Remove the pressure regulator spring retainer, springs, and spacer. **Maintain pressure on the retainer to prevent the springs from flying out.**

4. Remove the pressure regulator attaching bolts and washers, and remove the regulator.

5. Position the replacement regulator body in the transmission case and onto the front servo tube, and install the attaching bolts. Torque the bolts to specification.

6. Check the converter pressure and control pressure valves to be sure the valves operate freely in the bores.

7. Install the valve springs, spacer, and retainer.

8. Install the large control pressure tube and small compensator pressure tube.

9. Install the filter-type screen, retaining clip, and the oil pan. Fill the transmission with fluid.

FRONT SERVO REPLACEMENT

1. Drain the fluid from the transmission, and remove the oil pan and fluid screen.

2. Remove the vacuum diaphragm unit.

3. Loosen the three control valve body attaching bolts.

4. Remove the attaching bolts from the front servo (Fig. 16), hold the strut with the fingers, and remove the servo.

5. To install the front servo, position the front band forward in the case with the ends of the band facing downward. Align the large end of the servo strut with the servo actuating lever, and align the small end with the band end.

6. Rotate the band, strut, and servo to align the anchor end of the band with the anchor in the case. Push the servo body onto the control valve body tubes.

7. Install the servo retaining bolts and torque them to specification.

8. Torque the control valve body retaining bolts to specification.

Check the clearance between the manual valve and the manual lever actuating pin as given in Oil Pan and Control Valve Body Replacement.

9. Adjust the front band.

10. Install the vacuum diaphragm unit and rod.

11. Install the filter-type screen, retaining clip and oil pan. Fill the transmission with fluid.

REAR SERVO REPLACEMENT

1. Drain the fluid from the transmission, and remove the oil pan and filter-type screen.

2. Remove the vacuum diaphragm unit.

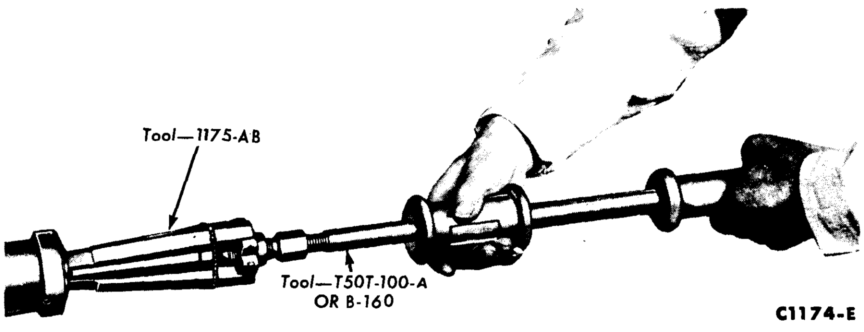


FIG. 17—Extension Housing Seal Removal

3. Remove the control valve body and the two front servo oil tubes.

4. Remove the attaching bolts from the rear servo, hold the actuating and anchor struts with the fingers, and remove the servo.

5. To install the rear servo, position to servo anchor strut on the servo band, and rotate the band to engage the strut.

6. Hold the servo anchor strut in position with the fingers, position the actuating lever strut, and install the servo.

7. Install the servo attaching bolts, and torque them to specification. **The longer bolt must be installed in the inner bolt hole.**

8. Install the two front servo oil tubes and the control valve body.

Check the clearance between the manual valve and the manual lever actuating pin as given in "Oil Pan and Control Valve Body Replacement."

9. Adjust the rear band.

10. Install the filter-type screen and oil pan. Fill the transmission with fluid.

EXTENSION HOUSING BUSHING AND REAR SEAL REPLACEMENT

1. Disconnect the drive shaft from the transmission.

2. Carefully remove the seal with the tool shown in Fig. 17.

3. Remove the bushing as shown in Fig. 18. **Use the bushing remover carefully so that the spline seal is not damaged.**

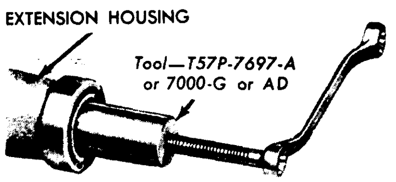


FIG. 18—Extension Housing Bushing Removal

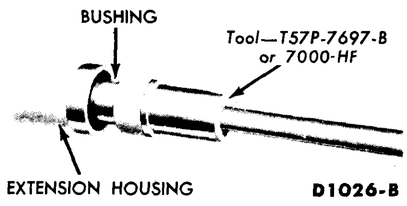


FIG. 19—Installing Extension Housing Bushing

4. When installing a new bushing, use the special tool shown in Fig. 19.

5. Before installing a new seal (Fig. 20), 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. 20. The seal should be firmly seated in the bore.

PARKING PAWL

1. Refer to the "Rear Band Adjustment" procedures for Band Adjusting tool usage.

2. With tool T58L-7195-A, loosen the adjusting stud locknut. Turn the adjusting stud and torque to specification. **This will tighten the rear band around the planet carrier and will hold the planet carrier and clutch assemblies in position during the parking pawl repair operation.**

3. Raise the car and drain the oil from the transmission.

4. Place the adjustable support stand under the rear of the engine.

5. Disconnect the inlet pipes from the exhaust manifolds.

6. Remove the drive shaft.

7. Disconnect the parking brake cables from the crossmember and equalizer bracket.

8. Remove the crossmember to extension housing bolts.

9. Raise the engine with the adjustable support stand until the extension housing clears the rear crossmember.

10. Remove the retaining bolts and crossmember from the frame.

11. Disconnect the speedometer cable from the transmission.

12. Remove the transmission oil pan and filter-type screen.

13. Remove the vacuum control diaphragm unit and control rod.

14. Remove the main control valve assembly retaining bolts and valve assembly.

15. Remove the tubes that go from the case into the rear pump.

16. Remove the extension housing retaining bolts and housing.

17. Remove the output shaft assembly from the case. Do not bend or damage the distributor tubes as they are removed from the case (Fig. 24).

18. Remove the parking pawl toggle pin from the case with a magnet.

19. Remove the retainer, washer

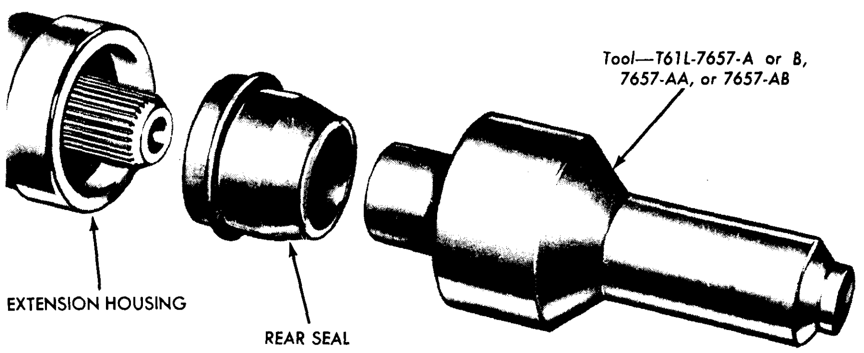


FIG. 20—Extension Housing Rear Seal Installation

and the end of the clip-type spring from the end of the parking pawl link pin.

20. Remove the pawl link pin and broken parking pawl.

21. To assemble the new parking pawl, reverse the above procedure. Use new gaskets and refill the transmission with the specified lubricant. Reset the transmission linkage. **Re-adjust the rear band and replace console parts.**

3 REMOVAL AND INSTALLATION

TRANSMISSION REMOVAL (GEAR CASE)

1. Raise the car on a hoist.

2. Disconnect the fluid filler tube from the oil pan and drain the fluid.

3. Remove the cover from the lower front side of the converter housing. Remove one of the converter drain plugs, rotate the converter 180°, and remove the other plug. Use a commercial flywheel turning tool. **Do not attempt to turn the converter with a wrench on the converter stud nuts.**

4. Disconnect the drive shaft from the pinion flange, and remove the drive shaft. Install the seal replacer in the extension housing seal.

5. Disconnect the Pitman arm to idler arm rod at the Pitman arm end.

6. Remove one bolt on each muffler inlet pipe to chassis bracket (toward rear of chassis).

7. Disconnect the inlet pipes from the engine exhaust manifolds.

8. Disconnect the cooler lines.

9. Disconnect the manual and downshift control rods from the transmission.

10. Remove the diaphragm unit tube from the clip and from the diaphragm unit.

11. Disconnect the speedometer cable from the extension housing.

12. Remove the two engine rear support to transmission bolts.

13. Position a transmission jack under the transmission and raise it slightly to take the weight off the crossmember.

14. Remove two transmission rear support bracket-to-chassis-bracket bolts. Remove the support and hand brake cables from the equalizer. Allow the support and equalizer to hang down from the front brake cable.

15. With the transmission jack in position, remove the four transmission to converter housing bolts.

16. Tilt the rear of the transmission assembly slightly upward, and with the jack move the assembly toward the rear until clear of the converter housing. Lower the assembly and remove it from the car.

TRANSMISSION (GEAR CASE) INSTALLATION

1. Install guide pins in the two top-transmission to converter housing attaching bolt holes.

2. Mount the transmission on the jack and position it under the car. **Be sure to align the turbine shaft splines with the turbine splines and the converter impeller lugs with the slots in the front pump drive gear.**

3. Raise the transmission, move it toward the front of the car, and position it on the converter housing.

4. Install the transmission to converter housing lower attaching bolts. Remove the two guide pins and install the two upper bolts. Torque the bolts to specification.

5. Install the transmission rear support and bolts.

6. Lower the transmission onto the rear support, and install the rear support to transmission bolts.

7. **Lubricate the front universal slip yoke with Ford lubricant B8A-19589-A.** Slide the universal joint yoke onto the output shaft, and then connect the drive shaft to the rear axle.

8. Connect the parking brake linkage.

9. Connect the exhaust system and steering linkage.

10. Connect the vacuum tube.

11. Connect the oil cooler to transmission oil inlet and outlet lines to the transmission and radiator. Tighten the fittings securely.

12. Connect the speedometer cable to the extension housing.

13. Connect the manual linkage to the transmission manual lever, and connect the downshift linkage to the transmission downshift lever.

14. Install the converter drain plugs and converter lower cover.

15. Connect the fluid filler tube to the oil pan. Tighten the fittings securely.

16. Lower the car to the floor, and fill the transmission with fluid. Then check the fluid level.

17. Adjust the linkage.

CONVERTER REMOVAL

1. Remove the transmission.

2. Remove the four stud nuts and flat washers that attach the converter to the flywheel. Replace the converter housing lower front cover to prevent the converter from falling when the housing is removed.

3. Remove the starter cable. Then remove the starter.

4. Remove the six converter housing to engine block bolts.

5. Work the converter housing off the engine dowel pins and remove the housing and converter.

CONVERTER INSTALLATION

1. Place the converter in the housing, and retain it there by installing the lower front cover.

2. Raise the housing and converter into position and start the housing on the engine dowel pins.

3. Start the six converter housing to engine bolts.

4. Remove the converter housing lower front cover and position the converter on the flywheel. Install the four converter to flywheel stud flat washers and nuts. Torque to specification.

5. Torque the converter housing to engine bolts to specification.

6. Install the converter housing lower front cover. Install the starter.

7. Install the transmission.

4 MAJOR REPAIR OPERATIONS

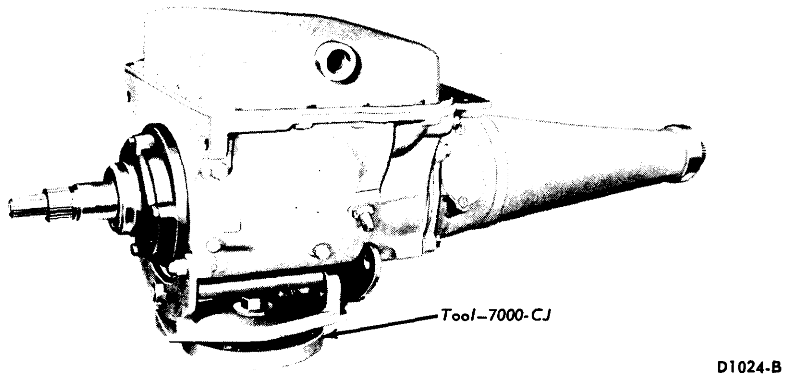


FIG. 21—Transmission Mounted on Bench

DISASSEMBLY

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, place the assembly in the transmission holder shown in Fig. 21.

3. Remove the oil pan, gasket, and filter-type screen clip.

4. Lift the filter-type screen off the forward tube, and then lift it off the rear tube.

5. Remove the spring seat from the pressure regulator. **Maintain constant pressure on the seat to prevent distortion of the spring seat and the sudden release of the springs.** Remove the pressure regulator springs and pilots, but do not remove the valves.

6. Loosen, **but do not remove,** the regulator body attaching bolts.

7. Lift the rear pump intake tube out of the bore in the transmission case. **Be careful not to bend the tube.**

8. Remove the small compensator pressure tube. Then remove the large control pressure tube from the pressure regulator and the control valve body. If necessary, tap the tubes with a soft hammer but do not distort them.

9. Loosen the front and rear servo band adjusting screws 5 turns. Loosen the front servo attaching bolts 3 turns.

10. Remove the vacuum diaphragm unit and push rod.

11. Remove the control valve body attaching bolts. Align the levers to permit removal of the valve body. Then lift the valve body clear of the transmission case. Pull the body off the servo tubes, and then remove it from the case.

12. Remove the regulator body

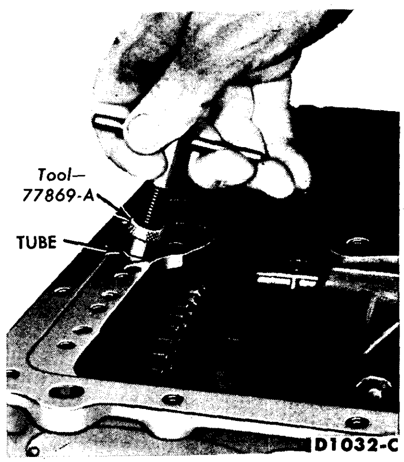


FIG. 23—Rear Pump Discharge Tube Removal

from the case. **Keep the control pressure valve and the converter pressure regulator valve in the pressure regulator to avoid damage to the valves.**

13. Remove the front servo apply and release tubes by twisting and pulling at the same time. Remove the front servo attaching bolts. Hold the front servo strut with the fingers, and lift the servo assembly from the case.

14. Remove the rear servo attaching bolts. Hold the actuating and anchor struts with the fingers, and lift the servo from the case.

TRANSMISSION END PLAY CHECK

1. Remove one of the front pump attaching bolts. Mount the dial indi-

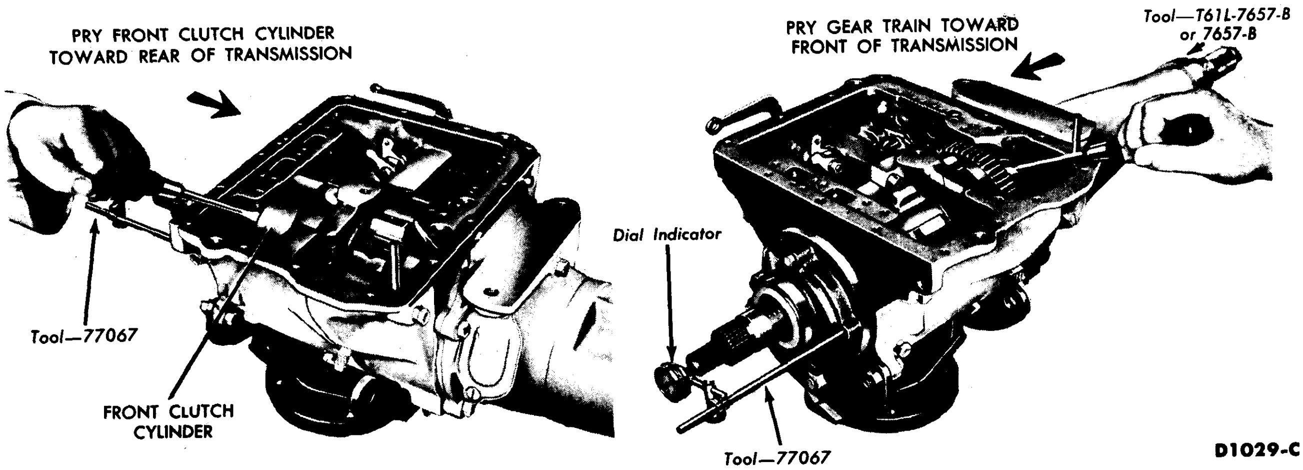


FIG. 22—Transmission End Play Check

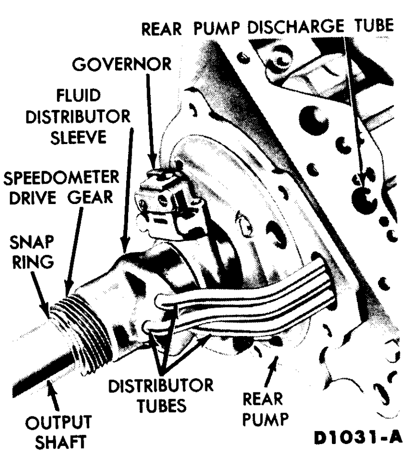


FIG. 24—Output Shaft, Governor and Rear Pump

cator support tool in the front pump bolt hole. Mount a dial indicator on the support so that the contact rests on the end of the turbine shaft as shown in Fig. 22.

2. Install the extension housing seal replacer on the output shaft to provide support for the shaft.

3. Pry the front clutch cylinder to the rear of the transmission with a large screwdriver (Fig. 22). Set the dial indicator at zero while maintaining a slight pressure on the screwdriver.

4. Remove the screwdriver and pry the units toward the front of the transmission by inserting the screwdriver between the large internal gear and the transmission case (Fig. 22).

5. Record the indicator reading for use during transmission assembly. End play should be 0.010-0.029 inch (minimum end play is preferred). If end play is not within specifications, a new selective thickness thrust washer has to be used when the transmission is assembled.

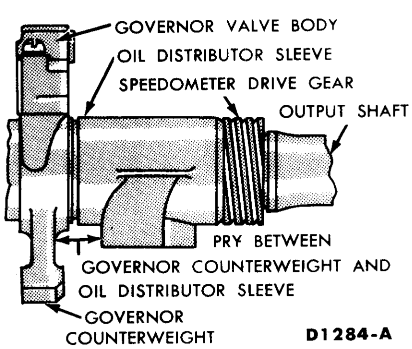


FIG. 25—Pressure Apply Area for Removing Speedometer Gear

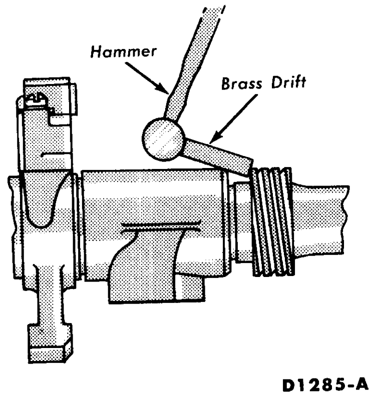


FIG. 26—Speedometer Drive Gear Removal

6. Remove the indicator support, and then remove the seal replacer from the output shaft.

REMOVAL OF CASE AND EXTENSION HOUSING PARTS

1. Remove the remaining front pump attaching bolts. Then remove the front pump assembly and gasket. **If necessary, tap the bolt bosses with a soft hammer to loosen the pump from the case.**

2. Remove the five transmission to extension housing bolts. These bolts also attach the rear pump to the case. Remove the extension housing. Install the tube extractor tool in the rear pump discharge tube (Fig. 23) and remove the tube. Remove the lubrication tube from the case.

3. Remove the output shaft complete assembly (Fig. 24). Be careful not to bend the pressure tubes between the distributor sleeve and case as the tubes are removed from the case.

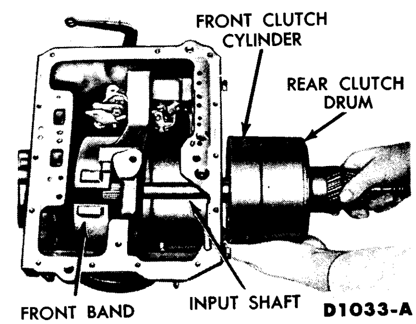


FIG. 28—Input Shaft and Clutch Removal or Installation

4. A nylon speedometer drive gear is used on the output shaft. If gear replacement is necessary, the old type steel gear may be used.

The nylon drive gear is a 0.004-0.010-inch shrink fit on the output shaft and can be removed in the following manner:

5. With the output shaft assembly on the bench, remove the oil distributor tubes from the sleeve. Remove the speedometer drive gear snap ring from the shaft. Pry the oil delivery sleeve toward the rear of the shaft with a hammer handle. Make certain to apply pressure on the governor counterweight, and not against the governor valve body. (Fig. 25).

6. Slide the oil delivery sleeve toward the front of the shaft.

7. Using a hammer and a small brass drift, tap the gear evenly and alternately (Fig. 26) to prevent cocking it on the shaft. Tap the gear gently to prevent damaging it.

8. If the drive gear ball does not fall out as the speedometer gear is removed, remove the ball from the seat in the output shaft.

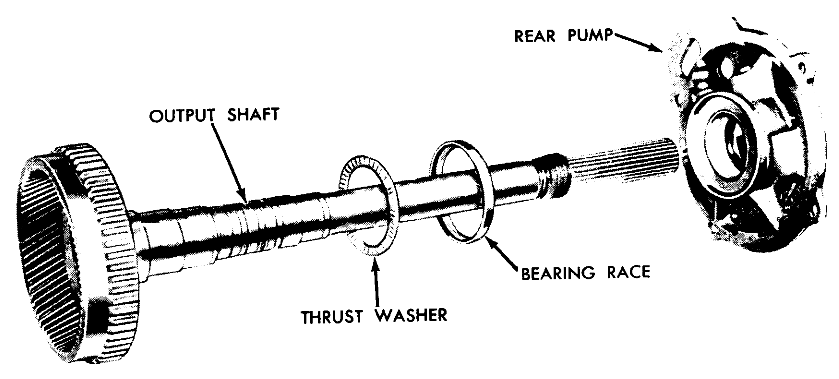


FIG. 27—Output Shaft and Thrust Washer

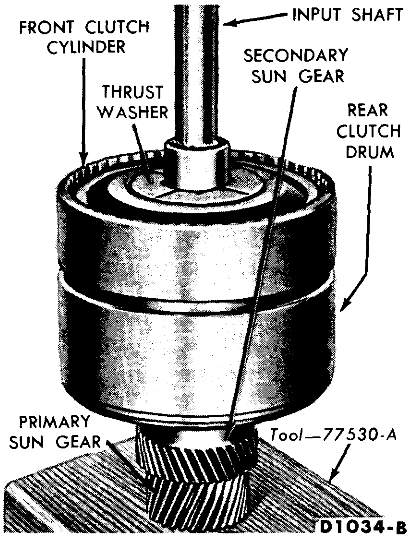


FIG. 29—Input Shaft and Clutch Mounted in Holding Fixture

9. Remove the distributor sleeve. Remove the four seal rings from the output shaft with the fingers to prevent breaking the rings.

10. Remove the governor snap ring from the output shaft. Slide the governor assembly off the output shaft. Then remove the governor drive ball. Remove the rear pump and remove the extension housing and pump gaskets. Remove the rear pump thrust washer and race (Fig. 27).

11. Remove the rear pump drive key from the output shaft. Then remove the bronze thrust washer from the output shaft.

12. Remove the selective thrust washer from the rear of the pinion carrier.

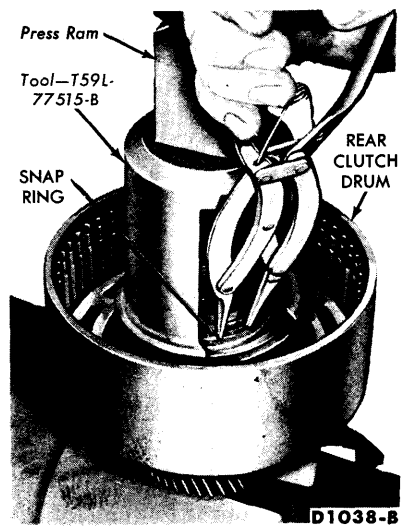


FIG. 30—Rear Clutch Spring Snap Ring Removal

13. Remove the two seal rings from the primary sun gear shaft. Remove the pinion carrier.

14. Remove the primary sun gear rear thrust bearing and race from the pinion carrier.

15. Remove the front clutch sun gear thrust washer race from the sun gear.

16. Note the rear band position for reference in assembly. The end of the band next to the adjusting screw has a depression (dimple) in the center of the boss. Squeeze the ends of the rear band together, tilt the band to the rear, and remove the rear band from the case.

17. Remove the two center support outer bolts (one each side) from the transmission case.

18. Exert enough pressure on the end of the input shaft to hold the clutch units together. Then remove the center support, front and rear clutch assemblies as a unit. (Fig. 28).

19. Install the clutch assemblies in the bench fixture (Fig. 29).

20. Remove the thrust washer from the front of the input shaft.

21. Remove the front band from the case. Lift the front clutch assembly from the primary sun gear shaft.

22. Remove the bronze and the steel thrust washers from the rear clutch assembly. Wire the thrust washers together to assure correct installation.

23. Remove the front clutch seal rings from the primary sun gear shaft.

24. Lift the rear clutch assembly from the primary sun gear shaft.

25. Remove the rear clutch seal rings from the primary sun gear shaft. **Do not break the seal rings.**

26. Remove the primary sun gear front thrust washer.

PARTS REPAIR AND REPLACEMENT

During the repair of the sub-assemblies, certain general instructions which apply to all units of the transmisson 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 transmission fluid. **Do not use any other lubricants.**

Gaskets and thrust washers may be coated with petroleum jelly to facilitate assembly. **Always install new gaskets when assembling parts of the transmission.**

Tighten all bolts and screws to the recommended torque. For detailed Cleaning and Inspection operations refer to Part 7-1.

PRIMARY SUN GEAR SHAFT

1. Position the primary sun gear shaft in the clutch bench fixture.

2. Check the fit of the seal rings in their respective bores. A clearance of 0.002-0.009 inch should exist between the ends of the rings.

3. Install the seal rings on the shaft, and check for free movement of the rings in the grooves of the shaft.

REAR CLUTCH

1. Remove the clutch pressure plate snap ring, and remove the pressure plate from the drum. Remove the bronze and steel plates.

2. Compress the spring in an arbor press with the tool shown in Fig. 30 and remove the snap ring.

3. Guide the spring retainer while releasing the press to prevent the retainer from locking in the snap ring groove.

4. Position the primary sun gear shaft in the rear clutch. Place an air hose nozzle in one of the holes in the shaft, and place one finger over the other hole. Then force the clutch piston out of the clutch drum with air pressure.

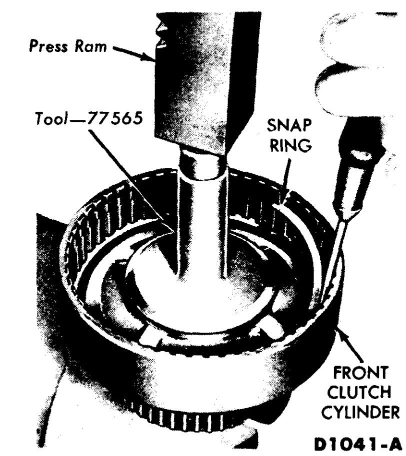


FIG. 31—Front Clutch Snap Ring Removal or Installation

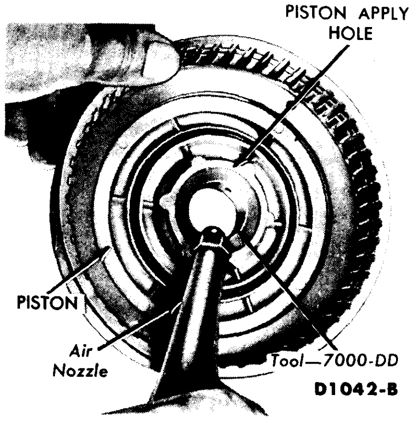


FIG. 32—Front Clutch Piston Removal

Hold one hand over the piston to prevent damage.

5. Remove the clutch piston inner seal ring from the clutch drum. Remove the clutch piston outer seal ring from the groove in the piston.

6. Lubricate all parts to facilitate assembly. Install the clutch piston inner seal ring in the groove in the drum. Install a new outer seal ring on the piston, and install the piston in the clutch drum.

7. Install the clutch release spring, and position the retainer on the spring.

8. Position the clutch assembly in an arbor press, and then position the proper tool on the spring retainer. Compress the clutch spring, and install the snap ring. **While compressing the spring, guide the retainer to avoid interference of the retainer with the snap ring groove. Make sure the snap ring is fully seated in the groove.**

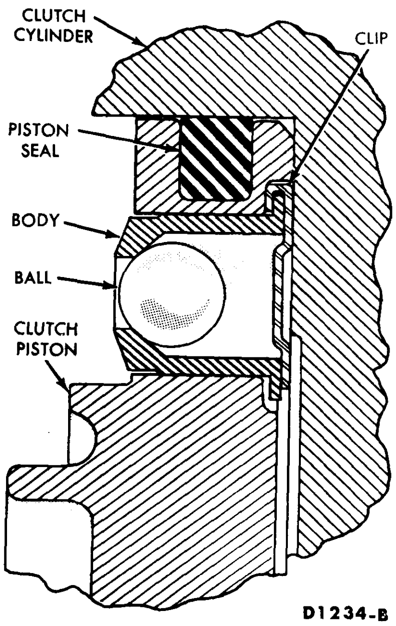


FIG. 33—Front Clutch Piston Seal and Check Valve

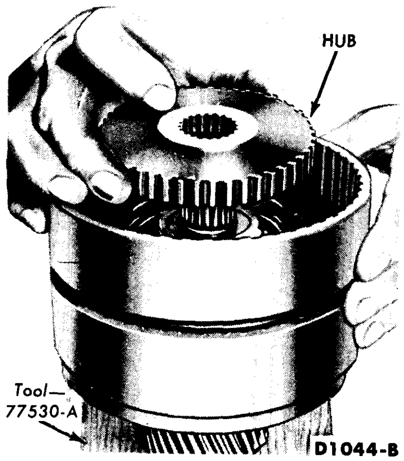


FIG. 34—Front Clutch Hub Installation

9. Install the composition and the steel clutch plates alternately, starting with a steel plate. Because of coning, all steel plates must face the same direction with either all concave or all convex sides up.

10. Install the clutch pressure plate with the bearing surface down. Then install the clutch pressure plate snap ring. Make sure the snap ring is fully seated in the groove.

11. Install the thrust washer on the primary sun gear shaft. Lubricate all parts with automatic transmission fluid or petroleum jelly. Install the two center seal rings.

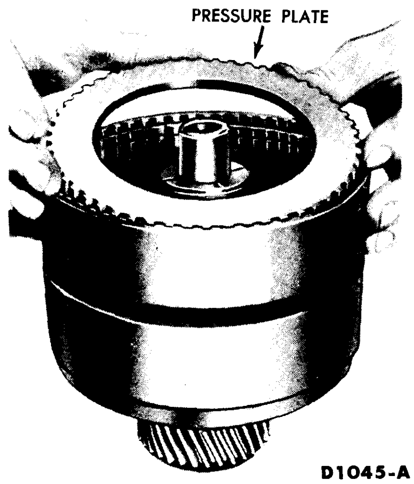


FIG. 35—Pressure Plate Installation

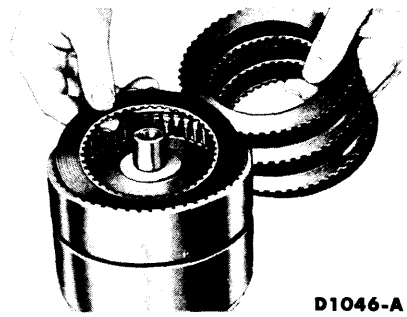


FIG. 36—Clutch Plate Installation

12. Install the rear clutch on the primary sun gear shaft. **Be sure all of the needles are in the hub if the unit is equipped with loose needle bearings.** Assemble two seal rings in the front grooves.

13. Install the steel and the bronze thrust washers on the front of the secondary sun gear assembly. If the steel washer is chamfered, place the chamfered side down.

FRONT CLUTCH

1. Remove the clutch cover snap ring with a screwdriver, and remove the input shaft from the clutch drum.

2. Remove the thrust washer from the thrust surface of the clutch hub. Insert one finger in the clutch hub, and lift the hub straight up to remove the hub from the clutch drum.

3. Remove the composition and the steel clutch plates, and then remove the pressure plate from the clutch drum.

4. Place the front clutch spring compressor on the release spring, position the clutch drum on the bed of an arbor press, and then compress the release spring with the arbor press until the release spring snap ring can be removed (Fig. 31).

5. Remove the clutch release spring from the clutch drum.

6. Install the special nozzle shown in Fig. 32 on an air hose. Place the nozzle against the clutch apply hole

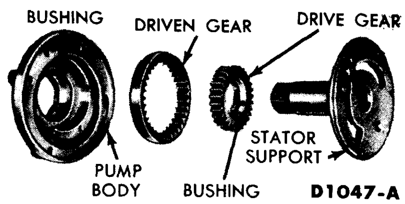


FIG. 37—Front Pump Disassembled

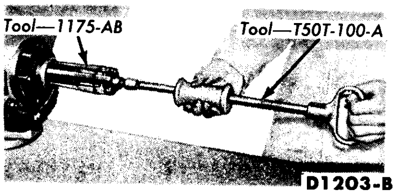


FIG. 38—Front Pump Seal Removal

in the front clutch housing, and force the piston out of the housing.

7. Remove the piston inner seal from the clutch housing. Remove the piston outer seal from the groove in the piston as shown in Fig. 33.

8. Lubricate all parts with transmission fluid. Install a new piston inner seal ring in the clutch cylinder. Install a new piston outer seal in the groove in the piston as shown in Fig. 33.

9. Install the piston in the clutch housing. **Make sure the steel bearing ring is in place on the piston.**

10. Position the release spring in the clutch cylinder with the concave side up. Place the release spring compressor on the spring, and compress the spring with an arbor press. Then install the snap ring as shown in Fig. 31. **Make sure the snap ring is fully seated in the groove.**

11. Install the front clutch housing on the primary sun gear shaft by rotating the clutch units to mesh the rear clutch plates with the serrations on the clutch hub. **Do not break the seal rings.**

12. Install the clutch hub in the clutch cylinder with the deep

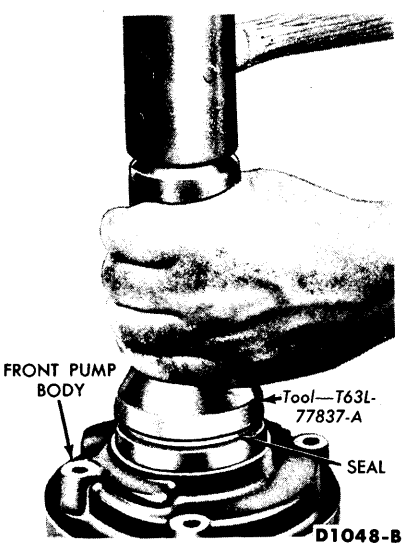


FIG. 39—Installing Front Pump Seal

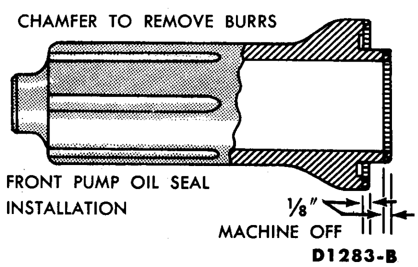


FIG. 40—Dimensions for Reworking Front Pump Seal Installing Tool

counter-bore down (Fig. 34). Install the thrust washer on the clutch hub.

13. Install the pressure plate in the clutch cylinder with the bearing surface up (Fig. 35). Install the bronze composition and the steel clutch plates alternately, starting with a bronze plate (Fig. 36). Lubricate the plates as they are installed.

14. Install the turbine shaft in the clutch cylinder, and then install the snap ring. **Make sure the snap ring is fully seated in the groove.**

15. Install the thrust washer on the turbine shaft.

FRONT PUMP

1. Remove the stator support attaching screws and remove the stator support. Mark the top surface of the pump driven gear with Prussian blue to assure correct assembly. **Do not scratch the pump gears.**

2. Remove the drive and driven gears from the pump body.

3. Refer to Fig. 37 for a disassembled view of the front pump. Inspect the pump body housing, drive gear bushing, gear pockets, and crescent for scores.

4. If any parts other than the stator support are found defective, replace the pump as a unit. Minor burrs and scores may be removed with crocus cloth. The stator support is serviced separately.

5. Bolt the front pump to the transmission case with capscrews.

6. Install the oil seal remover shown in Fig. 38. Then pull the front seal from the pump body.

7. Clean the pump body counterbore. Then inspect the bore for rough spots. Smooth up the counterbore with crocus cloth.

8. Remove the pump body from the transmisssion case.

9. Coat the outer diameter of a new seal with FoMoCo Sealing Compound, or its equivalent. Then position the seal in the pump body. Drive the seal into the pump body with the tool shown in Fig. 39 until the seal is firmly seated in the body. Tool 77837 may be reworked (Fig. 40) to install the latest type seal.

10. Place the pump driven gear in the pump body with the mark on the gear facing upward. Install the drive gear in the pump body.

11. Install the stator support and attaching screws. Check the pump gears for free rotation.

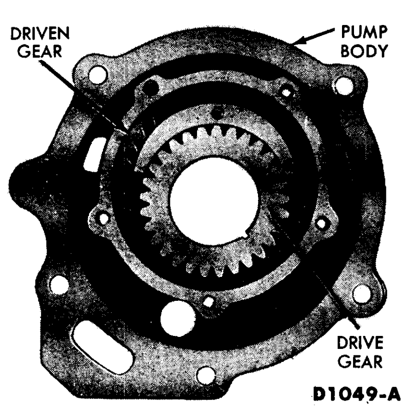


FIG. 41—Rear Pump

REAR PUMP

1. Remove the screws and lockwashers which secure the pump cover to the pump body, and remove the cover. Mark the top face of the pump drive and driven gear with Prussian blue to assure correct installation of gears at assembly (Fig. 41). **Do not scratch or punch marks on the pump gears.**

2. Remove the drive and driven gears from the pump body.

3. Place the pump driven gear in the pump body with the mark (placed on the gear at disassembly) facing upward.

4. Install the drive gear in the body with the mark facing upward. Install the pump cover, attaching screws, and lockwashers. Torque the screws to specification.

5. Check the pump for free rotation of the gears.

PRESSURE REGULATOR

1. Remove the valves from the regulator body.

2. Remove the regulator body cover attaching screws, and remove the cover (Fig. 42).

3. Remove the separator plate. Then remove the front pump check

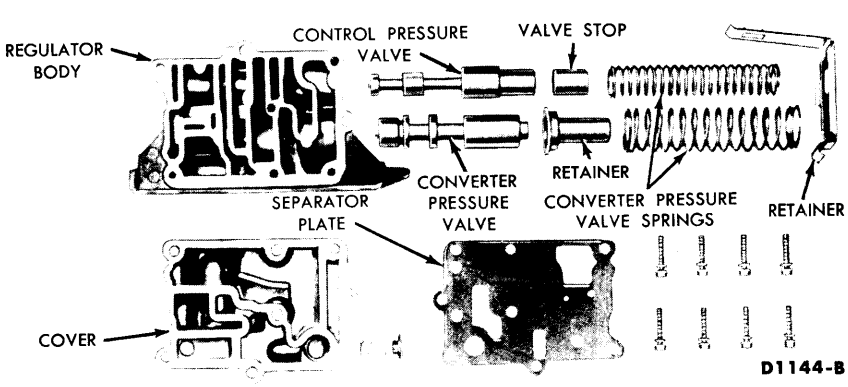


FIG. 42—Pressure Regulator Assembly

valve and spring from the regulator cover.

4. Wash all parts thoroughly in clean solvent and blow dry with moisture-free compressed air.

5. Inspect the regulator body and cover mating surfaces for burrs.

6. Check all fluid passages for obstructions.

7. Inspect the control pressure and converter pressure valves and bores for burrs and scores. Remove all burrs carefully with crocus cloth.

8. Check the free movement of valves in their bores. Each valve should fall freely into its bore when both the valve and bore are dry.

9. Inspect the valve springs for distortion.

10. Position the check valve spring and valve in the regulator cover.

11. Position the separator plate on the regulator cover.

12. Position the regulator cover and separator plate on the regulator body, and install the attaching screws. Torque the screws to specification.

13. Insert the valves in the pressure regulator body (Fig. 42).

CONTROL VALVE BODY

During the disassembly of the control valve assembly, avoid damage to valve parts and keep the valve parts clean. Place the valve assembly on a clean shop towel while performing the disassembly operation. **Do not separate the upper and lower valve bodies and cover until after the valves have been removed.**

1. Remove the manual valve (Fig. 43).

2. Remove the throttle valve body and the separator plate. Remove the throttle valve and retainer.

3. Remove one screw attaching the separator plate to the lower valve body. Remove the upper body front plate. **The plate is spring-loaded. Apply pressure to the plate while removing the attaching screws.**

4. Remove the compensator sleeve and plug, and remove the compensator valve springs. Remove the compensator valve.

5. Remove the throttle boost short valve and sleeve. Remove the throttle boost valve spring and valve.

6. Remove the downshift valve and spring.

7. Remove the upper valve body rear plate.

8. Remove the compensator cut back valve.

9. Remove the lower body side plate (Fig. 43). **The plate is spring-loaded. Apply pressure to the plate while removing the attaching screws.**

10. Remove the 1-2 shift valve and spring. Remove the inhibitor valve and spring.

11. Remove the two screws attaching the separator plate to the cover. Remove the lower body end plate. **The end plate is spring-loaded. Apply pressure to the plate while removing the attaching screws.**

12. Remove the rear servo lockout valve and spring.

13. Remove the 2-3 delay and throttle reducing valve sleeve, the throttle reducing valve, spring, and the 2-3 shift delay valve. Remove the 2-3 shift valve spring and valve.

14. Remove the transition valve.

15. Remove the plate (Fig. 43) from the valve body cover.

16. Remove the check ball spring and check ball. Remove the 3-2 kick-down control valve spring and valve.

17. Remove the 3-2 coasting control valve spring retainer from the cover. Remove the spring and valve.

18. Remove the through bolts and screws. Then separate the bodies.

19. Inspect the rear pump check valve for freedom of movement. This valve seats in the lower body, is staked for a firm fit and should not be removed unless a new one is to be installed.

20. Arrange all parts in their correct positions (Fig. 43). Rotate the valves and plugs when inserting them in their bores to avoid shearing of soft body castings.

21. Position the separator plate on the upper body.

22. Be sure that the rear pump check valve spring, valve, and seat in the lower body are correctly installed. Position the lower body on the upper body, and start **but do not tighten** the attaching screw.

23. Position the cover and separator plate on the lower body and start the four through bolts.

24. Align the separator with the upper and lower valve body attaching bolt holes. Install and torque the four valve body bolts to specification. **Excessive tightening of these bolts may distort the valve bodies, causing valves or plugs to stick.**

25. Install the 3-2 kick-down control valve and spring and the check ball and spring in the cover. Install the plate.

26. Install the 3-2 coasting control valve, spring, and spring retainer in the cover.

27. Install the transition valve in the lower body.

28. Install the 2-3 shift valve and spring. Install the 2-3 shift delay valve and the spring and throttle reducing valve in the sleeve. Slide the sleeve and valve into position in the lower body.

29. Install the rear servo lockout valve spring and valve. Install the lower body end plate.

30. Install the inhibitor valve spring and valve in the lower body.

31. Install the 1-2 shift valve spring and valve. Install the lower body side plate.

32. Install the compensator cut-back valve in the upper body. Install the upper body rear plate.

33. Install the downshift valve spring and valve.

34. Install the throttle boost valve and spring. Install the throttle boost short valve and sleeve.

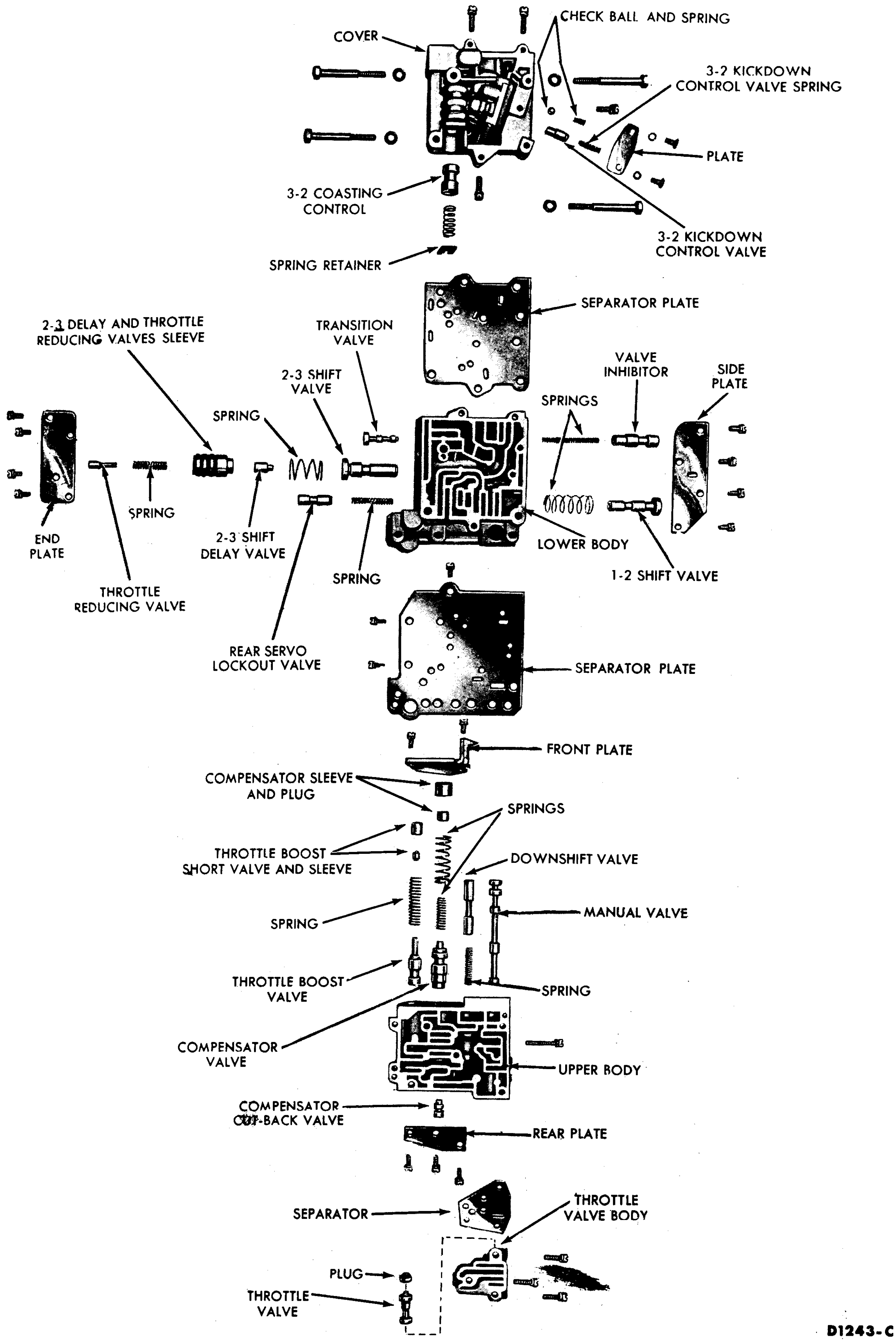


FIG. 43—Control Valve Body Disassembled

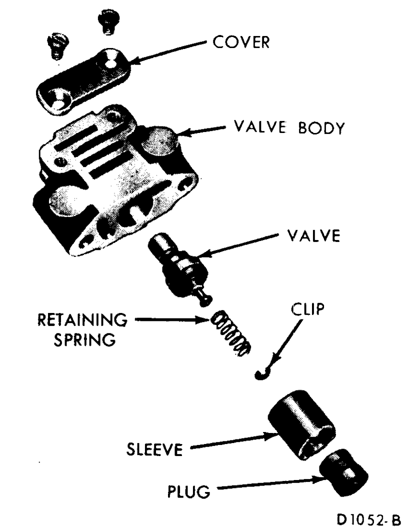


FIG. 44—Governor Disassembled

35. Install the compensator valve, inner and outer compensator springs, and the compensator sleeve and plug.

36. Position the front plate. Apply pressure to the plate while installing the two attaching screws.

37. Install the throttle valve and retainer in the throttle valve body. Position the separator on the upper body and install the throttle valve body. Install the three attaching screws.

38. Install four screws attaching the cover to the lower body, two screws attaching the separator plate to the upper body, and one screw attaching the separator plate to lower body. Torque the cover and body screws to specification.

39. Install the manual valve.

GOVERNOR

1. Remove the governor valve body cover.

2. Remove the valve body from the counterweight.

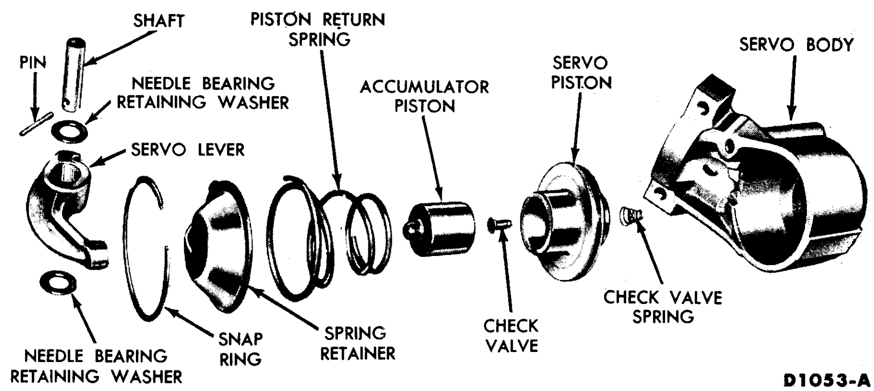


FIG. 46—Rear Servo

3. Remove the plug, sleeve, and valve from the body (Fig. 44).

4. Install the governor valve and spring assembly in the bore of the valve body. Install the sleeve, and plug. Make sure the three points on the end of the sleeve seat in the slots in the washer.

5. Install the body on the counterweight. **Make sure the fluid passages in the body and the counterweight are aligned.**

6. Position the valve body cover on the body, and install the screws.

FRONT SERVO

1. Remove the servo piston retainer snap ring (Fig. 45). The servo piston is spring loaded. **Apply pressure to the piston when removing the snap ring.**

2. Remove the servo piston retainer, servo piston, and the return piston from the servo body. It may be necessary to tap the piston stem lightly with a soft hammer to separate the piston retainer from the servo body.

3. Remove the screw and washer from the end of the piston stem, and separate the piston retainer, return piston, and servo piston.

4. Remove all the seal rings, and remove the spring from the servo body.

5. Inspect the servo body for cracks and the piston bore and the servo piston stem for scores (Fig. 45). Check fluid passages for obstructions.

6. Check the actuating lever for free movement, and inspect it for wear. If necessary to replace the actuating lever or shaft, remove the retaining pin and push the shaft out of the bracket. If the shaft is not retained by a pin, it is retained in the body by serrations on one end of the shaft. These serrations cause a press fit at that end. To remove the shaft, press on the end opposite the serrations.

Inspect the adjusting screw threads and the threads in the lever.

7. Check the servo spring and servo band strut for distortion.

8. Inspect the servo band lining for excessive wear and bonding to the metal. **The band should be replaced if worn to a point where grooves are not clearly evident.**

9. Inspect the band ends for cracks and check the band for distortion.

10. To assemble, reverse the disassembly procedure.

REAR SERVO

1. Remove the servo actuating lever shaft retaining pin with a 1/8-inch punch. Remove the shaft and actuating lever needle bearings and thrust washers.

2. Press down on the servo spring retainer, and remove the snap ring. **Release the pressure on the retainer slowly to prevent the spring from flying out.**

3. Remove the retainer and servo spring (Fig. 46).

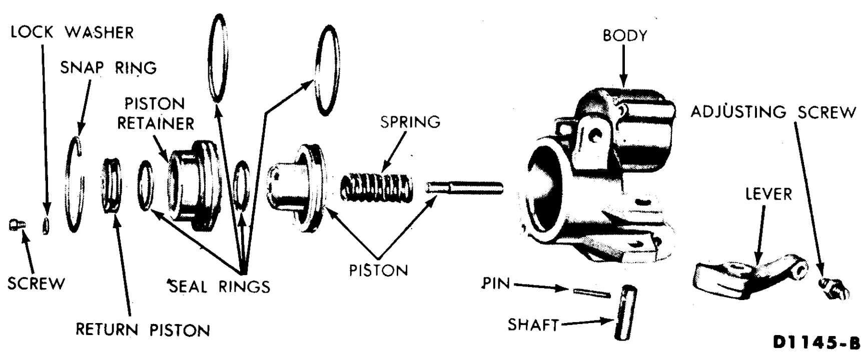


FIG. 45—Front Servo Disassembled

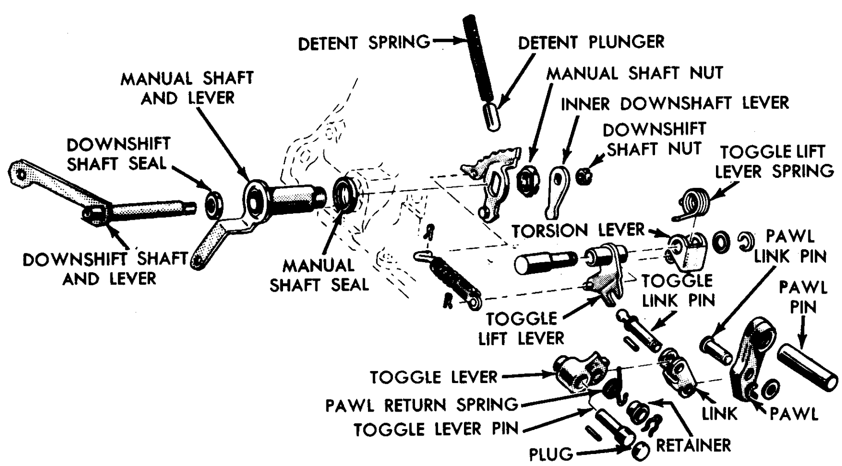


FIG. 47—Cruise-O-Matic Transmission Case Control Linkage

4. Force the piston out of the servo body with air pressure. Hold one hand over the piston to prevent damage.

5. Remove the piston seal ring. Remove the accumulator piston from the servo piston.

6. Install the accumulator piston in the servo piston.

7. Install a new seal ring on the servo piston.

8. Install the piston in the servo body. **Lubricate the parts to facilitate assembly.** Install the servo spring with the small coiled end against the servo piston.

9. Install the spring retainer. Compress the spring with a C-clamp. Then install the snap ring. **The snap ring must be fully seated in the groove.**

10. Install the needle bearings in the actuating lever. Install the actuating lever and thrust washers with the socket in the lever bearing on the piston stem. Install the actuating lever shaft, aligning the retaining pin holes, and install the pin.

11. Check the actuating lever for free movement.

TRANSMISSION CASE AND LINKAGE REPAIR

1. Remove the inner downshift lever shaft nut (Fig. 47). Then remove the inner downshift lever.

2. Remove the outer downshift lever and shaft. Remove the downshift shaft seal from the counterbore in the manual lever shaft.

3. Remove the cotter pin from the parking pawl toggle operating rod and remove the clip from the parking pawl operating lever. Remove the parking pawl operating rod assembly.

4. Rotate the manual shaft until the detent lever clears the detent plunger. Then remove the detent plunger and spring. **Do not allow the detent plunger to fly out of the case.**

5. Remove the manual lever shaft nut, and remove the detent lever. Remove the outer manual lever and shaft from the transmission case.

6. Remove the clip retaining the toggle operating lever and remove the assembly and disassemble the parts.

7. Tap the toggle lever sharply toward the rear of the case to remove the plug and pin.

8. Remove the pawl pin by working the pawl back and forth. Remove the pawl and toggle lever assembly, and then disassemble.

9. Remove the manual shaft seal and case vent tube.

10. If necessary remove cooler return check valve from the case.

11. To assemble the case linkage parts or cooler return check valve reverse the above disassembly procedure and check for free linkage operation.

ASSEMBLY

Do not use force to assemble mating parts. If the parts do not assemble freely, examine them for the cause of the difficulty. **Always use new gaskets during the assembly operations.**

CLUTCH ASSEMBLIES

1. Install the front band in the transmission case so that the anchor end is aligned with the anchor in the case.

2. Make sure the thrust washer is in place on the input shaft. Lift the clutch assemblies out of the holding block. **Do not allow the clutches to separate.**

3. Install the clutch sub-assemblies in the transmission case while positioning the servo band on the drum. Hold the units together while installing them (Fig. 28).

CENTER SUPPORT, ONE-WAY CLUTCH, PINION CARRIER, AND OUTPUT SHAFT

The production center supports are chamfered at the edge of the race (Fig. 48). The service center supports are not chamfered. The following assembly procedures cover both type of center supports.

INSTALLATION CENTER SUPPORT WITH CHAMFERED EDGE

1. Install the center support and the rear band in the case.

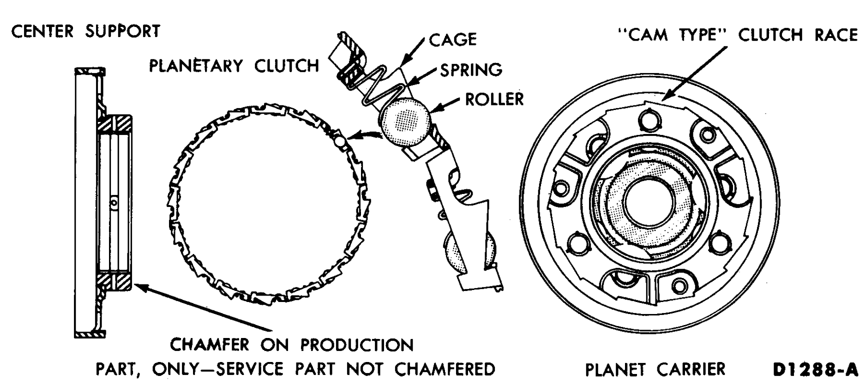


FIG. 48—Planetary Clutch, Planet Carrier and Center Support

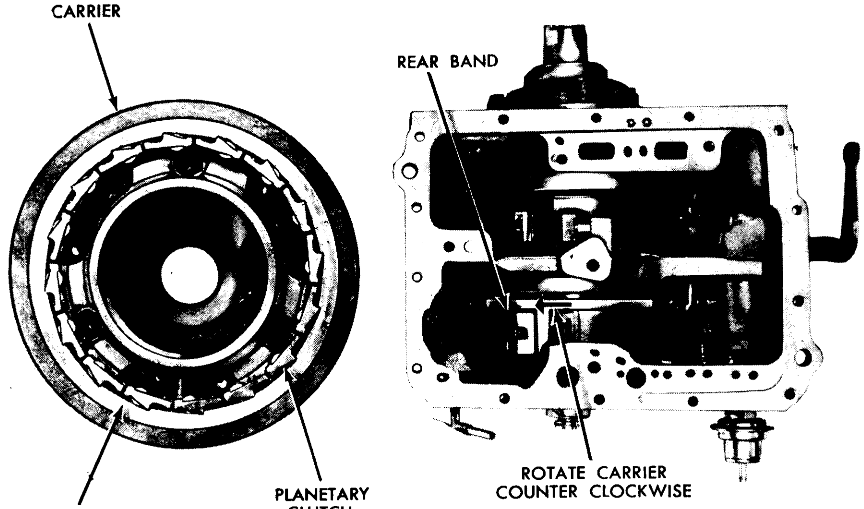


FIG. 49–Planetary Clutch Installation in Carrier–Using Chamfered Center Support

2. Install the primary sun gear rear thrust bearing race, needle bearing and front thrust bearing race, in the planet carrier, using petroleum jelly to retain them in place.

3. Lubricate the bearing surface on the center support, the rollers of the planetary clutch and the cam race in the carrier with petroleum jelly.

4. Install the planetary clutch in the carrier (Fig. 49).

5. Carefully position the planet carrier on the center support. Move the carrier forward until the clutch rollers are felt to contact the bearing surface of the center support.

6. While applying forward pressure on the planet carrier, rotate it counterclockwise as viewed from the rear (Fig. 49). This will cause the clutch rollers to roll toward the large opening end of the cams in the race, compressing the springs slightly, so that the rollers will ride up the chamfer on the planetary support and onto the inner race.

7. Push the planet carrier all the way forward.

8. Check the operation of the planetary clutch by rotating the carrier counterclockwise (viewed from the rear). It should rotate in this direction with a slight drag, and it should lock up when attempting to rotate it in a clockwise direction.

INSTALLATION–CENTER SUPPORT NOT CHAMFERED

1. Install the center support and the rear band in the case.

2. Install the primary sun gear rear thrust bearing race, needle bearing, and front thrust bearing race, in the planet carrier, using petroleum jelly to retain them in place.

3. Lubricate the bearing surface on the center support, the rollers of the planetary clutch and the cam race in the carrier with vaseline.

4. Install the planetary clutch on the center support with the "saw teeth" of the clutch cage pointing in the clockwise direction as viewed from the rear (Fig. 50). Make sure that all rollers are in the cage.

5. Position the planet carrier on the support so that the cams in the carrier engage the "saw teeth" on the clutch cage.

6. Push the planet carrier forward until the rollers are felt to contact the surface of the cam race.

7. While applying forward pressure on the carrier, rotate it counterclockwise as viewed from the rear. This will cause the rollers to roll toward the large opening end of the cams in the race, compressing the springs slightly, so that the rollers will enter the cams.

8. Some rollers may become cocked preventing their entry into the outer race. These rollers must be positioned individually with a small screwdriver by pushing the rear of the rollers toward the transmission and into the cam race (Fig. 50).

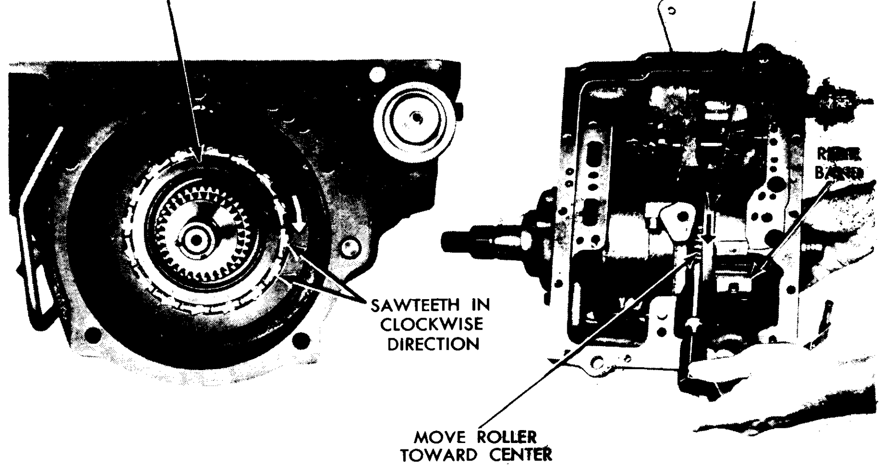


FIG. 50–Planetary Clutch Installation in Carrier–Using Center Support Not Chamfered

Keep pressure applied to the carrier at all times.

9. After all of the rollers have been started into the cam race, rotate the carrier counterclockwise while pushing it forward. Again, straighten any rollers which still may be in a cocked position and prevent the carrier from sliding onto the support.

10. Make sure that all springs are entered in the cam race before attempting to push the carrier on the support. Push the carrier all the way forward and check the operation of the clutch by rotating it in a counterclockwise direction. The carrier should rotate in this direction with a slight drag and should lock up when attempting to rotate it in a clockwise direction.

11. Install the selective thrust washer on the pinion carrier rear pilot. **If the end play was not within specifications when checked prior to disassembly, replace the washer with one of proper thickness.** Refer to the specifications, Part 7-3, for thrust washer selective thickness.

12. Install the output shaft, carefully meshing the internal gear with the pinions.

REAR PUMP

1. Position the rear pump drive key in the keyway on the output shaft.

2. Position new front and rear gaskets on the pump body. Retain the gaskets with transmission fluid.

3. Install the thrust washer and race in the rear pump (Fig. 27). Then install the rear pump. **Be sure the drive key is aligned with the keyway in the pump drive gear.**

GOVERNOR

1. Position the governor drive ball in the pocket in the output shaft. Retain the ball with transmission fluid.

2. Install the governor assembly, aligning the groove with the ball in the output shaft.

3. **Install the governor with the governor body plate toward the rear of the transmission.** Install the governor snap ring.

DISTRIBUTOR

1. Place the four seal rings in the distributor sleeve, and check the ring gap.

2. Check the fit of the seal rings in the grooves in the output shaft. The rings should rotate freely. Install the rings in the grooves of the output shaft.

3. Install the three tubes in the distributor sleeve.

4. Install the distributor sleeve on the output shaft, chamfer forward. Lubricate parts to facilitate assembly. Slide the sleeve forward over the 4 rings and at the same time start the tubes into the case. The distributor sleeve is located between the governor snap ring and speedometer driving gear.

5. Install a new seal on the rear pump outlet tube and install the tube in the transmission case and rear pump body.

SPEEDOMETER DRIVE GEAR

1. Position the speedometer drive gear ball in the pocket of the output shaft. Retain it with fluid.

2. To install the nylon gear, dip it in transmission fluid and place it on an illuminated 100-watt light bulb. If a steel gear is used, it will not be necessary to heat the gear to install it.

3. Allow the gear to remain on the bulb for five minutes. Then turn it over and heat the other side for five minutes. This will heat the gear to approximately 180° F.

4. Make sure the lock ball is in place on the shaft, and then quickly slide the gear into place.

5. Install the speedometer drive gear snap ring on the output shaft.

EXTENSION HOUSING

1. Insert the extension housing oil seal replacer and pilot in the housing, and install the extension housing on the transmission case. Coat the bolt threads with B5A-19554-A sealer and install the extension housing attaching bolts, breather tube clip, vacuum tube clip, and external tooth lockwashers. **The lockwashers must be installed with the rolled edge toward the transmission case to insure a tight seal.**

2. Torque the extension housing attaching bolts to specification.

3. Install the governor inspection cover and a new gasket on the housing.

FRONT PUMP

1. Position a new front pump gasket in the counterbore of the transmission case.

2. Install the front pump, aligning the pump bolt holes with the holes in the case. Install 3 of the front pump attaching bolts. Torque the bolts to specification.

TRANSMISSION END PLAY CHECK

1. Mount the dial indicator support in a front pump bolt hole. Mount a dial indicator on the support so that the contact rests on the end of the turbine shaft (Fig. 22).

2. Use a large screwdriver to pry the front of the clutch drum toward the rear of the transmission (Fig. 22). Set the dial indicator at zero.

3. Remove the screwdriver and pry the units toward the front of the transmission by inserting a screwdriver between the large internal gear and the transmission case (Fig. 22). Note the indicator reading. End play should be 0.010-0.029 inch (minimum end play is preferred).

4. Remove the indicator and the tool from the extension housing.

5. Install the one remaining front pump attaching bolt. Torque the bolt to specification.

FRONT SERVO

1. Position the front band forward in the case with the band ends up.

2. Position the servo strut with the slotted end aligned with the servo actuating lever, and with the small end aligned with the band end. Rotate the band, strut, and servo into position engaging the anchor end of the band with the anchor pin in the case.

3. Locate the servo on the case, and install the attaching bolts. **Tighten the attaching bolts only 2 or 3 threads.**

4. Install the servo tubes and lubrication tube.

REAR SERVO

1. Position the servo anchor strut, and rotate the rear band to engage the strut.

2. Position the servo actuating lever strut with a finger, and then install the servo and attaching bolts. Torque the bolts to specification.

PRESSURE REGULATOR BODY

1. Install the pressure regulator body and attaching bolts, and torque the bolts to specifications.

2. Install the control and converter valve guides and springs. Install the spring retainer.

3. Install a new seal ring on the rear pump intake tube, and install the tube in the case.

CONTROL VALVE BODY

1. Install the control valve assembly, carefully aligning the servo tubes with the control valve. Align the inner downshift lever between the stop and the downshift valve. Shift the manual lever to the L position. **Align the manual valve with the actuating pin in the manual detent lever. Do not tighten the attaching bolts.**

2. Install the large control pressure tube in the valve body and regulator.

3. Install the small control pressure compensator tube in the valve body and regulator.

4. Move the control valve body toward the center of the case as far as the attaching bolts will permit. This movement is made to take up clearance between the manual valve and the actuating pin on the manual detent lever.

5. Torque the attaching bolts to specification.

6. Turn the manual valve one full turn in each manual lever detent position. If the manual valve binds against the actuating pin in any detent position, loosen the valve body attaching bolts and move the body away from the center of the case. Move the body only enough to relieve the binding. Torque the attaching bolts and recheck the manual valve for binding.

7. Torque the front servo attaching bolts to specification.

FRONT SERVO ADJUSTMENT

1. Loosen the front servo adjusting screw lock nut, and back off the nut three turns.

2. Loosen the adjusting screw 5 complete turns.

3. Using the front band adjusting wrench shown in Fig. 14, adjust the front band.

REAR SERVO ADJUSTMENT

1. Loosen the adjusting screw lock nut 3 turns with the ¾-inch socket of the rear band adjusting wrench.

2. Back off the adjusting screw until free travel is obtained.

3. Use the special tools shown in Fig. 14 to adjust the rear band.

VACUUM DIAPHRAGM UNIT

1. Position the push rod in the bore of the vacuum diaphragm unit and install the diaphragm unit. Make sure the rod enters the hole in throttle valve.

2. Torque the diaphragm unit to specification.

FILTER-TYPE SCREEN AND OIL PAN

1. Position the filter-type screen over the rear pump inlet tube, and then over the front pump inlet tube. Press the filter-type screen down firmly. Install the retaining clip.

2. Place a new gasket on the transmission case, and install the pan. Install the attaching bolts and lockwashers. Torque the bolts to specification.

If the converter and converter housing were removed from the transmission, install these components. Position the transmission assembly on the transmission jack, and refer to "Transmission Installation Procedures" for installing the transmission.

PART 7-3 SPECIFICATIONS

CONTROL PRESSURE RANGES

Manifold Vacuum HG (Inches)	Engine Speed (RPM)	Selector Position	Gauge Reading (PSI)
18 Minimum	450-475	P-N-D1-D2-L	57-77
		R	71-106
16 to 13.7	As Required	D1-D2-L R	Pressure Starts Increasing
1.5 or Less	Stall 1800-2000	D1-D2-L	151-176
		R	201-213

TORQUE SPECIFICATIONS

Name	Foot Pounds
Converter to Flywheel Nuts	20-30
Converter Housing to Transmission Case Bolts	35-45
Front Pump to Transmission Case Bolts	17-22
Front Servo to Transmission Case Bolts	30-35
Rear Servo to Transmission Case Bolts	40-50
Planetary Support to Transmission Case Screws	20-25
Upper Valve Body to Lower Valve Body Bolts	4-6
Control Valve Body to Transmission Case Bolts	8-10
Pressure Regulator Assembly to Transmission Case Screws	17-22
Extension Assembly to Transmission Case Bolts	28-38
Oil Pan to Transmission Case Bolts	10-13
Case Assembly—Gauge Hole Plugs	7-15
Rear Band Adjusting Screw Locknut	35-40
Front Band Adjusting Screw Locknut	20-25
Manual Control Lever Nut	35-40
Downshift Lever Nut	17-20
Front Pump Cover Screws	25-35*
Rear Pump Cover Screws (¼-20)	80-90*
Rear Pump Cover Screws (10-24)	25-35*
Governor Inspection Cover Screws	50-60*
Converter Cover Drain Plug	15-28
Converter Housing to Engine Bolts	45-50
Transmission Vent Assembly	7-12
Governor Valve Body to Counterweight Screws	50-60*
Governor Valve Body Cover Screws	20-30*
Pressure Regulator Cover Screws	20-30*
Control Valve Body Screws	20-30*
Case Assembly—Oil Cover Inlet & Outlet Plugs	10-15
Front Servo Release Piston to Servo Piston Screws	20-30*
Vacuum Diaphragm Unit to Case	18-27†
Cooler Return Check Valve (In Case)	15-21

*Inch-Pounds †Using Tool FCO-24

TRANSMISSION GEAR RATIOS

Gear	Selector Lever Position	Clutch Applied	Band Applied	Gear Ratio
Neutral	N	None	None	—
First	D1	Front	Rear*	2.40:1
Second	D1 or D2	Front	Front	1.47:1
Third	D1 or D2	Front and Rear	None	1.00:1
Reverse	R	Rear	Rear	2.00:1

*In first gear D1, the planet carrier is held against rotation by the one-way clutch.

STALL SPEEDS

Selector Lever Position	Clutch Applied	Band Applied	Engine RPM
D2	Front	Front	1800-2000
D1	Front	One-Way Clutch	
L	Front	Rear	
R	Rear	Rear	

LUBRICANT REFILL CAPACITY

Type of Lubricant	Approximate Capacity
Ford Automatic Transmission Fluid C1AZ-19582-A	11½ Quarts (System Dry) 10 Quarts (Drain and Refill)

CHECKS AND ADJUSTMENTS

Operation	Specification
Transmission End Play Check	0.010-0.029 inch Selective Thrust Washers Available: 0.063-0.061 inch, 0.069-0.067 inch 0.076-0.074 inch, 0.083-0.081 inch
Turbine and Stator End Play Check	0.060 inch (maximum)
Front Band Adjustment (Use ¼-inch spacer between adjustment screw and servo piston stem)	Adjust screw to 10 in-lbs torque, and back off one full turn; lock nut to 20-25 ft-lbs
Rear Band Adjustment	Adjust screw to 10 ft-lbs torque, and back off 1½ turns; lock nut to 35-40 ft-lbs
Primary Sun Gear Shaft Ring End Gap Check	0.002-0.009 inch
Accelerator Pedal Height Adjustment	3¹¹⁄₁₆ inches above floor mat
Rear Clutch Steel Plate Coning Clearance Check	0.010 inch (maximum)
Output Shaft to Fluid Distributor Seal Ring End Gap	0.001 to 0.006 inch

TRANSMISSION SHIFT POINTS (APPROXIMATE)

Automatic Shift Speeds (mph) (with 3.00:1 axle ratio)								Manual Shift Speeds (mph)
D1		D1 or D2		D1	D1 or D2	D1	D2	L
1-2 Minimum Throttle	1-2 Maximum Throttle	2-3 Minimum Throttle	2-3 Maximum Throttle	3-1 Minimum Throttle	3-2 Maximum Throttle	2-1 Maximum Throttle	3-2 Minimum Throttle	2-1
8-11	41-49	14-24	65-75	8-10	60-69	28-36	7-10	18-26

AUTOMATIC TRANSMISSION TOOLS

Ford Tool No.	Former No.	Description
T50T-100-A	—	Impact Hammer
TOOL-1175-AB	1175-AB	Grease Seal Remover (Head Only)
T50T-100-A & TOOL-1175-AB	1175-AE	Seal Remover (Head and Handle)
TOOL-4201-C	4201-C	Differential Backlash & Runout Gauge, with Universal Bracket, Dial Indicator & Bracket
TOOL-7000-CJ	7000-CJ	Transmission Overhaul Holding Fixture
TOOL-7000-DD	7000-DD	Air Nozzle Rubber-Tip Assembly
TOOL-7003	7003	Bench Test Turning Tool
TOOL-7195-C	7195-C	Rear Brake Adjusting Wrench
T58L-7195-A	—	Fordomatic Band Adjusting Wrench
TOOL-7225-B	7225-B	Front Band Adjustment Wrench
TOOL-7225-C13-B	7225-C13-B	Gauge Block and Chain Assembly
T61L-7657-A	7657-AA	Transmission Extension Housing Oil Seal Replacer
T61L-7657-B	7657-AB	Transmission Extension Housing Oil Seal Replacer
T57P-7697-A	7000-AD	Transmission Extension Housing Bushing Remover
T57P-7697-B	7000-J	Transmission Extension Housing Bushing Replacer
T58L-7902-A or B	7937-A 7946-A	Welded Converter Sprag Driver and Gauge Post
T63P-7902-A	—	Converter Stator Check Adapter
TOOL-77067	77067	Dial Indicator Support Fixture
TOOL-77515	—	Rear Clutch Spring Compressor
TOOL-77530-A	77530-A	Clutch Assembly Fixture
TOOL-77565	77565	Front Clutch Spring Compressor
T57L-77820-A	77820-B	Automatic Transmission 400 Pound Pressure Gauge
T59L-77837-A	—	Front Pump Seal Replacer
T63L-77837-A	—	Front Pump Seal Replacer
TOOL-77869-A	77869-A 77869-W	Transmission Sleeve Remover and Replacer

CLUTCH PLATE APPLICATION

FRONT CLUTCH		REAR CLUTCH	
Steel Plates	Composition Plates	Steel Plates	Composition Plates
4	5	6	6

ENGINE

GROUP 8

PART 8-1 GENERAL ENGINE SERVICE

This part covers engine diagnosis, testing, adjustment and repair procedures. In addition, the cleaning and inspection procedures are covered.

For engine removal, disassembly, assembly, installation and major repair procedures, refer to the pertinent part of this group.

The engine identification tag is attached to the engine with the ignition coil mounting bracket bolt. The symbol code (Fig. 1) identifies each engine for determining parts usage; i.e., engine cubic inch displacement and model year. The change level and engine code number determine if parts are peculiar to a specific engine.

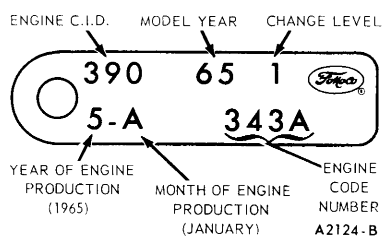


FIG. 1—Engine Identification Tag

1 DIAGNOSIS AND TESTING

DIAGNOSIS

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

For diagnosis of transistor ignition system malfunctions, refer to Group 9.

DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK	The cause of this trouble is usually in the starting system (Group 14). If the starting system is not at fault, check for hydrostatic lock or a seized engine as follows: Remove the spark plugs; then attempt to crank the engine with the starter. If the engine cranks, it indicates that water is leaking into the cylinders. Remove the cylinder head(s) and inspect the gasket(s) and/or head(s) for cracks. Examine the cylinder block for cracks.

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

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 end of the wire. Then hold the adapter approximately 3/16 inch from the exhaust manifold and crank the engine. **IF THERE IS NO SPARK OR A WEAK SPARK AT THE SPARK PLUGS** The cause of the trouble is in the ignition system. **Disconnect the brown lead ("I" terminal) and the red and blue lead ("S" terminal) at the starter relay.** Install an auxiliary starter switch between the battery and "S" terminals of the starter relay. 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, rotor or spark plug wires. 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: **AUTOMATIC CHOKE** Check the position of the choke plate. If the engine is hot, the plate should be open. If the plate is not open, the engine will load up due to the excessively rich mixture and will not start. If the engine is cold, the plate should be closed. If the plate is not operating properly, check the following items: The choke linkage for binding. The fast idle cam linkage for binding. Thermostatic spring housing adjustment. **FUEL SUPPLY AT THE 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 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 vented cap. If fuel is reaching the carburetor, check: The fuel inlet system including the fuel inlet needle and seat assembly and float assembly. **ENGINE** Mechanical failure in camshaft drive.
ENGINE STARTS, BUT FAILS TO KEEP RUNNING	**FUEL SYSTEM** Idle fuel mixture needles 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 in the 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** Defective spark plugs. Leakage in the high tension wiring. Open circuit in primary resistance wire. Breaker points not properly adjusted.

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

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 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 the distributor cap.

If a good spark occurs, check the spark plug. If the spark plug is not at fault, a mechanical component of the engine is probably at fault.

ENGINE

Intake manifold gasket leak.

Perform a manifold vacuum test or a compression 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.

Defective ignition switch.

FUEL SYSTEM

Float setting incorrect.

Fuel inlet system not operating properly.

Dirt or water in the fuel lines or carburetor.

Restricted fuel filter.

COOLING SYSTEM

Check the cooling system for internal leakage and/or a condition that prevents the engine from reaching normal operating temperature.

ENGINE

Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault.

MISSES AT IDLE ONLY

FUEL SYSTEM

Idle fuel mixture needles not properly adjusted.

Restriction in idle fuel system.

IGNITION SYSTEM

Excessive play in the distributor shaft.

Worn distributor cam.

Defective coil, condenser, breaker points, rotor, ignition wiring or spark plugs.

ENGINE

Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault.

MISSES AT HIGH SPEED ONLY

FUEL SYSTEM

Power valve or passages clogged or damaged.

Low or erratic fuel pump pressure.

Fuel inlet system not operating properly.

Restricted fuel filter.

Restricted main fuel system.

Positive crankcase ventilation system restricted or valve not operating properly.

COOLING SYSTEM

Engine overheating.

IGNITION SYSTEM

Defective spark plugs.

ENGINE

Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault.

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

Condition	Possible Causes	
ROUGH ENGINE IDLE	**FUEL SYSTEM** Engine idle speed set too low. Idle fuel mixture needles not properly adjusted. Idle compensator malfunction. Float setting incorrect. Air leaks between the carburetor, spacer, and the manifold and/or fittings. Power valve leaking fuel. Idle fuel system air bleeds or fuel passages restricted. Fuel bleeding from the accelerating pump discharge nozzles. Secondary throttle plates not closing. Improper secondary throttle plate stop adjustment. Leaking fuel pump, lines or fittings.	**IGNITION SYSTEM** Improperly adjusted or defective breaker points. Fouled or improperly adjusted spark plugs. Incorrect ignition timing. Spark plug misfiring. **ENGINE** Loose engine mounting bolts or worn engine support insulator. Cylinder head bolts not properly torqued. Positive crankcase ventilation regulator valve defective or a restricted ventilation system. Worn camshaft lobes. Perform a manifold vacuum test and/or compression test to determine which mechanical component is at fault.
POOR ACCELERATION	**IGNITION SYSTEM** Incorrect ignition timing. Fouled or improperly adjusted spark plugs. Improperly adjusted or defective breaker points. Distributor not advancing properly. **FUEL SYSTEM** Accelerating pump malfunction. Float setting incorrect. Throttle linkage not properly adjusted. Accelerating pump stroke not properly adjusted. Leaky power valve, gaskets or accelerating pump diaphragm.	Dirt or corrosion in accelerating system. Distributor vacuum passages in the carburetor blocked. Restricted fuel filter. **BRAKES** Improper adjustment — too tight. **TRANSMISSION** Improper band adjustment. Converter One-Way Clutch. **ENGINE** Perform a manifold vacuum test and/or compression test to determine which mechanical component of the engine is at fault.
ENGINE DOES NOT DEVELOP FULL POWER OR HAS POOR HIGH SPEED PERFORMANCE	**FUEL SYSTEM** Restricted air cleaner. Restricted fuel filter. Clogged or undersize main jets and/or low float setting. Clogged or undersize secondary jets. Power valve or passages clogged or damaged. Fuel pump pressure incorrect. Distributor vacuum passage in the carburetor blocked. Secondary throttle plates not opening. Automatic choke malfunctioning or improperly adjusted. **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, or spark plugs or incorrect heat range. Improperly adjusted or defective breaker points. **EXHAUST SYSTEM** Restriction in system. **COOLING SYSTEM** Thermostat inoperative or of incorrect heat range. Thermostat installed incorrectly. Check the cooling system for in-

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

ENGINE DOES NOT DEVELOP FULL POWER OR HAS POOR HIGH SPEED PERFORMANCE (Continued)	ternal leakage and/or for a condition that prevents the engine from reaching normal operating temperature. **ENGINE** Positive crankcase ventilation system and/or regulator valve not operating properly. Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault. One or more camshaft lobes worn beyond wear limit. Worn valve guides. **TRANSMISSION** Improper band adjustment (automatic transmission).
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. **EXHAUST SYSTEM** Check for restriction in system. **ODOMETER** Check calibration. **IGNITION SYSTEM** Check: Distributor breaker points. Ignition timing. **ENGINE** Positive crankcase ventilation regulator valve defective or restricted ventilation system. **FINAL CHECKS** **FUEL SYSTEM** Check: Fuel pump pressure. Engine idle speed. Idle fuel mixture needles for proper adjustment. Automatic choke for proper operation. Fast idle speed screw for proper adjustment. Accelerating pump stroke adjustment. Anti-stall dashpot for proper adjustment. Air cleaner for restrictions. Float setting or fuel level. Jets for wear and/or damage. Power valve operation. Air bleeds for obstructions. Accelerating pump discharge nozzles for siphoning. Accelerator linkage for binds. Choke adjustment. **IGNITION SYSTEM** Check: Spark plug condition and adjustment. Distributor spark advance operation. Initial ignition timing. **ENGINE** Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault. **COOLING SYSTEM** Check thermostat operation and heat range. **TRANSMISSION** Check band adjustment (automatic transmission).
ENGINE OVERHEATS	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective or not indicating correct temperature, or constant voltage regulator defective. **ENGINE** Cylinder head bolts not properly torqued. Incorrect valve clearance. Low oil level or incorrect viscosity oil used. Perform a manifold vacuum test or a compression test to determine which mechanical component of the engine is at fault.

CONTINUED ON NEXT PAGE

DIAGNOSIS GUIDE (Continued)

ENGINE OVERHEATS (Continued)	**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.	Faulty fan drive clutch. **IGNITION SYSTEM** Incorrect ignition timing. **EXHAUST SYSTEM** Restrictions in system. **BRAKES** Improper adjustment – too tight.
LOSS OF COOLANT	**COOLING SYSTEM** Leaking radiator or water pump. Loose or damaged hose connections. Radiator cap defective. Overheating. **ENGINE** Cylinder head gasket defective.	Intake manifold to cylinder head gasket defective. Cylinder head or intake manifold bolts not properly torqued. Cylinder block core plugs leaking. Temperature sending unit leaking. Cracked cylinder head or block, or warped cylinder head or block gasket surface.
ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	**TEMPERATURE SENDING UNIT AND GAUGE** Unit or gauge defective or not indicating correct temperature, or constant voltage regulator defective.	**COOLING SYSTEM** Thermostat inoperative or of incorrect heat range.
NOISY HYDRAULIC VALVE LIFTER	A noisy valve lifter can be located by operating the engine at idle speed and placing a finger on the face of the valve spring retainer. If the lifter is not functioning properly, a shock will be felt when the valve seats. Another method of identifying a noisy lifter is by the use of a piece of hose. With the engine operating at idle speed, place one end of the hose near the end of the valve stem and the other end to the ear and listen for a metallic noise. Repeat this procedure on each intake and exhaust valve until the noisy lifter(s) has been located. The most common causes of hydraulic valve lifter troubles are dirt, gum, varnish, carbon deposits and air bubbles. Dirt in the lifter assembly can prevent the disc valve from seating, or it may become lodged between the plunger and body surfaces. In either case, the lifter becomes inoperative due to failure to "pump-up," or because the internal parts are no longer free to function properly. When dirt is found to be responsible for lifter malfunction, remove the lifter assembly and thoroughly clean it. Recommended engine oil and filter change intervals should be followed to minimize lifter problems caused by dirt (Group 19).	Deposits of gum and varnish cause similar conditions to exist which may result in lifter malfunction. If these conditions are found to be present, the lifter should be disassembled and cleaned in solvent to remove all traces of deposits. Air bubbles in the lubricating oil, caused by an excessively high or low oil level, may likewise cause lifter malfunction. A damaged oil pick-up tube may allow air to be drawn into the lubricating system. Check for engine oil aeration as follows: Check the engine oil level to be sure it is within specification and correct as required. **Be sure the correct engine oil dipstick is being used.** Operate the engine at approximately 1200 rpm until normal operating temperature is reached. Stop the engine and remove the oil pressure sending unit. Install a fitting in this opening with a petcock-type valve that will permit attachment of a ¼- to ⅜-inch diameter hose of sufficient length to direct the oil discharge into the oil filler pipe. Close the valve. Start the engine and operate it at approximately 500 rpm for a minimum of 5 minutes; then, open the valve slightly to permit a steady dis-

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DIAGNOSIS GUIDE (Continued)

NOISY HYDRAULIC VALVE LIFTER (Continued)	charge of oil. Check the oil flow for air bubbles. Increase the engine speed to approximately 1000 rpm and check for air bubbles in the oil. **To facilitate checking for air bubbles, direct the oil flow over white paper or through a piece of transparent tube. The engine should not be operated at excessive speeds or for extended periods with the oil bleed attached.** If oil aeration is evident, remove the oil pan for further test and/or inspection of the oil pump intake system. Perform corrective action as required to remove air from the lubricating oil.

TESTING

CAMSHAFT LOBE LIFT

Check the lift of each lobe in consecutive order and make a note of the readings.

1. Remove the air cleaner and the valve rocker arm cover(s). Remove the valve rocker arm shaft assembly(lies). Install a solid tappet-type push rod in the push rod bore of the camshaft lobe to be checked, or use the adapter for ball-end push rods shown in Fig. 2.

2. Make sure the push rod is in the valve lifter 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. 2).

3. Disconnect the brown lead ("I" terminal) and the red and blue lead ("S" terminal) at the starter relay. Install an auxiliary starter switch between the battery and "S" terminals of the starter relay. **Crank the engine with the ignition switch "OFF".**

"Bump" the crankshaft over until the valve lifter rests on the base circle of the cam. **At this point the push rod is in its lowest position.**

4. Zero the dial indicator. Continue to rotate the crankshaft 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 crankshaft until the indicator reads zero. **If the camshaft reading on any lobe is below specified wear limits, the camshaft and the valve lifters operating on the worn lobes must be replaced.**

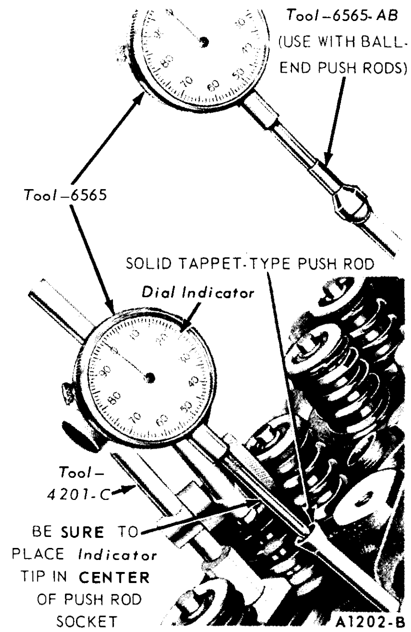

FIG. 2–Camshaft Lobe Lift

7. Remove the dial indicator and the auxiliary starter switch.

8. Install the valve rocker arm shaft assembly(ies). Install the valve rocker arm cover and the air cleaner.

TABLE 1—Manifold Vacuum Gauge Readings

Gauge Reading	Engine Condition
18 inches or over.	Normal.
Low and steady.	Loss of power in all cylinders possibly caused by late ignition or valve timing, or loss of compression due to leakage around the piston rings.
Very low.	Intake manifold, carburetor spacer or cylinder head gasket leak.
Needle fluctuates steadily as speed increases.	A partial or complete loss of power in one or more cylinders caused by a leaking valve, cylinder head or intake manifold gasket, 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 or carburetor, spacer or intake manifold gasket leak, or crankcase ventilation system restricted.

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 check manifold vacuum:

1. Operate the engine for a minimum of 30 minutes at 1200 rpm or until the engine is at normal operating temperature.

2. Remove the plug or power brake line at the rear of the intake manifold (front of crankcase ventilation outlet), and install an accurate, sensitive, vacuum gauge.

3. Operate the engine at the recommended idle rpm, with the transmission selector lever in neutral.

4. Check the vacuum reading on the gauge.

Test Conclusions. Manifold vac-

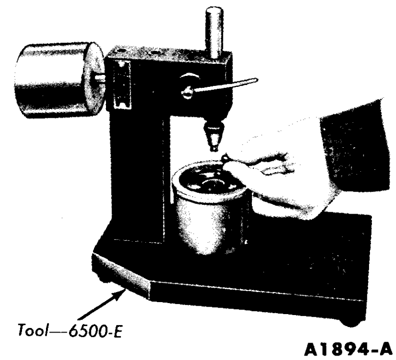

FIG. 3—Placing Steel Ball in Valve Lifter Plunger

uum is affected by the carburetor adjustment, valve timing, ignition timing, the condition of the valves, cylinder compression and leakage of the manifold, carburetor, carburetor spacer or cylinder head gaskets, or a restricted crankcase ventilation system.

Because abnormal gauge readings may indicate that more than one of the above factors are 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,

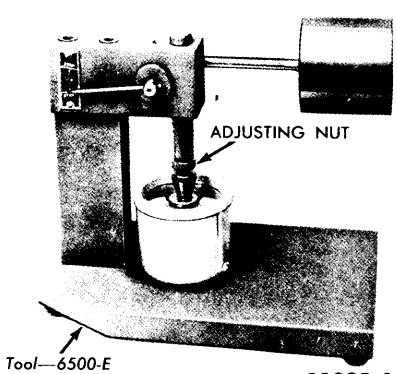

FIG. 4—Adjusting the Ram Length

where necessary, in order to arrive at the correct diagnosis of the trouble.

Table 1 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.

COMPRESSION TEST

1. Be sure the crankcase oil is at the proper level.

2. Be sure the battery is properly charged. Operate the engine for a minimum of 30 minutes at 1200 rpm or until the engine is at normal operating temperature. Turn the ignition switch off; then remove all the spark plugs. Remove the coil high tension lead from the distributor cap and ground it against the engine.

3. Set the primary throttle plates and choke plate in the wide open position.

4. Install a compression gauge in No. 1 cylinder.

5. Using an auxiliary starter switch, crank the engine a minimum of 5 pumping strokes and record the highest reading.

Disconnect the brown lead ("I" terminal) and the red and blue lead ("S" terminal) at the starter relay. Install an auxiliary starter switch between the battery and "S" terminals of the starter relay. **Crank the engine with the ignition switch "OFF".**

Note the number of compression strokes required to obtain the highest reading.

6. 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.

Test Conclusions. A variation of ± 20 psi from specified pressure is satisfactory. However, the compression of all cylinders should be uniform within 20 psi.

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 substantially 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.

HYDRAULIC VALVE LIFTER TESTS

Dirt, deposits of gum and varnish and air bubbles in the lubricating oil can cause hydraulic valve lifter failure or malfunction.

Dirt, gum and varnish can keep a check valve from seating and cause a loss of hydraulic pressure. An open valve disc will cause the plunger to force oil back into the valve lifter reservoir during the time the push rod is being lifted to force the valve from its seat.

Air bubbles in the lubricating system can be caused by too much oil in the system or too low an oil level. Air may also be drawn into the lubricating system through an opening in a damaged oil pick-up tube. **Air in the hydraulic system can cause a loss of hydraulic pressure.**

Assembled valve lifters can be tested with tool 6500-E to check the leak down rate. The leak down rate specification (for gauging purposes) is 10-50 seconds at 50 lbs. load. Plunger travel is 0.125 inch. Test the valve lifters as follows:

1. Place the valve lifter in the tester, with the plunger facing upward. Pour hydraulic tester fluid into the cup to a level that will cover the valve lifter assembly. **The fluid can be purchased from the manufacturer of the tester. Do not use kerosene, for it will not provide an accurate test.**

2. Place a 5/16-inch steel ball in the plunger cup (Fig. 3).

3. Adjust the length of the ram so that the pointer is in line with the starting mark when the ram contacts the valve lifter plunger (Fig. 4).

4. Work the valve lifter plunger up and down until the lifter fills with fluid and all traces of air bubbles have disappeared.

5. Allow the ram and weight to force the valve lifter plunger downward. Measure the exact time it takes for the pointer to travel from the "Start Timing" to the "Stop Timing" marks of the tester.

6. A valve lifter that is satisfactory must take at least 10 seconds, but not more than 50 seconds, to leak down.

7. If the valve lifter is not within specifications, disassemble the lifter and clean and inspect it as outlined in Section 3. Assemble the lifter and test the lifter again. If it does not meet specifications, replace it with a new lifter. **Always test a new lifter before installing it in the engine.**

8. Remove the fluid from the cup and bleed the fluid from the lifter by working the plunger up and down. **This step will aid in depressing the lifter plungers when checking the valve clearance.**

FLYWHEEL RUNOUT AUTOMATIC TRANSMISSION

Remove the spark plugs.

Install a dial indicator so that the indicator point rests on the face of the ring gear midway between the mounting bolt circle and gear teeth.

Push the flywheel and crankshaft forward as far as possible to prevent crankshaft end play from being indicated as flywheel runout.

Set the indicator dial on the "zero" mark. Turn the flywheel one complete revolution while observing the total indicator reading (T.I.R.). If the T.I.R. exceeds specifications, the starter ring gear or flywheel and ring gear assembly must be replaced.

Install the dial indicator so that the point rests on a tooth of the ring gear, and check the outside diameter (O.D.) of the assembled flywheel and ring gear. **For this check, carefully adjust the indicator on the gear tooth so that the indicator point is near the extreme limit of its travel. This will prevent the indicator point from catching between the gear teeth as the flywheel is turned.** Set the indicator dial on the "zero" mark and slowly turn the flywheel through one revolution while observing the total indicator reading. The T.I.R. must be within specifications, or the ring gear must be replaced.

2 COMMON ADJUSTMENTS AND REPAIRS

VALVE CLEARANCE

A 0.060-inch shorter push rod or a 0.060-inch longer push rod are available for service to provide a means of compensating for dimensional changes in the valve mechanism. Refer to the Master Parts List or the specifications for the pertinent color code.

Valve stem to valve rocker arm clearance should be within specifications with the hydraulic lifter completely collapsed. Repeated valve reconditioning operations (valve and/or valve seat refacing) will decrease this clearance to the point that if not compensated for, the hydraulic valve lifter will cease to function.

To determine whether a shorter or a longer push rod is necessary, make the following check:

1. Disconnect the brown lead ("I" terminal) and the red and blue lead ("S" terminal) at the starter relay. Install an auxiliary starter switch between the battery and "S" terminals of the starter relay. **Crank the engine with the ignition switch "OFF".**

2. Position the crankshaft as outlined in steps 6 and 7.

3. Position the hydraulic lifter compressor tool on the rocker arm and slowly apply pressure to bleed down the hydraulic lifter until the plunger is completely bottomed (Fig. 5). Hold the lifter in the fully collapsed position.

4. Insert the correct end of the clearance gauge between the valve stem and the rocker arm.

5. If the first step of the gauge enters, a standard length push rod may be used.

If the first step of the gauge does not enter, replace the standard push rod with a 0.060-inch shorter service push rod.

If the second step of the gauge enters, the operating range of the lifter is excessive. This indicates that the incorrect push rod has been installed or severe wear has occurred at the push rod ends, rocker arm, or valve stem. In this case, it will be necessary to determine the area of discrepancy and the incorrect or defective part(s) should be replaced.

If all the valve train components except the push rod are within limits, install a 0.060-inch longer push rod.

6. Rotate the crankshaft until No. 1 piston is on TDC at the end of the compression stroke, and check the following valves:

No. 1 Intake	No. 1 Exhaust
No. 3 Intake	No. 4 Exhaust
No. 7 Intake	No. 5 Exhaust
No. 8 Intake	No. 8 Exhaust

7. Position No. 6 piston on TDC and check the following valves:

No. 2 Intake	No. 2 Exhaust
No. 4 Intake	No. 3 Exhaust
No. 5 Intake	No. 6 Exhaust
No. 6 Intake	No. 7 Exhaust

When compressing the valve spring to remove push rods, be sure the piston in the individual cylinder is below TDC to avoid contact between the valve and the piston.

To replace a push rod, it will be necessary to remove the valve rocker arm shaft assembly following the procedures in Part 8-2, Section 3.

Upon replacement of a valve push rod and/or valve rocker arm shaft assembly, the engine should not be cranked or rotated until the hydraulic valve lifters have had an opportunity to leak down to their normal operating position. The leak down rate can be accelerated by using the tool shown in Fig. 5 on the valve rocker arm and applying pressure in a direction to collapse the lifter.

VALVE ROCKER ARM SHAFT ASSEMBLY

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

If the pad at the valve end of the rocker arm has a grooved radius, replace the rocker arm. **Do not at-**

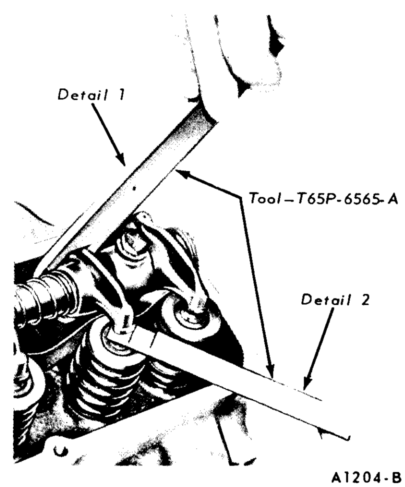

FIG. 5—Valve Clearance

tempt to true this surface by grinding.

PUSH RODS

Following the procedures in Section 3 under "Push Rod Inspection," check the push rods for straightness.

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

CYLINDER HEADS

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

REAMING VALVE GUIDES

If it becomes necessary to ream a valve guide (Fig. 6) 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 and 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 reface the valve seat after the valve guide has been reamed.**

REFACING VALVE SEATS

Refacing of the valve seats should be closely coordinated with the refacing of the valve face so that the finished seat and valve face will be concentric and the specified interference fit will be maintained. This is important so that the valve and seat will have a compression-tight fit. Be sure that the refacer grinding wheels are properly dressed.

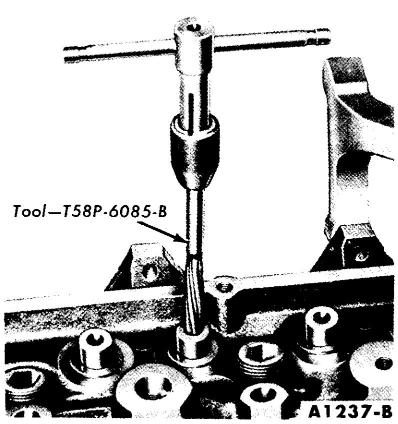

FIG. 6—Reaming Valve Guides

Grind the valve seats to a true 45° angle (Fig. 7). Remove only enough stock to clean up pits and grooves or to correct the valve seat runout. After the seat has been refaced, measure the seat width (Fig. 8). 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.

On the valve seats, use a 60° angle grinding wheel to remove stock from the bottom of the seats (raise the seats) and use a 30° angle wheel to remove stock from the top 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

For inspection procedures refer to Section 3.

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

Discard any defective part of the valve assembly.

REFACING VALVES

The valve refacing operation should be closely coordinated with the valve seat refacing operation so that the finished angles of the valve face and of the valve seat will be to specifications and will provide a 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 thick after grinding, replace the valve as the valve will run too hot in the engine. **The interference fit of the valve and seat should not be lapped out.**

Remove all grooves or score marks from the end of the valve stem; then chamfer as necessary. Do not remove more than 0.010 inch from the stem.

If the valve and/or valve seat has been refaced, it will be necessary to check the clearance between the rocker arm pad and the valve stem with the valve train assembly installed 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. **Always reface the valve seat after the valve guide has been reamed.** Refer to "Reaming Valve Guides."

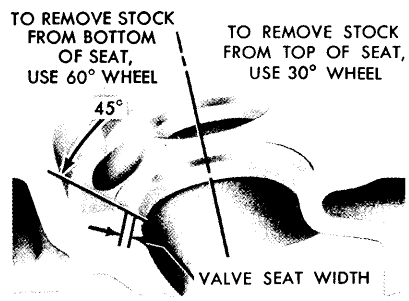

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FIG. 7—Valve Seat Refacing

CAMSHAFT

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

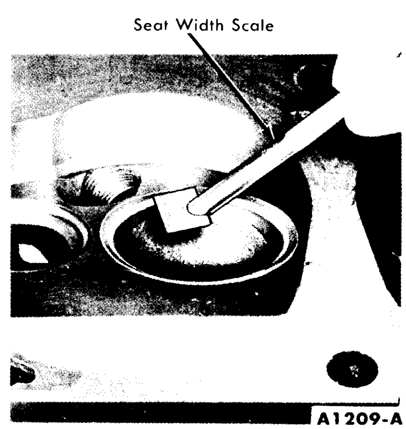

FIG. 8—Checking Valve Seat Width

CRANKSHAFT

Dress minor imperfections with an oil stone. Reface severely marred journals.

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

REFINISHING JOURNALS

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

Always reproduce the same journal shoulder radius that existed originally. Too small a radius 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.

PISTONS, PINS AND RINGS

FITTING PISTONS

Pistons are available for service in standard sizes and 0.020, 0.030 and 0.040 inch oversizes.

The standard-size pistons are color coded "red" or "blue" on the dome. Refer to the specifications for the standard-size piston dimensions. Piston pins and retainers are provided with new pistons.

Follow the procedures in Section 3 to measure the piston O.D. and cylinder bore. The dimensions should be within specifications, and the piston to bore clearance (bore I.D. minus piston O.D.) must be within the specified limits.

Then, check the piston fit in the bore with a feeler gauge and spring scale, following the procedure in steps 1 thru 7 below.

If the piston 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 available.

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 specified limits. If the new rings are to be installed in a used cylinder that has not been refinished, remove the cylinder wall "glaze." Be sure to clean the cylinder bore thoroughly, following the procedures in Section 3.

To fit a piston:

1. Calculate the size piston to be used by taking a cylinder bore check, following the procedures in Section 3.

2. Select the proper size piston to provide the desired clearance (Refer to the specifications).

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.**

To check the measured fit of piston to cylinder bore, use a feeler gauge and tension scale following the procedure in steps 4-7 below. **This procedure must not be used to overrule the calculated fit determined from measuring the piston and cylinder bore (Section 3).**

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 thicknesses listed in Fig. 9.

5. Position the ribbon in the cyl-

PISTON CLEARANCE							
RIBBON 0.0015 THICK & 0.500 WIDE		RIBBON 0.002 THICK & 0.500 WIDE		RIBBON 0.0035 THICK & 0.500 WIDE		RIBBON 0.006 THICK & 0.500 WIDE	
Ribbon Pull Lbs.	Clearance Inches	Ribbon Pull Lbs.	Clearance Inches	Ribbon Pull Lbs.	Clearance Inches	Ribbon Pull Lbs.	Clearance Inches
13	—	13	—	13	0.0012	13	0.0038
12	—	12	—	12	0.0014	12	0.0040
11	—	11	—	11	0.0016	11	0.0041
10	—	10	—	10	0.0018	10	0.0043
9	—	9	0.0002	9	0.0021	9	0.0045
8	—	8	0.0005	8	0.0023	8	0.0047
7	0.0002	7	0.0007	7	0.0025	7	0.0049
6	0.0004	6	0.0010	6	0.0027	6	0.0050
5	0.0007	5	0.0012	5	0.0030	5	0.0057
4	0.0009	4	0.0015	4	0.0032	4	0.0059
3	0.0012	3	0.0017	3	0.0033	3	0.0060
2	0.0015	2	0.0020	2	0.0036	2	0.0062
1	0.0017	1	0.0022	1	0.0038	1	0.0063
0	0.0020	0	0.0025	0	0.0040	0	0.0065

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FIG. 9—Piston Clearance Chart

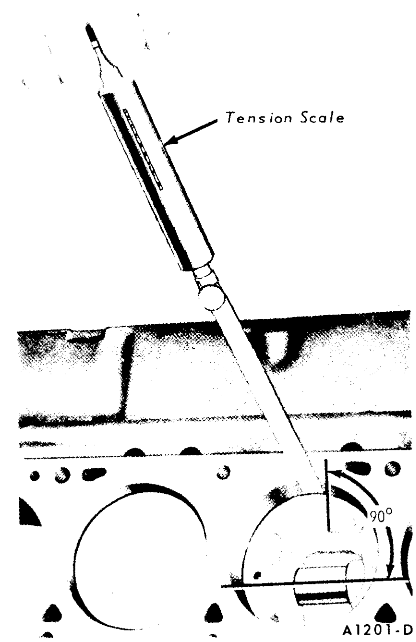

FIG. 10—Checking Piston Fit

inder bore so that it extends the entire length of the piston at 90° from the piston pin location.

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

7. Hold the piston and slowly pull the scale in a straight line with the ribbon, noting the pull required to remove the feeler ribbon (Fig. 10).

Compare the required pull with Fig. 9 to determine the piston clearance.

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 that the ring is square with the cylinder wall. **Use caution to avoid damage to the ring or cylinder bore.**

5. Measure the gap between the ends of the ring with a feeler gauge (Fig. 11). If the ring gap is less or greater than the specified limits, 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. 12). 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.**

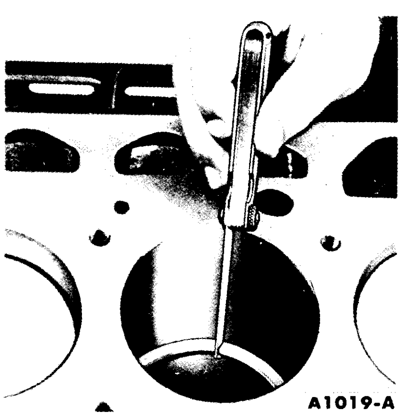

FIG. 11—Typical Piston Ring Gap

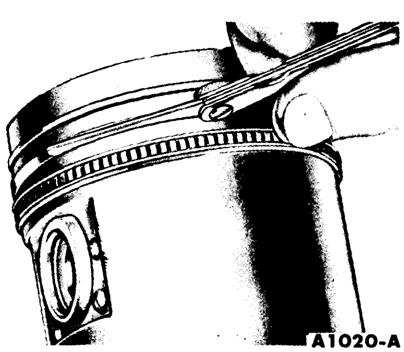

FIG. 12—Ring Side Clearance

FITTING PISTON PINS

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

If the pin hole in the piston must be reamed or honed, use precision honing equipment or an expansion-type piloted reamer.

If a reamer is used, place the reamer in a vise and revolve the piston around the reamer. Set the reamer to the size of the pin bore; then expand the reamer slightly and trial ream the pin bore. Take a light cut. Use a pilot sleeve of the nearest size to maintain alignment of the bores.

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

Install the piston pin in the piston and rod. Install a new retainer at each end of the pin to hold it in place. Make sure the retainers are properly seated in their grooves.

CYLINDER BLOCK

REFINISHING CYLINDER WALLS

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

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

Refinish only the cylinder or cylinders that require it. **All pistons are the same weight, both standard and oversize; therefore, various sizes of pistons can be used 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 that the correct surface finish and pattern are obtained. Use clean sharp hones of No. 180-220 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 clean and oil the cylinder walls, following the procedure in Section 3. Check the piston fit, following the procedures in this section and Section 3. 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.

3 CLEANING AND INSPECTION

The cleaning and inspection procedures in this section are for a complete engine overhaul; therefore, for partial engine overhaul or parts replacement follow the pertinent cleaning or inspection procedure.

INTAKE MANIFOLD

CLEANING

Remove all gasket material from the machined surfaces of the manifold. Clean the manifold in a suitable solvent, and dry with compressed air.

INSPECTION

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

Check the baffle plate on the underside of the manifold; it should be securely fastened to all retaining points.

EXHAUST MANIFOLDS

CLEANING

Remove all gasket material from the manifolds.

On the right exhaust manifold, clean out the automatic choke air heat chamber. Make sure the air inlet passage is completely open and the cover does not leak. Blow out the automatic choke air heat tube and air inlet tube with compressed air.

INSPECTION

Inspect the manifolds for cracks, damaged gasket surfaces, or other defects that would make them unfit for further service.

VALVE ROCKER ARM SHAFT ASSEMBLY

CLEANING

Clean all the parts thoroughly. Make sure all oil passages are open. If necessary, remove the plugs from both ends of the rocker arm shaft to thoroughly clean the shaft passages.

INSPECTION

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

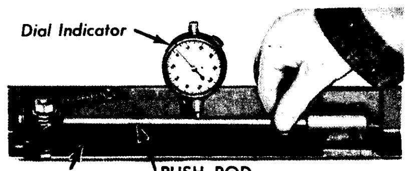

FIG. 13—Push Rod Runout

Inspect the pad at the valve end of the rocker arms for indications of scuffing or abnormal wear. If the pad is grooved, replace the rocker arm. **Do not attempt to true this surface by grinding.**

Check for broken locating springs.

PUSH RODS

INSPECTION

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

The push rods can be visually checked for straightness while they are installed in the engine by rotating them with the valve closed. They also can be checked with a dial indicator (Fig. 13).

CYLINDER HEADS

CLEANING

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

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

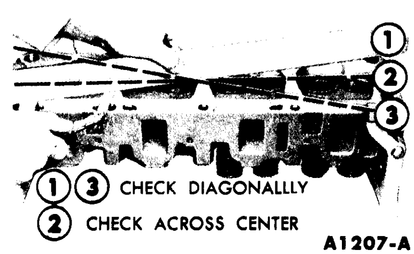

FIG. 14—Cylinder Head Flatness

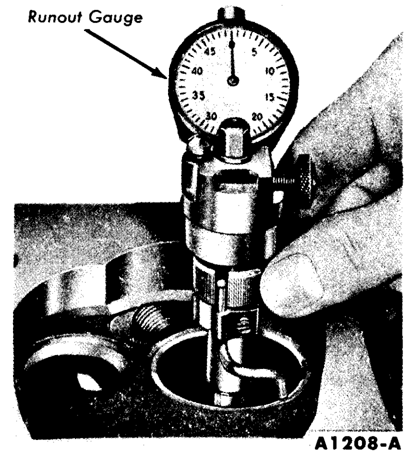

FIG. 15—Valve Seat Runout

INSPECTION

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

The following inspection procedures are for a cylinder head that is to be completely overhauled. For individual repair operations, use only the pertinent inspection procedure.

Cylinder Head Flatness. When a cylinder head is removed because of gasket leaks, check the flatness of the cylinder head gasket surface (Fig. 14) for conformance to specifications. If necessary to refinish the cylinder head gasket surface, **do not plane or grind off more than 0.010 inch.**

Valve Seat Runout. Check the valve seat runout with an accurate gauge (Fig. 15). Follow the instructions of the gauge manufacturer. If the runout exceeds the wear limit, reface the valve and valve seat.

Valve Seat Width. Measure the valve seat width (Fig. 8). Reface the valve seats if the width is not within specifications.

Valves. The critical inspection points and tolerances of the valves are illustrated in Fig. 16. Refer to the specifications for the wear limits.

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, erosion, warpage and cracking. Defects, such as minor

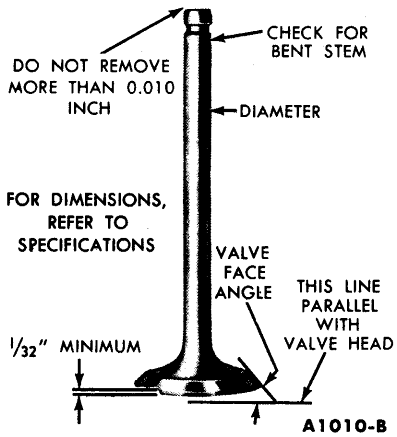

FIG. 16—Critical Valve Tolerances

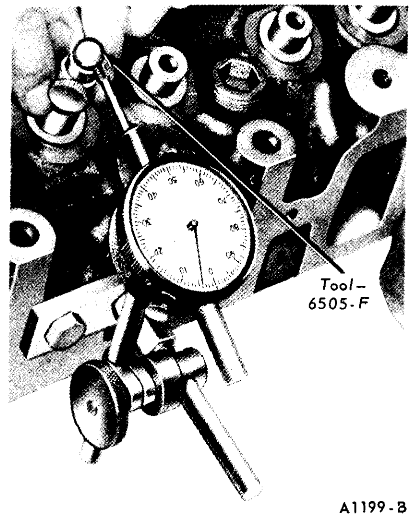

FIG. 18—Valve Stem Clearance

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 visually defective parts.

Valve Face Runout. Check the valve face runout as shown in Fig. 17. The valve face runout should not exceed the specified limits. If the runout exceeds the wear limit, the valve should be replaced or refaced as outlined under "Refacing Valves" in this section.

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. 18 or its equivalent. Use a flat-end indicator point.

Valve Spring Pressure. Check the spring for proper pressure (Fig. 19). Do not remove the damper spring when checking the pressure. Weak valve springs cause poor engine performance; therefore, if the pressure of any spring exceeds the wear limit, replace the spring.

Valve Springs. Check each spring for squareness, using a steel square and a surface plate (Fig. 20). 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 the square. If the spring is out of square more than 1/16 inch, replace it.

Follow the same procedure to check new valve springs before installation.

Make certain the proper spring (color coded) is installed.

Visually inspect the valve spring retainer to determine if the damper spring coil has been hitting the retainer. This interference will also cause a clicking noise when the engine is operating. The damper spring is properly installed in the valve spring when positioned so that the end of the damper spring bottom coil is 135° counterclockwise from the end of the valve spring lower coil.

HYDRAULIC VALVE LIFTERS

The valve lifter assemblies should be kept in proper sequence so that they can be installed in their original position. Inspect and test each lifter separately so as not to intermix the internal parts. **If any part of the lifter assembly needs replacing, replace the entire assembly.**

CLEANING

Thoroughly clean all the parts in clean solvent and wipe them with a clean, lint-free cloth.

INSPECTION

Inspect the parts and discard the entire lifter assembly if any part shows pitting, scoring, galling, or evidence of non-rotation. Replace the entire assembly if the plunger is not free in the body. The plunger should drop to the bottom of the body by its own weight.

Assemble the lifter assembly and check for freeness of operation by pressing down on the push rod cup. The lifters can also be checked with a hydraulic tester to test the leak down rate. Follow the instructions of the test unit manufacturer or the procedure in Section 1.

TIMING CHAIN AND SPROCKETS

CLEANING AND INSPECTION

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

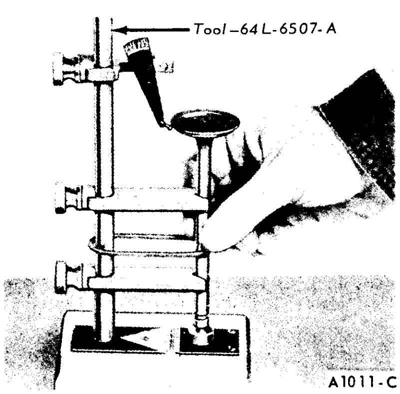

FIG. 17—Valve Face Runout

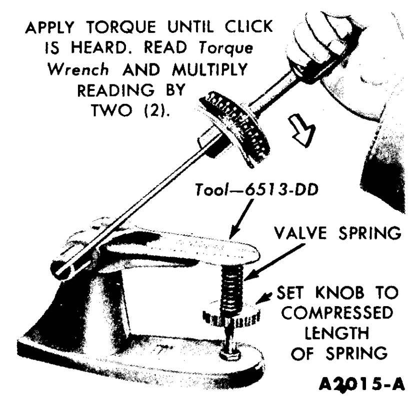

FIG. 19—Valve Spring Pressure

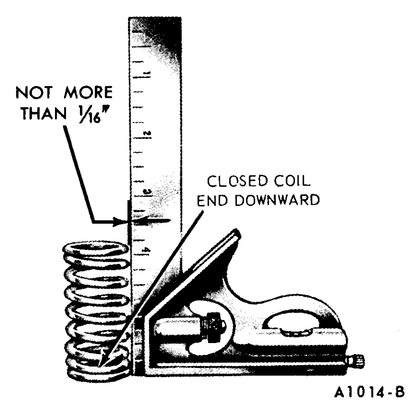

FIG. 20—Valve Spring Squareness

CAMSHAFT

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 characteristics may result in pitting in the general area of the lobe toe. 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 checked with the camshaft installed in the engine or on centers. Refer to "Camshaft Lobe Lift."

Check the distributor drive gear for broken or chipped teeth.

CRANKSHAFT

CLEANING

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

INSPECTION

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

Measure the diameter of each journal in at least four places to determine out-of-round, taper, or undersize condition (Fig. 21).

FLYWHEEL—AUTOMATIC TRANSMISSION

INSPECTION

Inspect the flywheel for cracks or other defects that would make it unfit for further service. Inspect the starter ring gear for worn, chipped or cracked teeth. If the teeth are damaged, replace the starter ring gear.

A VS B = VERTICAL TAPER
C VS D = HORIZONTAL TAPER
A VS C AND B VS D = OUT-OF-ROUND
CHECK FOR OUT-OF-ROUND AT EACH END OF JOURNAL

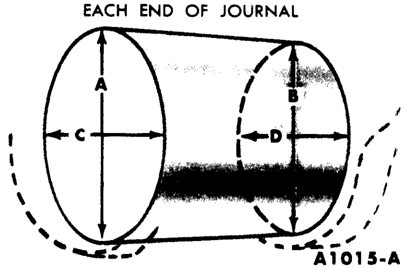

FIG. 21—Crankshaft Journal Measurements

With the flywheel installed on the crankshaft, check the gear face runout and outside diameter runout of the flywheel (refer to Section 1 for the proper procedure).

CONNECTING RODS

CLEANING

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

INSPECTION

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.

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

Replace defective connecting rod nuts and bolts.

Check the connecting rods for bend or twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. If the bend and/or twist exceeds specifications, the connecting rod must be straightened or replaced.

PISTONS, PINS AND RINGS

CLEANING

Remove deposits from the piston surfaces. Clean gum or varnish from the piston skirt, piston pins and rings with solvent. **Do not use a caustic cleaning solution or a wire brush to clean pistons.** Clean the ring grooves with a ring groove cleaner such as shown in Fig. 22. Make sure the oil ring slots (or holes) are clean.

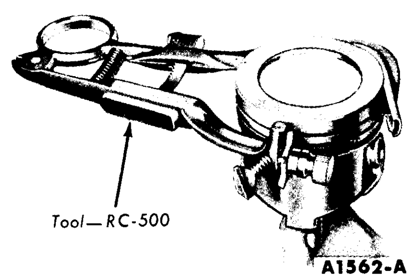

FIG. 22—Cleaning Ring Grooves—Typical

INSPECTION

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

Check the piston to cylinder bore clearance by measuring the piston and bore diameters. Refer to the specifications for the proper clearance. Refer to "Cylinder Block Inspection" for the bore measurement procedure. **Measure the O.D. of the piston with micrometers at the centerline of the piston pin bore and at 90° to the pin bore axis.** Install the piston(s) and recheck the clearance with a tension scale and ribbon, following the procedure under "Fitting Pistons." Check the ring side clearance following the procedure under "Fitting Piston Rings."

Replace piston pins showing signs of fracture, etching or wear. Check the piston pin fit in the piston and rod (Section 2).

Replace all rings that are scored, chipped or cracked. Check the end gap and side clearance (Section 3). 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.**

MAIN AND CONNECTING ROD BEARINGS

CLEANING

Clean the bearing inserts and caps thoroughly in solvent, and dry them with compressed air. **Do not scrape gum or varnish deposits from bearing shells.**

INSPECTION

Inspect each bearing carefully. Bearings that have a scored, chipped or worn surface should be replaced. Typical examples of bearing failures and their causes are shown in Fig. 23. The copper lead bearing base may be visible through the bearing overlay. This does not mean that the bearing is worn. It is not necessary to replace the bearing if the bearing clearance is within recommended limits. Check the clearance of bearings that appear to be satisfactory with Plastigage. Fit new bearings following the recommended procedure (Part 8-2).

CYLINDER BLOCK

CLEANING

After any cylinder bore repair operation, such as honing or deglazing, clean the bore(s) with soap or detergent and water. **Then, thoroughly rinse the bore(s) with clean water to remove the soap or detergent, and wipe the bore(s) dry with a clean, lint-free cloth. Finally, wipe the bore(s) with a clean cloth dipped in engine oil. If these procedures are not followed, rusting of the cylinder bore(s) may occur.**

If the engine is disassembled, 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. **Be sure the jiggle pin in the main oil gallery front plug operates freely.**

Make sure the threads in the cylinder head bolt holes are clean. Dirt in the threads may cause binding and result in a false torque reading. Use a tap to true-up threads and to remove any deposits.

INSPECTION

After the block has been thoroughly cleaned, check it 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 cylinder block for flatness of the cylinder head gasket surface following the procedure and specifications recommended for the cylinder head. The cylinder block can be machined to bring the cylinder head gasket surface within the flatness specifications, **but do not exceed 0.010 inch stock removal.**

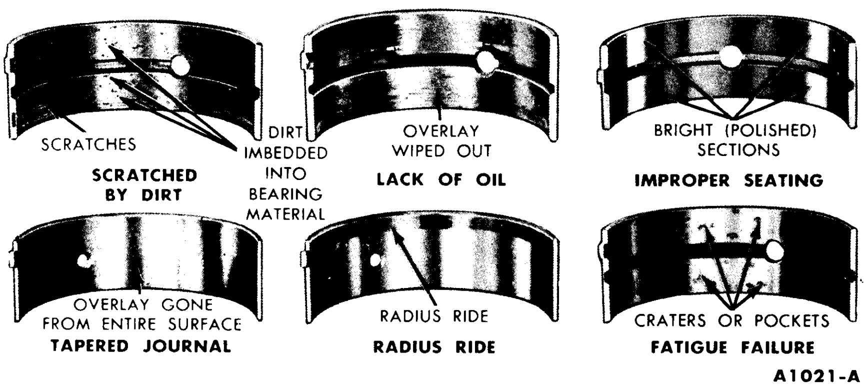

FIG. 23—Typical Bearing Failures

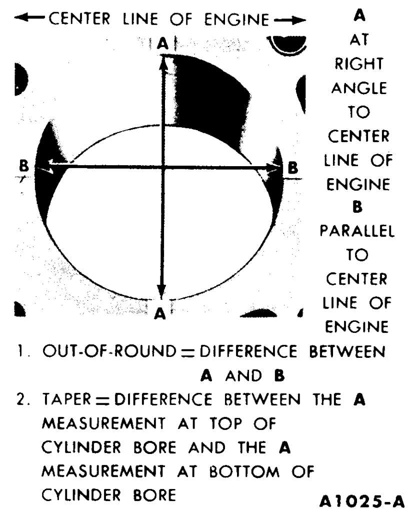

FIG. 24—Cylinder Bore Out-of-Round and Taper

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 bore 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. 24).

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 specified limits. Use the finest grade of honing stone for this operation.

OIL PAN

CLEANING

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 particles are removed from below the baffle plate.

INSPECTION

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

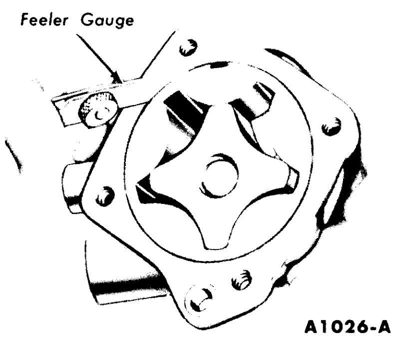

FIG. 25—Outer Race to Housing Clearance—Typical Oil Pump

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

OIL PUMP

CLEANING

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

INSPECTION

Refer to the specifications for clearances and wear limits.

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

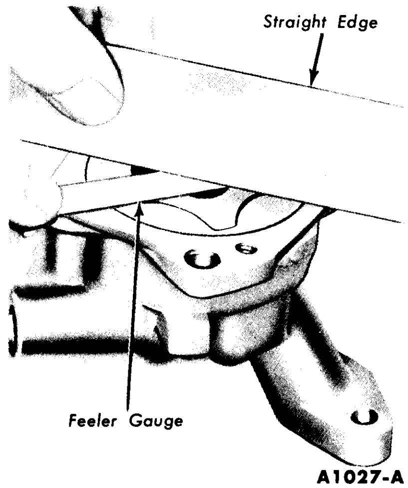

FIG. 26—Rotor End Play—Typical Oil Pump

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. 25).

With the rotor assembly installed in the housing, place a straight edge over the rotor assembly and the housing. Measure the rotor end play clearance between the straight edge and the rotor and outer race (Fig. 26).

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 or the spring is defective, replace the spring.

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

CRANKCASE VENTILATION SYSTEM

Refer to Group 19 for the correct mileage interval for maintenance.

CLEANING

Do not attempt to clean the crankcase regulator valve.

Clean the crankcase ventilation system connection on the carburetor spacer by probing the inlet nipple with a flexible wire or bottle brush.

Clean the rubber hose with a low-volatility, petroleum-base solvent and dry with compressed air.

PART 8-2 390 V-8 ENGINE

1 DESCRIPTION AND OPERATION

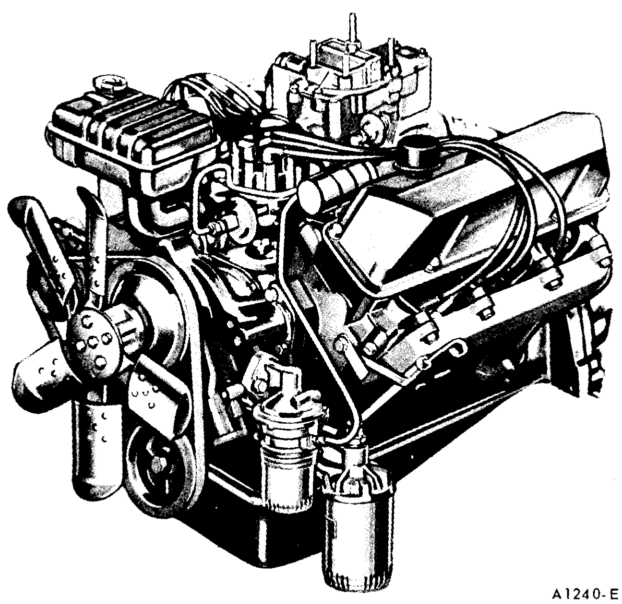

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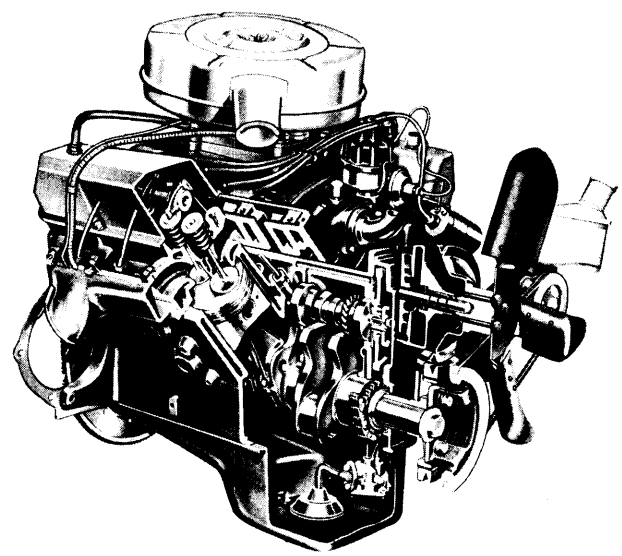
FIG. 1—Typical ¾ Left Front View



A1898-B

FIG. 2—Typical ¾ Right Front Sectional View

The Thunderbird 390 Special V-8 engine (Figs. 1, 2 and 3) has a 4.05-inch bore and a 3.78-inch stroke and a total piston displacement of 390 cubic inches. It has a compression ratio of 10.1:1. The warranty plate identification symbol for the engine is "Z."

An engine identification tag is attached to the ignition coil bracket; refer to Part 8-1, Section 1.

MANIFOLDS

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 and into the carburetor coolant spacer. The coolant circulates through the spacer and flows into the heater inlet hose and into the heater. Exhaust gases provide the initial heat necessary to assist in vaporizing the incoming fuel mixture.

The intake manifold has two sets of fuel passages, each with its own separate inlet connection to the carburetor (Fig. 5). The right barrels of the carburetor feed Nos. 1, 4, 6 and 7 cylinders and the left barrels feed Nos. 2, 3, 5 and 8 cylinders.

The distributor is mounted at the left front of the intake manifold.

Warm air for the automatic choke is drawn from the heat chamber of the right exhaust manifold (Fig. 6).

CYLINDER HEADS

The cylinder head assemblies contain the valves and the valve rocker

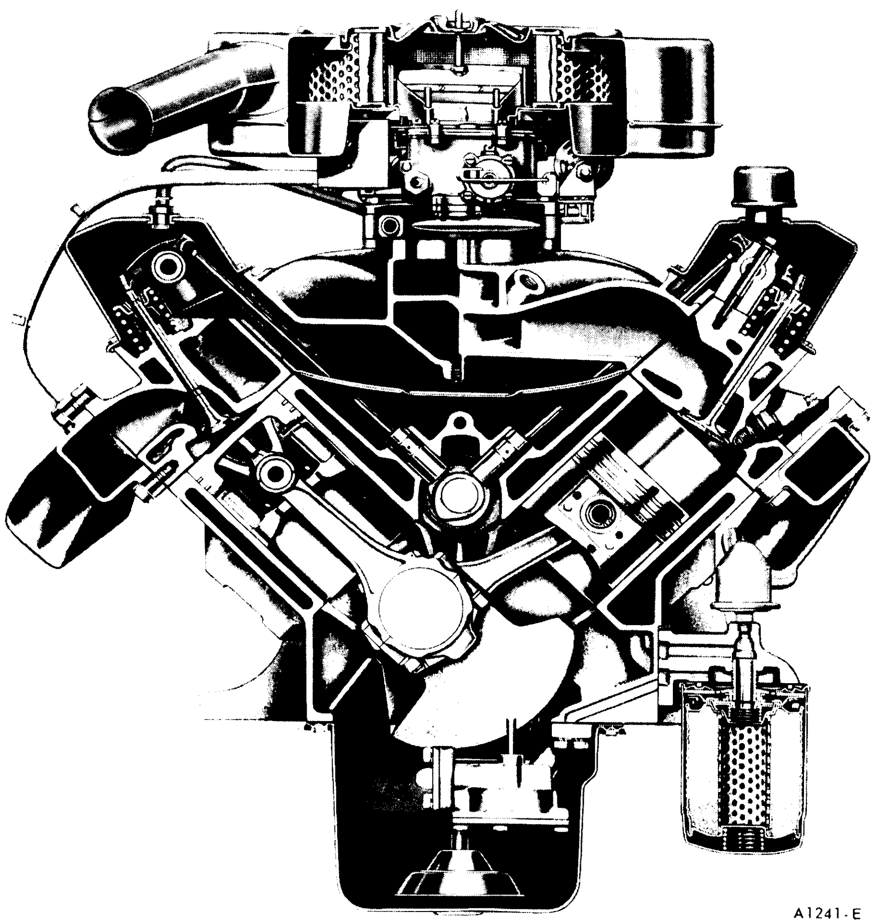


FIG. 3—Typical Front Sectional View

arm shaft assembly. The combustion chambers are machined in the head. Valve guides are an integral part of the head. The valves are arranged from front to rear on both banks E-I-E-I-I-E-I-E (Fig. 7).

CYLINDER BLOCK

The cylinders are numbered from front to rear, on the right bank 1, 2, 3 and 4 and on the left bank 5, 6, 7 and 8. The firing order is 1-5-4-2-6-3-7-8.

The oil pump, mounted inside the oil pan at the front, is driven by the distributor through an intermediate drive shaft.

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

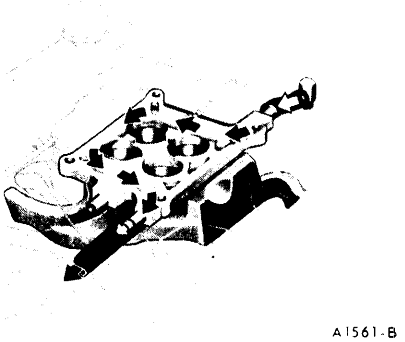


FIG. 4—Engine Coolant-Heated Spacer Passages

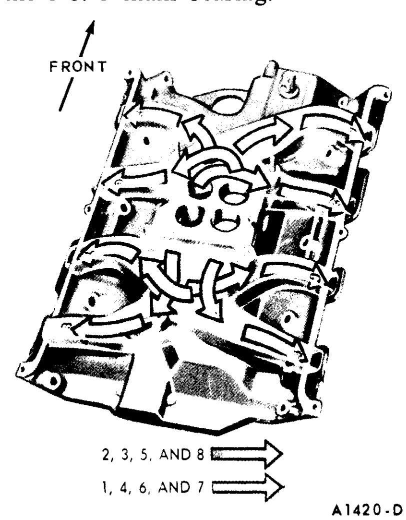


FIG. 5—Intake Manifold Fuel Passages

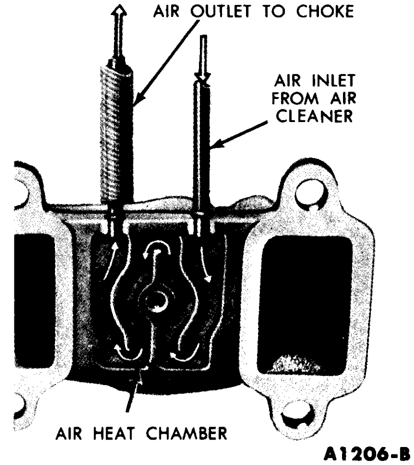


FIG. 6—Automatic Choke Heat Chamber

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 which rotate slightly each time the valve opens and closes.

The push rods are solid steel with oil cushioned sockets.

The camshaft is supported by five bearings pressed into the block. It is driven by a sprocket and timing chain in mesh with a sprocket on the crankshaft. Camshaft thrust is controlled by a thrust plate bolted to the front of the cylinder block. An eccentric, bolted to the front end of the camshaft, operates the fuel pump.

Hydraulic valve lifters are used in the engine. The valve lifters are housed in bores located in the cylinder block valve lifter chamber. The valve lifters operate directly on the camshaft lobes, thereby transmitting the thrust of the camshaft lobes, by the means of hydraulic pressure, to the push rods which actuate the valve train. Figure 8 shows the various components and operation of a hydraulic lifter.

When either an exhaust valve or

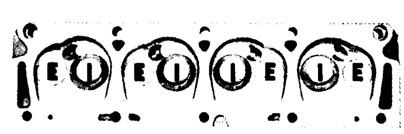


FIG. 7—Valve Port Arrangement

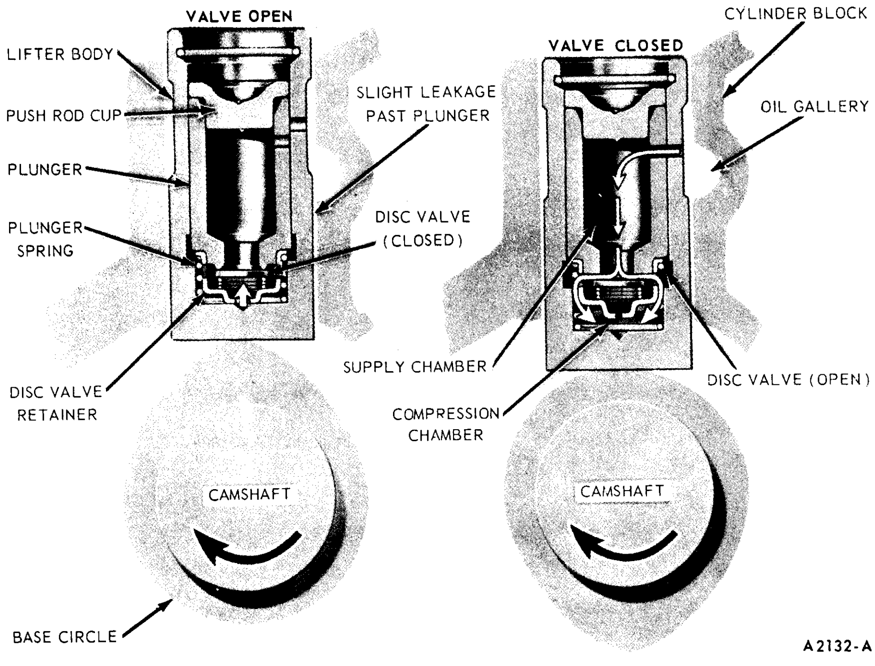


FIG. 8—Typical Hydraulic Valve Lifter Operation

an intake valve is closed, the actuating valve lifter is on the base circle (lowest position) of the camshaft lobe.

When the valve lifter is in this position, the lifter plunger spring expands. This action forces the lifter plunger and valve push rod upward, forcing the valve end of the rocker arm to maintain solid contact with the valve (zero valve lash). In this position, the oil hole in the lifter body and plunger is indexed with the oil gallery in the cylinder block.

As the lifter plunger moves upward, the volume of the compression chamber is increased, resulting in reduced oil pressure in the compression chamber. Therefore, to equalize the resulting pressure differential between the supply chamber and the compression chamber, the disc valve moves off its seat and permits oil to flow from the supply chamber to the compression chamber. When the compression chamber becomes filled with oil, the pressures in the two chambers are equalized. The oil flow ceases and the disc valve spring seats the disc valve and closes the disc valve port.

As the camshaft rotates, the lifter assembly is raised by the camshaft lobe. This increases the push rod force against the lifter plunger and hydraulic pressure immediately builds up in the compression chamber until it acts as a solid member of the valve operating mechanism. The lifter then becomes a hydraulic ram which forces the valve in the cylinder head to open. During this period, a slight leakage of oil past the plunger occurs (calibrated leak down rate).

As the high point of the camshaft lobe rotates and passes by the foot of the valve lifter, the valve in the cylinder head seats and the valve lifter assembly is forced downward. Reduced force on the lifter plunger at this time relieves the pressure on the lifter plunger and it is free to be moved upward by the plunger spring. This action allows oil to flow once again through the indexed oil holes in the lifter body and plunger.

The operating cycle is completed for each revolution of the camshaft. Zero clearance (lash) in the valve train mechanism is maintained at all times by the hydraulic force and expansion of the plunger spring between the lifter body and plunger.

LUBRICATION SYSTEM

Oil from the oil pan sump, located in the front of the oil pan, is forced through the pressure-type lubrication system (Fig. 9) by a rotor oil pump. A spring-loaded relief valve in the pump limits the maximum pressure of the system. Oil relieved by the valve is directed back to the intake side of the pump.

All the oil discharged by the pump passes through a full flow-type filter before it enters the engine. The filter is mounted in a vertical position at the lower left front of the engine. A relief valve in the filter permits oil to by-pass the filter element if it becomes clogged.

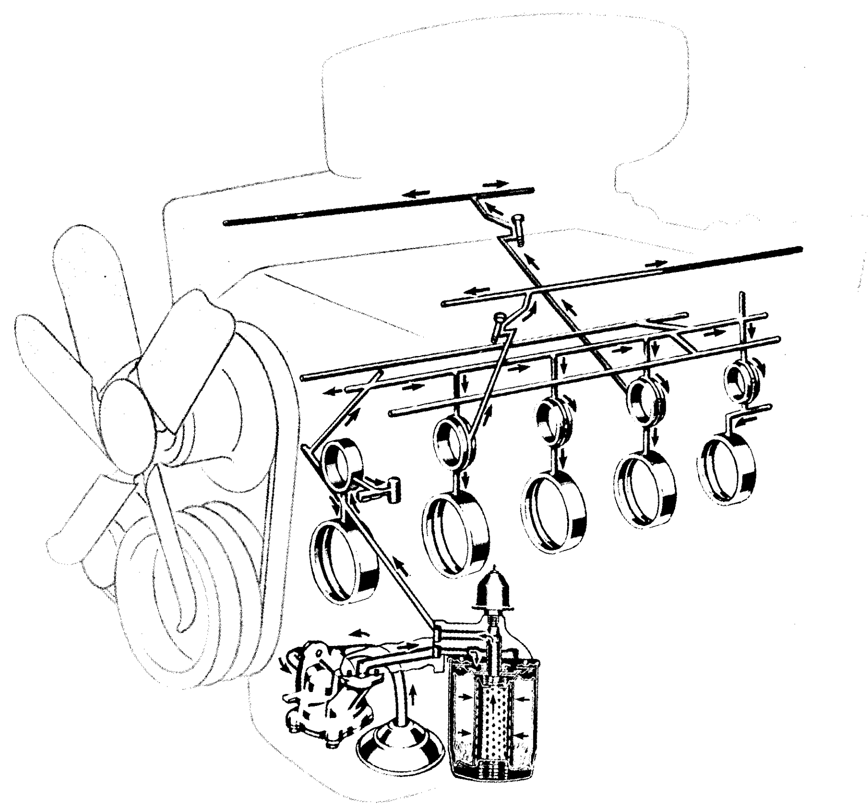


FIG. 9—Lubrication System

From the filter, the oil flows into the main oil gallery which is located in the center of the valve push rod chamber floor. The oil gallery supplies oil to each individual camshaft bearing, through drilled passages in the block. Passages are drilled from each camshaft bearing to each main bearing. The camshaft No. 1 bearing feeds No. 1 main bearing, and the camshaft No. 2 bearing feeds No. 2 main bearing, etc. The oil then flows through notches or grooves in the main bearings to lubricate the crankshaft journals. A jiggle pin in the main oil gallery front plug allows any air that may be trapped in the oil to escape. The timing chain and sprockets are splash lubricated by oil from the jiggle pin.

The crankshaft is drilled from the main bearings to the connecting rod bearings.

A small groove is located in the connecting rod at the mating face where the cap contacts the connecting rod. This groove is used as an oil squirt hole for cylinder wall lubrication. Oil from the connecting rod squirt hole lubricates the opposite cylinder wall. For example, the No. 1 connecting rod oils No. 5 cylinder, etc. As the crankshaft turns, the hole in the connecting rod bearing aligns with the hole in the journal causing a direct squirt of oil onto the cylinder wall.

Oil passages are drilled from the main oil gallery to each valve lifter oil gallery. Oil from here feeds the valve lifter assemblies. A reservoir at each valve lifter bore boss traps oil so that oil is available for valve lifter lubrication as soon as the engine starts.

An oil passage is drilled from the camshaft No. 2 bearing web to the left cylinder head between Nos. 5 and 6 cylinders to lubricate the valve rocker arm shaft assembly (Fig. 10). The oil passage in the cylinder head is drilled from the cylinder head bolt bore to the No. 2 valve rocker arm shaft support.

The oil flows through the valve rocker arm shaft through drilled holes in each valve rocker arm to lubricate the bushing and both ends of the valve rocker arm. The excess oil spirals down the rotating push rods and lubricates the push rod seats. The right valve rocker arm shaft assembly is similarly lubricated from No. 4 camshaft bearing via the No. 3 valve rocker arm shaft support.

A baffle located under the valve rocker arm shaft assembly shields the valve stems from oil splash. Excess oil is returned to the oil pan through drain-back holes located at

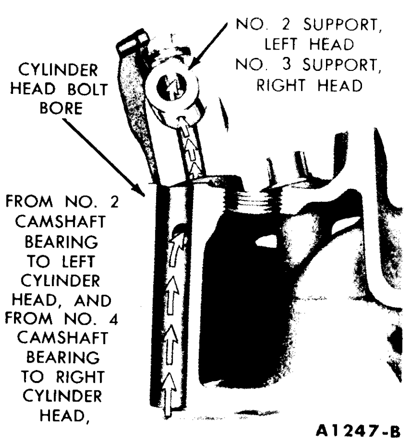


FIG. 10—Valve Rocker Arm Shaft Lubrication

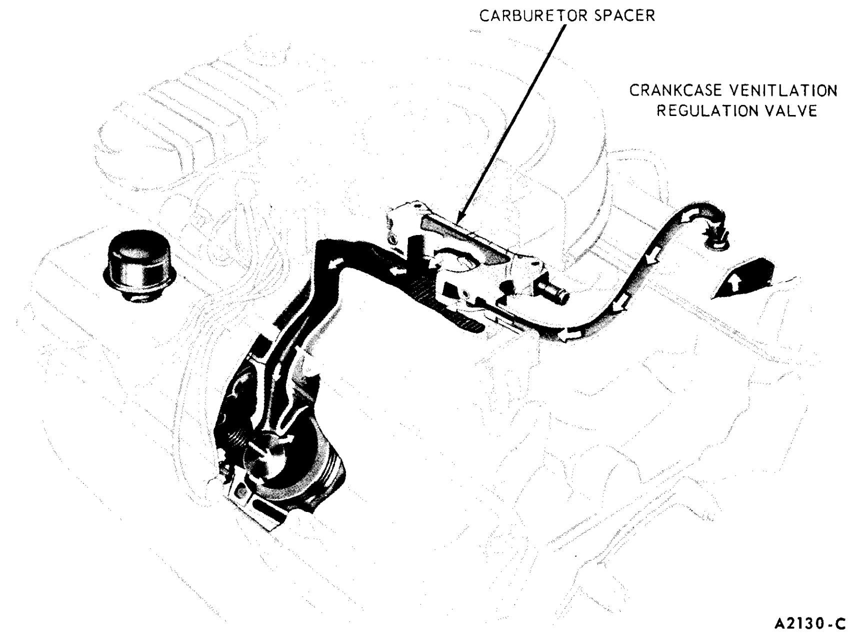


FIG. 11—Positive Crankcase Ventilation System

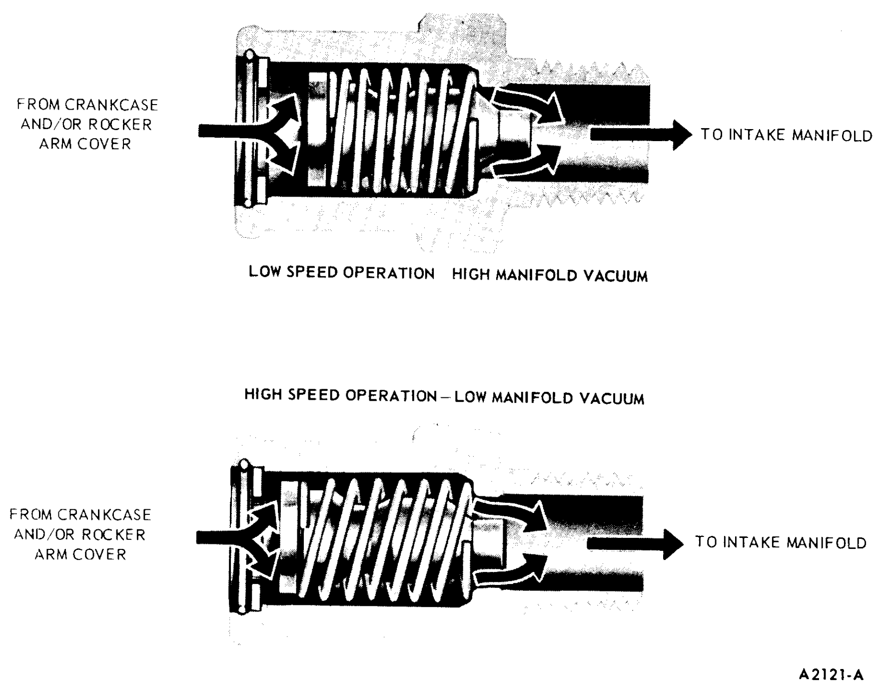


FIG. 12—Positive Crankcase Ventilation Regulator Valve Operation

each end of the cylinder head and in the push rod chamber floor.

POSITIVE CRANKCASE VENTILATION SYSTEM

Ventilating air enters the engine through the oil filler tube cap (breather cap) on the left rocker cover (Fig. 11).

On a closed crankcase ventilation system, the breather cap is sealed and connected to the air cleaner by a hose. Thus, the crankcase receives air from the air cleaner.

On closed crankcase ventilation systems, if the system becomes restricted, a back-flow condition will occur, thereby venting the crankcase gases into the air cleaner silencing chamber.

A slight vacuum is maintained in the engine crankcase due to a restriction (metering hole) in the breather cap and by the amount of air flow through the regulator valve. A baffle plate, located under the intake manifold, directs a portion of the ventilating air to the front of the crankcase and into the cylinder front cover. The baffle plate, aided by the turbulent pressures of the crankcase, circulates air throughout the valve push rod chamber and the crankcase. The ventilating air flows into the right valve rocker arm cover from the valve push rod chamber. From the valve rocker arm cover, the ventilating air passes through the crankcase ventilation regulator valve and into the carburetor spacer through a connecting hose. The carburetor spacer disperses the air, laden with crankcase vapors, into the intake manifold below the carburetor.

The amount of regulator valve opening or restriction is governed by intake manifold vacuum pressure (Fig. 12).

During idle, the high intake manifold vacuum overcomes the spring pressure and moves the valve to the "Low Speed Operation" position (Fig. 12). With the valve in this low flow position, the ventilating air passes between the valve (jiggle pin) and the outlet port. In this position there is minimum ventilation, but it never completely seals off the air flow.

As engine speed increases, and manifold vacuum decreases, the valve spring forces the valve to the full open position (Fig. 12). This increases the flow of ventilating air.

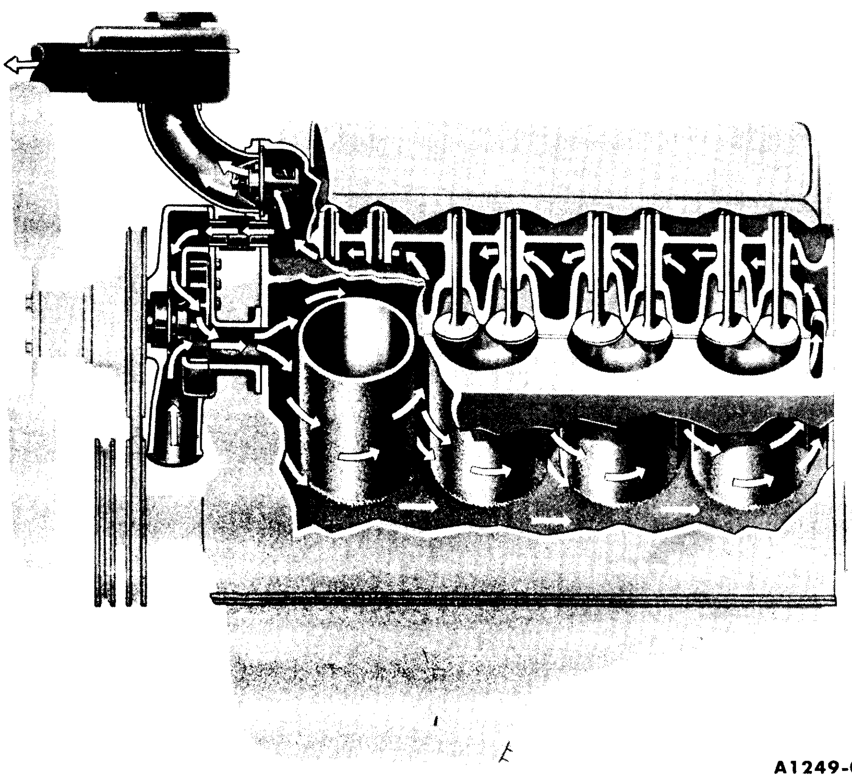


FIG. 13–Typical Cooling System

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. 13).

The coolant 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 heads where it cools the combustion chambers, valves, and valve seats on its return to the front of the engine.

The coolant from each cylinder head flows through the water passages in the intake manifold and past the water thermostat, if it is open, into the radiator supply tank. 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 12-15 psi.

2 IN-CAR ADJUSTMENTS AND REPAIRS

ENGINE SUPPORTS

The front supports are located on each side of the cylinder block and the rear support is located at the transmission extension housing (Fig. 14).

FRONT SUPPORT INSULATOR

The engine front support is shown in Fig. 14.

Removal

1. Position a jack and wood block under the engine oil pan, and raise the engine sufficiently to unload the engine front support insulators.

2. Remove the insulator assembly to engine retaining bolts and lock washers. Remove the insulator assembly to intermediate support bracket retaining nuts and washers on both engine supports.

3. Raise the engine about 1 inch and remove the right side insulator

assembly. Remove the assembly nuts and separate the insulator from the intermediate support bracket.

4. On the left side engine support, move the insulator and intermediate support bracket forward, and remove the assembly nuts. Separate the insulator and intermediate support bracket, and remove them from the engine compartment.

Installation

1. On a left side engine support, position the insulator and intermediate support bracket between the engine and frame crossmember. Assemble the insulator and support bracket and torque the nuts to specifications.

2. On a right side engine support, assemble the support insulator to the intermediate support bracket, and torque the nuts to specifications.

3. Position the insulator assembly(lies) to the engine and install the retaining bolts and lock washers. Torque the retaining bolts to specifications.

4. Lower the engine and install the insulator assembly to intermediate support bracket retaining nut and washer on both supports. Torque the retaining nuts to specifications.

REAR SUPPORT INSULATOR

The engine rear support is shown in Fig. 14.

Removal

1. Position a jack under the transmission extension housing. Remove the insulator assembly to support bracket retaining bolt and nut. Remove the insulator retainer bolts and lock washers.

2. Raise the transmission extension housing slightly to gain clearance and remove the insulator assembly and retainer.

3. If necessary, remove the support bracket to end bracket retaining bolts, washers and nuts. Remove the support bracket.

4. If necessary, remove the end bracket to floor pan reinforcement retaining bolts and lock washers. Remove the end bracket.

Installation

1. If the end brackets were removed, position the end bracket to the floor pan reinforcement and install the retaining bolts and lock washers. Torque the bolts to specifications.

2. If the support bracket was removed, position the support bracket to the end brackets and install the retaining bolts, lock washers and nuts. Torque the bolts to specifications.

3. Position the insulator assembly and insulator retainer to the transmission extension housing and install the insulator retainer bolts and lock washers. Torque the bolts to specifications.

4. Lower the transmission extension housing and install the support assembly to support bracket retaining bolt and nut. Torque the bolt to specifications. Remove the jack.

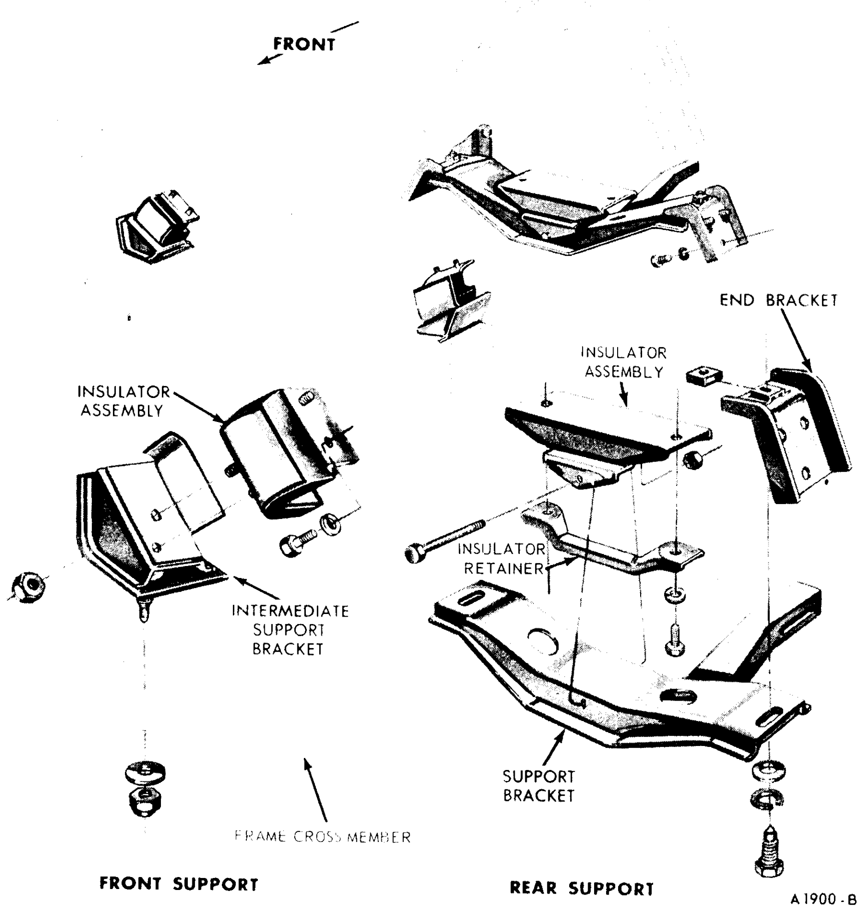


FIG. 14—Engine Front and Rear Supports

VALVE ROCKER ARM SHAFT ASSEMBLY

REMOVAL

1. Disconnect the automatic choke heat chamber air inlet tube and remove the air cleaner.

2. Disconnect the spark plug wires at the spark plugs. Remove the wires from the bracket on the valve rocker arm cover(s) and position the wires out of the way.

To remove the right valve rocker arm cover, remove the carburetor choke air heat tube. Remove the crankcase ventilation regulator valve.

To remove the left valve rocker arm cover, disconnect the brake booster vacuum line and position the line out of the way.

3. Remove the valve rocker arm cover(s).

If the left cover is removed, position the wire loom out of the way.

4. Starting at the No. 4 cylinder, loosen the right valve rocker arm shaft support bolts in sequence, two turns at a time. After the bolts are all loosened, remove the valve rocker arm shaft assembly and the oil baffle plate. Starting at the No. 5 cylinder, follow the same procedure on the left valve rocker arm shaft support bolts. **This procedure must be followed to avoid damage to the valve mechanism.**

FIG. 15—Typical Installation Identification Mark—Rocker Arm Shaft Assembly

INSTALLATION

1. Apply Lubriplate to the pad end of the rocker arms, to the tip of the valve stems, and to both ends of the push rods.

2. Crank the engine until the No. 1 piston is on TDC at the end of the compression stroke.

3. Rotate the crankshaft damper an additional 45° (identified by "XX" on the damper).

4. Position the baffle plate and the valve rocker arm shaft assembly(ies) on the cylinder head(s) with the valve push rods in place and the rocker shaft support bolts finger-tight. **Be sure the shaft is positioned so that the oil holes are to the bottom. Also, the identification notch (Fig. 15) must be downward and toward the front on the right bank, or toward the rear on the left bank.**

5. Starting at the No. 4 cylinder, tighten the bolts in sequence, two turns at a time, until the supports fully contact the cylinder head. Torque the bolts in sequence to specifications.

6. Starting at the No. 5 cylinder, follow the same procedure for the left valve rocker arm shaft support bolts. The additional time consumed in this procedure will permit the hydraulic lifters to leak down. This will minimize the possibility of bending the push rods, valves or rocker arms. **Be sure that the hydraulic lifters have leaked down to their normal operating position before cranking the engine. This is necessary in order to avoid possible damage to the valves, push rods or valve rocker arms.**

7. Check the valve clearances and correct if necessary (Part 8-1, Section 2).

8. Clean the valve rocker arm cover(s). Apply oil-resistant sealer to one side of new cover gasket(s). Lay the cemented side of the gasket(s) in place in the cover(s).

9. Position the cover(s) on the cylinder head(s). Make sure the gasket seats evenly all around the head. Install the bolts (and the wire loom clamps on the left cover). The cover is tightened in two steps. First, torque the bolts to specifications. Two minutes later, torque the bolts to the same specifications.

If the left cover was removed, connect the brake booster vacuum line.

If the right cover was removed, install the carburetor choke air heat tube. Install the crankcase ventilation regulator valve in the rocker cover.

10. Connect the spark plug wires. Install the air cleaner and connect the automatic choke heat chamber air inlet tube.

DISASSEMBLY

1. Remove the cotter pins from each end of the valve rocker arm shaft. Remove the flat washer and spring washer from each end of the shaft.

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

3. If it is necessary to remove the plugs from each end of the shaft, drill a hole in one plug. Insert a steel rod through the drilled plug and knock out the plug on the opposite end. Working from the open end, knock out the remaining plug.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Refer to Part 8-1, Section 2 for the repair procedures.

ASSEMBLY

1. Oil all the moving parts with engine oil. Apply Lubriplate to the pad of the valve rocker arms.

2. If the plugs were removed from the ends of the shaft, use a blunt tool

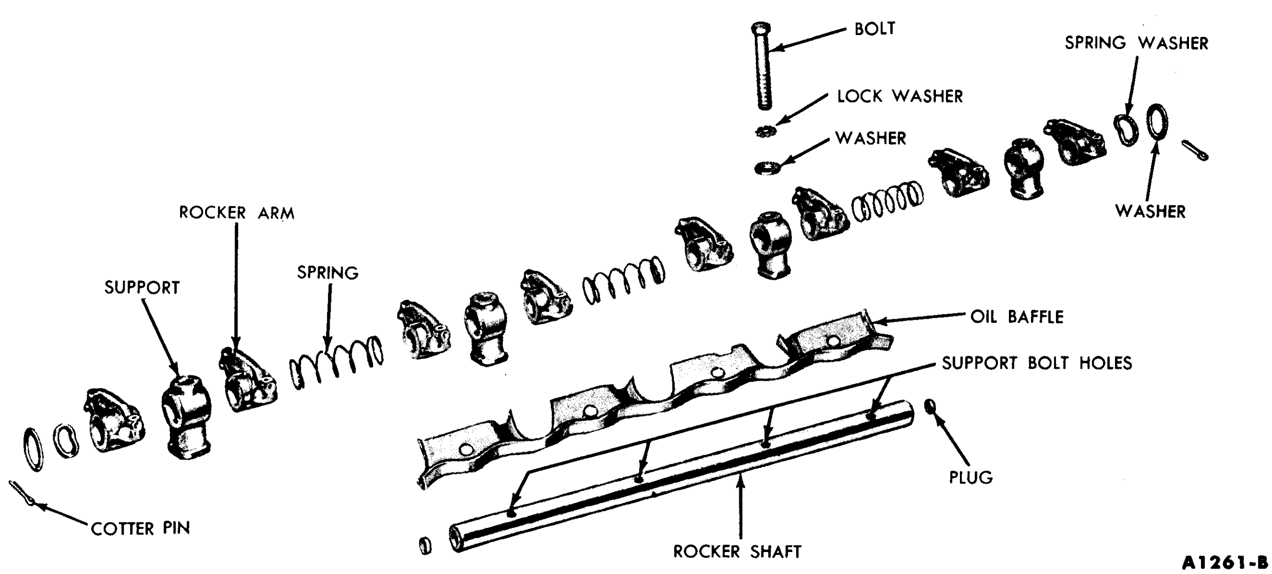


FIG. 16—Valve Rocker Arm Shaft Assembly

or large diameter pin punch, and install a plug, cup side out, in each end of the rocker arm shaft.

3. Install the rocker arms, supports and springs in the order shown in Fig. 16. **Be sure the oil holes in the shaft are facing downward. When properly assembled, the identification notch (Fig. 15) on the right rocker shaft assembly must be facing downward and toward the front of the engine. On the left rocker shaft assembly, the notch is downward and toward the rear.** Complete the assembly by installing the remaining flat washer and spring washer and install the cotter pin.

INTAKE MANIFOLD

REMOVAL

1. Drain the cooling system. Disconnect the automatic choke heat chamber air inlet tube and remove the air cleaner.

2. Disconnect the accelerator rod at the carburetor. Remove the accelerator cross shaft bracket from the intake manifold and position it out of the way.

3. Remove the carburetor fuel inlet line and the automatic choke air heat tube. Disconnect the brake booster vacuum line at the intake manifold and at the flexible hose. Remove the vacuum line.

4. Disconnect the coil high tension lead and the coil wires at the coil. Disconnect the oil pressure sending unit wire at the sending unit. Remove the wire loom from the retaining clips on the left valve rocker arm cover and position it out of the way.

5. Disconnect the spark plug wires at the spark plugs and remove the wires from the ignition harness brackets on the valve rocker arm covers.

6. Remove the distributor cap and spark plug wire assembly. Disconnect the distributor vacuum line at the distributor.

7. Remove the distributor hold-down bolt and clamp. Remove the distributor.

8. Disconnect the radiator upper hose at the radiator supply tank; then remove the supply tank. Disconnect the water temperature sending unit wire at the sending unit. Disconnect the heater hose at the carburetor spacer and the heater hose at the automatic choke housing. Position the hoses out of the way.

On a car with an air conditioner,

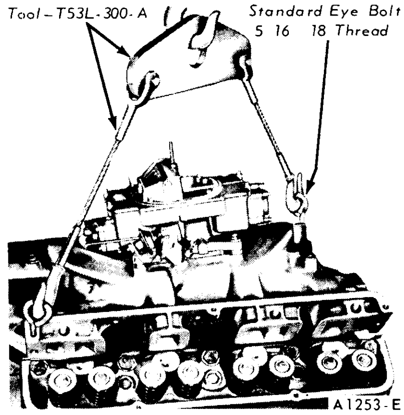


FIG. 17–Intake Manifold Removal or Installation

disconnect the heater hoses at the intake manifold and at the "T" connector in the heater hose to the water pump.

9. Slide the clamp on the water pump bypass hose toward the water pump.

10. Remove the valve rocker arm covers.

11. Refer to "Valve Rocker Arm Shaft Assembly Removal," and remove the valve rocker arm shaft assembly by following steps 4 and 5.

12. Remove the valve push rods in sequence.

13. Remove the intake manifold retaining bolts.

14. Install standard eye bolts with 5/16-18 threads in the left front and right rear rocker arm cover screw holes. Attach the engine lifting sling (Fig. 17).

15. Raise the intake manifold and carefully remove it and radiator supply tank as an assembly. **It may be necessary to pry the intake manifold away from the cylinder head(s).** Remove the intake manifold gaskets and seals.

16. If the manifold is to be disassembled, remove the radiator supply tank, thermostat and gasket. Remove the heater hose and fitting. Remove the carburetor, spacer and gasket. Remove the coolant temperature sending unit.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

The intake manifold assembly is shown in Fig. 18.

1. If the intake manifold was disassembled, install the carburetor, spacer and gasket. Coat the thermostat gasket and heater hose fitting

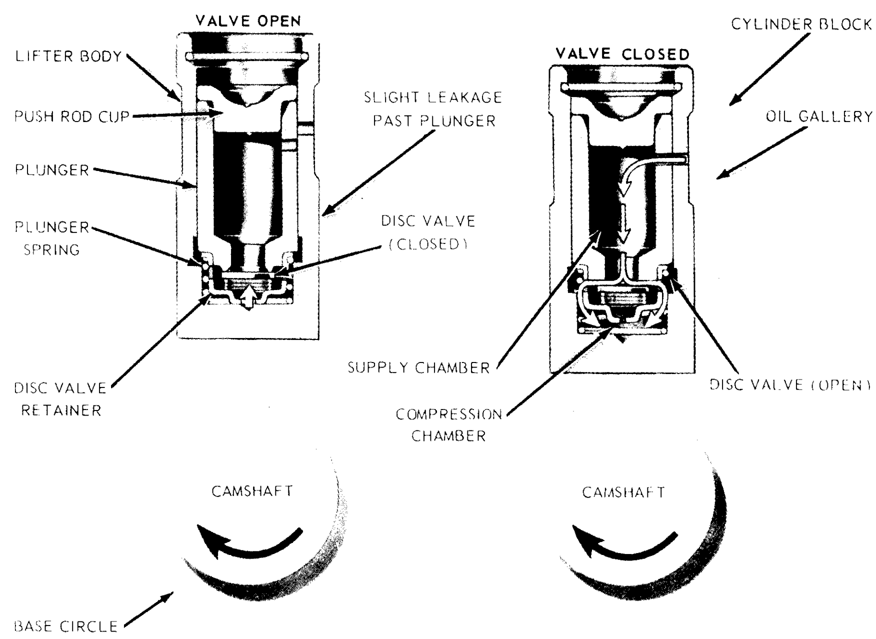


FIG. 18–Typical Intake Manifold Assembly

with water-resistant sealer. Install the heater hose and fitting. Coat the coolant temperature sending unit with electrical-conductive sealer and install it in the intake manifold. Position the thermostat gasket on the intake manifold. Install the thermostat and radiator supply tank.

2. Clean the mating surfaces of the intake manifold, cylinder heads and cylinder block. Use a suitable solvent to remove all traces of oil.

3. Coat the cylinder block seal surfaces with a quick-setting seal adhesive. Apply a non-hardening sealer to the mating lines of the cylinder heads and cylinder block.

4. Position new seals on the cylinder block and new gaskets on the cylinder heads. **Be sure the seals are properly positioned during installation as the adhesive sticks to the seals immediately on contact.** Position the manifold gasket slots over the end tabs on the seals. Coat these four connections with a non-hardening sealer. Be sure the holes in the gaskets are aligned with the holes in the cylinder heads.

5. Install the eye bolts in the intake manifold and attach the engine lifting sling. Carefully lower the intake manifold on the engine (Fig. 17) and at the same time engage the coolant outlet nipple with the water pump bypass hose.

6. Position the intake manifold by inserting the distributor in place. **After the intake manifold is in place, run a finger around the seal area to make sure the seals are in place. If the seals are not in place, remove the intake manifold and reposition the seals.**

7. Be sure the holes in the manifold gaskets and manifold are in alignment. **Apply a non-hardening, oil-resistant sealer under the head of each bolt**, and install the manifold retaining bolts. Torque the bolts to specifications in sequence as shown in Fig. 19.

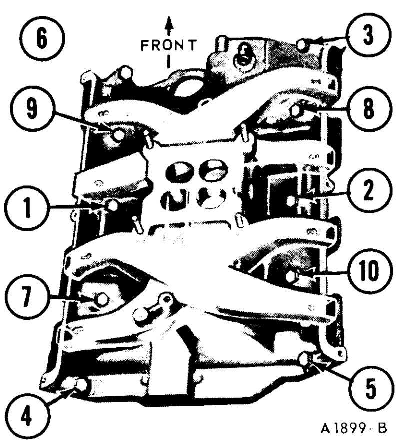


FIG. 19–Intake Manifold Torque Sequence

8. Remove the distributor.

9. Remove the engine lifting sling and eye bolts.

10. Slide the water pump bypass hose clamp into position. Connect the water temperature sending unit, and the radiator upper hose. Install the heater hose on the automatic choke housing and connect the heater hose to the carburetor spacer.

11. On a car with an air conditioner, connect the heater hoses at the intake manifold and at the "T" connector in the heater hose to the water pump.

12. Apply Lubriplate to both ends of the push rods. Install the push rods in their original bores, positioning the lower ends of the rods in the lifter cups. Refer to "Valve Rocker Arm Shaft Assembly Installation," and install the valve rocker arm shaft assembly by following steps 1 thru 7.

13. Rotate the crankshaft damper until the No. 1 piston is on TDC at the end of the compression stroke. Position the distributor in the block with the rotor at the No. 1 firing position and the points open. Install the hold down clamp.

14. Install the valve rocker arm covers; refer to steps 8 and 9 under Valve Rocker Arm Shaft Assembly Installation.

15. Connect the brake booster vacuum line and the flexible hose.

16. Install the carburetor fuel inlet line and connect the distributor vacuum line. Install the automatic choke air heat tube.

17. Install the distributor cap. Connect the spark plug wires. Install the wire loom in the retaining clips on the left valve rocker arm cover.

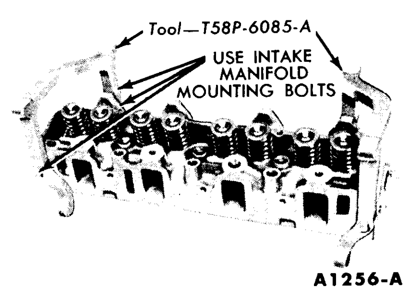


FIG. 20–Cylinder Head Holding Fixtures

18. Connect the oil pressure sending unit wire, coil high tension lead, coil primary wire, and coolant temperature sending unit wire.

19. Install the accelerator cross shaft bracket. Connect the accelerator rod.

20. Fill and bleed cooling system.

21. Start the engine and check and adjust the ignition timing. Operate the engine until engine temperatures have stabilized, and adjust the engine idle speed and idle fuel mixture.

22. Adjust the transmission control linkage. Install the air cleaner and connect the automatic choke heat chamber air inlet tube.

EXHAUST MANIFOLD

REMOVAL

1. On a right exhaust manifold, disconnect the automatic choke heat chamber air inlet tube at the carburetor. Remove the air cleaner. Remove the automatic choke air heat tube and air inlet tube.

2. On a left exhaust manifold, disconnect the power steering pump bracket from the cylinder block and move it out of the way. Position the pump so that the oil will not drain out. Disconnect the power steering hose bracket and position the hoses out of the way. Remove the dipstick and tube assembly.

3. Disconnect the exhaust manifold at the muffler inlet pipe. Remove the retaining bolts and tab washers and remove the exhaust manifolds.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Clean the mating surfaces of the exhaust manifold(s) and cylinder head(s). Scrape the gasket material from the mounting flange of the exhaust manifold and muffler inlet pipe.

2. Apply graphite grease to the mating surface(s) of the exhaust manifold(s) and cylinder head(s).

3. Position the exhaust manifold(s) on the cylinder head(s) and install the retaining bolts and tab washers. Working from the center to the ends torque the retaining bolts to specifications. Lock the bolts by bending one tab of the washer over a flat on the bolt.

4. On a left exhaust manifold, install the dipstick and tube assembly.

Use oil-resistant sealer on the dipstick tube threads. Position the power steering pump bracket on the cylinder block and install the retaining bolts. Adjust the belt tension. Position the hoses and install the power steering hose bracket.

5. On a right exhaust manifold, install the automatic choke air heat tube and air inlet tube on the right exhaust manifold.

6. Position a new gasket on the muffler inlet pipe(s) and connect the exhaust manifold(s) to the inlet pipe(s). Install and torque the retaining nuts to specifications.

7. Install the air cleaner and connect the automatic choke heat chamber air inlet tube.

POSITIVE CRANKCASE VENTILATION SYSTEM

REMOVAL

1. Remove the carburetor air cleaner. Remove the vent hose.

2. Grasp the crankcase ventilation regulator valve and pull it straight upwards and out of the grommet in the right valve rocker arm cover.

3. Use a hose clamp tool to slide both hose clamps off the ends of the inlet hose. Remove the inlet hose from the carburetor spacer, and separate the hose from the regulator valve.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for cleaning and inspection procedures on the inlet hose, carburetor spacer and oil filler tube breather cap. **Do not clean the regulator valve.**

INSTALLATION

1. Install the inlet hose and hose clamp on the regulator valve. Position the hose clamp.

2. Install the inlet hose and hose clamp on the carburetor spacer inlet nipple. Position the hose clamp.

3. Install the crankcase ventilation regulator valve in the right valve rocker arm cover. Install the air cleaner and vent hose.

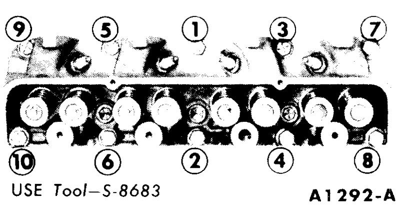


FIG. 21—Cylinder Head Bolt Torque Sequence

CYLINDER HEADS

REMOVAL

If a cylinder head is to be replaced, follow the procedures under "Cylinder Head Disassembly and Assembly," and transfer all valves, springs, spark plugs, etc., to the new cylinder head. Clean and inspect all parts and reface the valves (refer to Part 8-1) before assembling the used parts to the new cylinder head.

1. Remove the intake manifold, carburetor and radiator supply tank as an assembly following the procedure under "Intake Manifold Removal."

2. Disconnect the exhaust manifolds at the muffler inlet pipes.

If the left cylinder head is to be removed, remove the ignition coil and engine identification tag, and remove the power steering pump mounting bolt from the cylinder head.

3. Remove the cylinder head bolts. Install the cylinder head holding fixtures (Fig. 20).

4. Lift the cylinder heads off the block. **Do not pry between the head and the block.** Remove and discard the cylinder head gasket.

INSTALLATION

1. Clean the cylinder head and cylinder block gasket surfaces.

2. Inspect the cylinder head, following the procedures in Part 8-1, Section 3.

3. Apply cylinder head gasket sealer to both sides of a new gasket. Guided by the word "FRONT" on the gasket, install the gasket over the cylinder head dowels.

4. Place the cylinder head on the engine and remove the holding fixtures.

On the left cylinder head, install the ignition coil, engine identification tag, and the power steering pump mounting bolt.

5. Install the cylinder head bolts. The cylinder head bolts are tightened in three progressive steps. Torque all the bolts in sequence (Fig. 21) to 70 ft-lbs; then torque them to 80 ft-lbs, and finally torque to specifications. **After the cylinder head bolts have been torqued to specifications, the bolts should not be disturbed.**

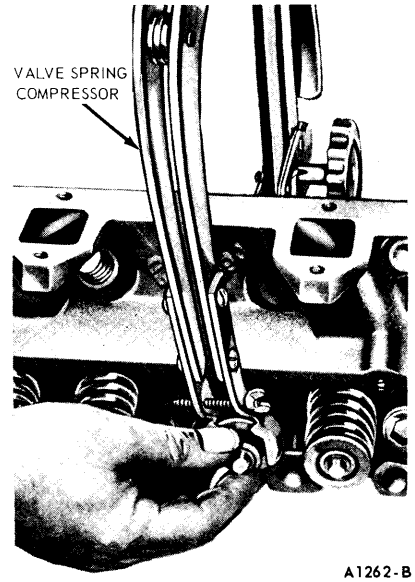


FIG. 22—Compressing Valve Spring—On Bench

6. Position new gaskets on the muffler inlet pipes. Connect the exhaust manifolds to the muffler inlet pipes. Torque the nuts to specifications.

7. Install the intake manifold and related parts following the procedure under "Intake Manifold" Installation."

DISASSEMBLY

1. Remove the spark plugs. Clean the carbon out of the cylinder head combustion chambers before removing the valves.

2. Remove the exhaust manifolds.

3. Compress the valve springs (Fig. 22). Remove the spring retainer locks and release the spring.

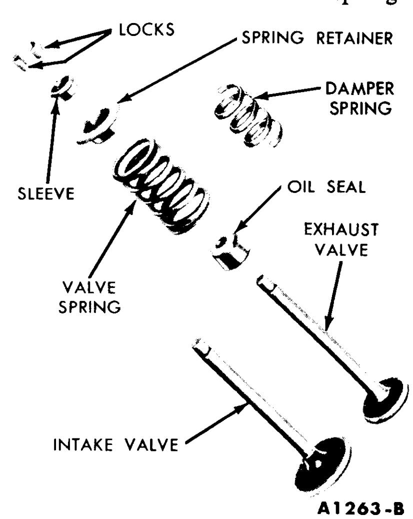


FIG. 23—Valve Assembly

Inspect the valve springs removal to determine if the damper spring(s) is intertwined with the valve spring(s). If this condition exists, replace all defective or worn components (refer to inspection procedures in Part 8-1, Section 3).

4. Remove the sleeve, spring retainer, spring (and damper spring if applicable), stem seal and valve. Discard the valve stem seals. Identify all valve parts.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Cylinder head repair procedures and checks such as valve and valve seat refacing, cylinder head flatness checks, etc., are covered in Part 8-1, Sections 2 and 3.

ASSEMBLY

1. Install each valve (Fig. 23) in the port from which it was removed or to which it was fitted. Install a new stem seal on the valve. **The exhaust valve stem seal is approximately 0.025 inch shorter in overall height than the intake valve stem seal; therefore, be sure the seals are installed on the proper valves.**

2. Install the valve spring (closed coils downward) over the valve, and install the spring retainer and sleeve. **Make sure the damper spring is installed in the valve spring so that the coil end of the damper spring is 135° counterclockwise from the coil end of the valve spring.**

3. Compress the spring and install the retainer locks (Fig. 22).

4. 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. 24). Check the dividers against a scale. If the assembled height is greater than specified, 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 specifications.

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.

5. Install the exhaust manifolds.

6. Install the spark plugs.

VALVE SPRING, RETAINER AND STEM SEAL REPLACEMENT

Broken valve springs, or defective valve stem seals and retainers may be replaced without the need of removing the cylinder head, providing damage to the valve or valve seat has not occurred.

1. Disconnect the automatic choke heat chamber air inlet tube and remove the air cleaner. Remove the valve rocker arm cover(s), following steps 2 and 3 under "Valve Rocker Arm Shaft Assembly Removal."

2. Remove the applicable spark plug. **Disconnect the brown lead ("I" terminal) and the red and blue lead ("S" terminal) at the starter relay.** Install an auxiliary starter switch between the battery and "S" terminals of the starter relay. **Crank the engine with the ignition switch "OFF".**

Crank the engine until the piston of the affected cylinder is on the power stroke.

3. Loosen the valve rocker arm support bolts evenly and alternately, two turns at a time, until the valve spring tension has been released. Remove the push rod(s) of the valve(s) to be serviced.

4. Tighten the valve rocker arm support bolts evenly and alternately, two turns at a time, until they are snug. Push the rocker arm to one side and secure it in this position (Fig. 25). If an end valve is to be worked on, it will be necessary to remove the rocker arm from the shaft.

5. Install an air adapter in the spark plug hole and connect the air supply hose to the adapter. Turn on the air supply. **Air pressure may turn the crankshaft until the piston reaches the bottom of its stroke.**

6. Compress the valve spring and remove the valve retainer locks from the valve (Fig. 26). **If air pressure fails to hold the valve in the closed position during this operation, it can be presumed that the valve is**

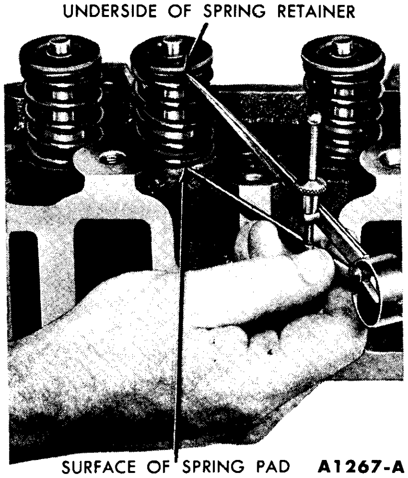


FIG. 24—Valve Spring Assembled Height

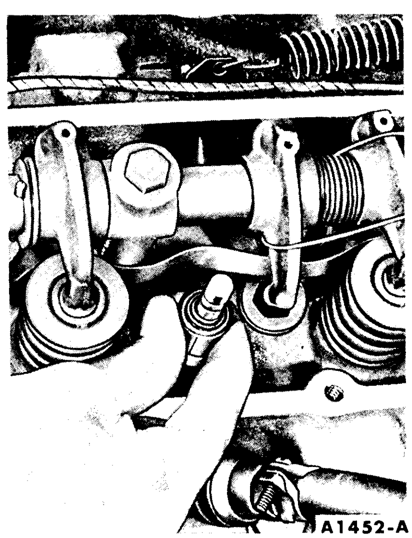


FIG. 25—Valve Stem Seal Removal

FIG. 26—Compressing Valve Spring—In Chassis

not seating or is damaged. If this condition occurs, remove the cylinder head for further inspection.

7. Remove the valve spring and related parts. Remove the valve stem seal (Fig. 25). **If air pressure has forced the piston to the bottom of the cylinder, any removal of air pressure will allow the valve(s) to fall into the cylinder. A rubber band, tape or string wrapped around the end of the valve stem will prevent this condition and still allow enough travel to check the valve for binds.**

8. Inspect the valve stem for damage. Rotate the valve and check the valve stem tip for eccentric movement during rotation. Move the valve up and down through normal travel in the valve guide and check the stem for binds. **If the valve has been damaged, it will be necessary to remove the cylinder head for repairs as outlined in Part 8-1, Section 2.**

9. If the condition of the valve proved satisfactory, hold the valve in the closed position and apply the air pressure within the cylinder.

10. Inspect the valve stem seal for a cracked, torn or brittle condition, and replace it if necessary. Install the seal on the valve stem. **The exhaust valve stem seal is approximately 0.025 inch shorter in overall height than the intake valve stem seal; therefore, be sure the proper seal is installed.**

11. Install the valve springs, retainer and sleeve over the valve stem. **Make sure the valve damper spring is installed in the valve spring so that the coil end of the damper spring is 135° counterclockwise from the coil end of the valve spring.**

12. Compress the valve spring (Fig. 26) and install the valve retainer locks. Tap the valve stem tip with a soft mallet to make certain that the retainer locks are properly seated.

13. Remove the air line and adapter. Install the spark plug. Remove the wire securing the valve rocker arm and slide the rocker arm in position. Install the end rocker arm(s), if they were removed.

14. Loosen the valve rocker arm support bolts evenly and alternately, two turns at a time, until spring tension is removed. Apply Lubriplate to both ends of the push rod. Position the push rod within the rocker arm socket and the valve lifter seat.

15. Tighten the rocker arm shaft support bolts evenly and alternately, two turns at a time, until they are snug. Torque the bolts to specifications.

16. Remove the remote control starter switch. Install the high tension lead wire in the ignition coil terminal.

17. Install the spark plug wires. Check the valve clearances and correct if necessary (Part 8-1, Section 2).

18. Install the valve rocker arm cover(s), following steps 8 and 9 under "Valve Rocker Arm Shaft Assembly Installation."

19. Install the air cleaner and connect the automatic choke heat chamber air inlet tube.

CRANKSHAFT DAMPER REPLACEMENT

To remove the crankshaft damper, refer to steps 5, 6 and 7 under "Cylinder Front Cover and Timing Chain Removal," except do not remove the water pump. Install the crankshaft damper following the procedures in steps 7, 8, 9, 12 and 13 under "Cylinder Front Cover and Timing Chain Installation."

CYLINDER FRONT COVER AND TIMING CHAIN

REMOVAL

1. Drain the cooling system and and crankcase. Disconnect the battery ground cable.

2. Disconnect the radiator upper hose at the radiator supply tank. Disconnect the radiator lower hose at the water pump.

3. Disconnect the transmission oil cooler lines at the radiator. Remove the radiator.

4. Disconnect the heater hose at the water pump. Slide the water pump bypass hose clamp toward the engine.

5. Disconnect the power steering pump bracket from the water pump and remove the drive belt. Wire the power steering pump assembly to the left side of the car in a position that will prevent the oil from draining out.

On a car with an air conditioner, remove the compressor drive belt.

6. Loosen the alternator mounting bolts at the alternator. Remove the drive belt. Remove the alternator support bolt at the water pump. Remove the water pump, drive belt adjusting arm, pulley and fan as an assembly.

7. Remove the cap screw and washer from the end of the crankshaft. Remove the power steering pulley from the crankshaft damper. Install the puller on the crankshaft damper (Fig. 27) and remove the damper.

8. Disconnect the carburetor fuel inlet line at the fuel pump.

9. Remove the fuel pump retaining bolts and lay the pump to one side with the flexible fuel line still attached.

10. Remove the crankshaft sleeve as shown in Fig. 28.

11. Remove the screws fastening the cylinder front cover to the block. Remove the cylinder front cover.

On a car with an air conditioner, the compressor brackets are retained by cylinder front cover screws.

12. Discard the cylinder front cover gasket. Remove the oil slinger.

13. Rotate the crankshaft in a clockwise direction (as viewed from the front) to take up the slack on the left side of the chain.

14. Establish a reference point on the block and measure from this point to the chain (Fig. 29).

15. Rotate the crankshaft in the opposite direction to take up the slack on the right side of the chain.

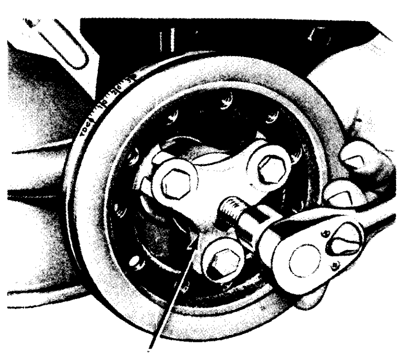


FIG. 27—Crankshaft Damper Removal

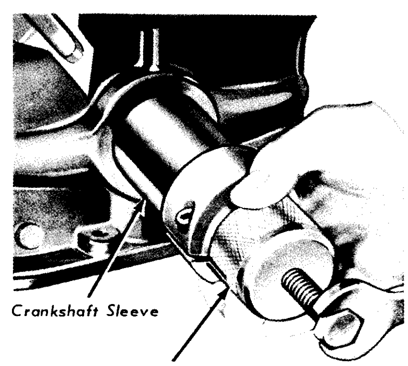


FIG. 28—Crankshaft Sleeve Removal

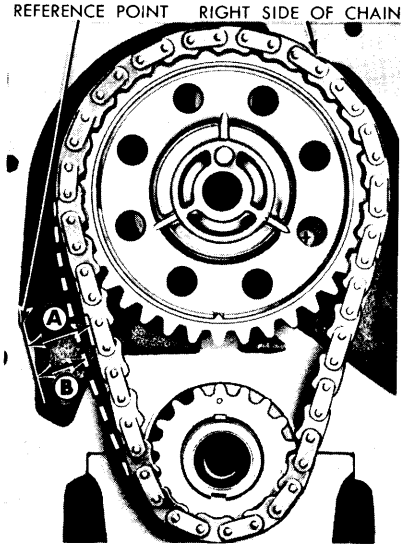


FIG. 29—Timing Chain Deflection

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/or sprockets.

16. Crank the engine until the timing marks on the sprockets are positioned as shown in Fig. 30.

17. Remove the camshaft sprocket cap screw and the fuel pump eccentric.

18. Slide both sprockets and the timing chain forward, and remove the sprockets and timing chain as an assembly (Fig. 31).

19. Remove the oil pan and oil pump screen, following the procedure under "Oil Pan Removal."

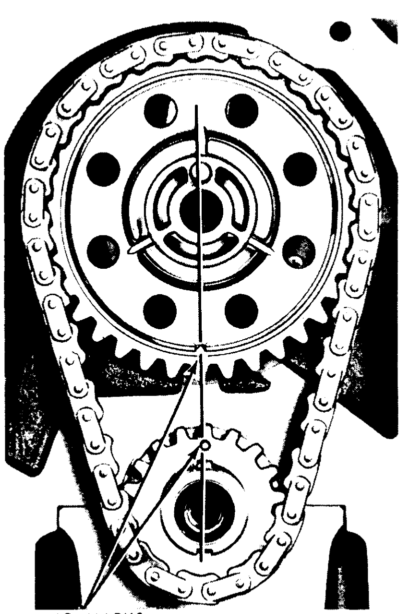


FIG. 30—Aligning Timing Marks

FRONT OIL SEAL REPLACEMENT

It is good practice to replace the oil seal each time the cylinder front cover is removed.

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

2. Coat a new seal with grease; then install the seal (Fig. 32). 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.

INSTALLATION

1. Position the sprockets and timing chain on the camshaft and crankshaft (Fig. 31). Be sure the timing marks on the sprockets are positioned as shown in Fig. 30.

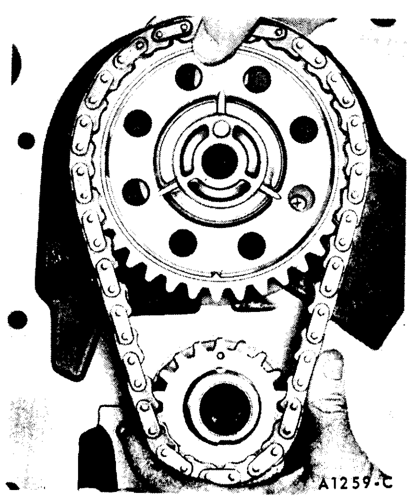


FIG. 31—Timing Chain Removal or Installation

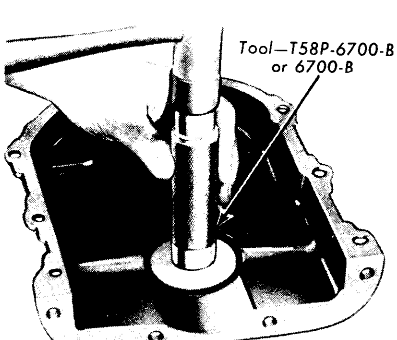


FIG. 32—Oil Seal Installation

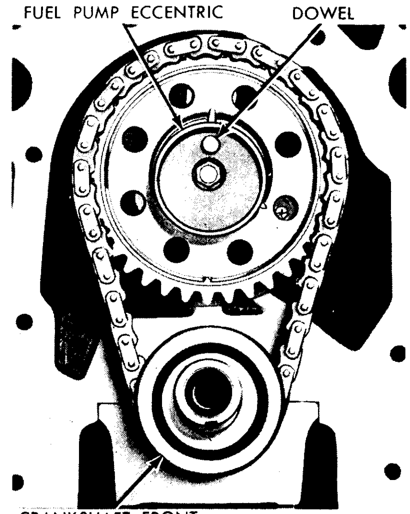


FIG. 33—Fuel Pump Eccentric and Front Oil Slinger Installed

2. Install the fuel pump eccentric and the camshaft sprocket cap screw (Fig. 33). Torque the sprocket cap screw to specifications. Install the crankshaft front oil slinger.

3. Clean the cylinder front cover, oil pan and cylinder block gasket surfaces.

4. Coat the gasket surface of the block and cover and the cover bolt threads with sealer. Position a new gasket on the block.

5. Lubricate and install the alignment pilot tool on the cylinder front cover so that the keyway in the pilot

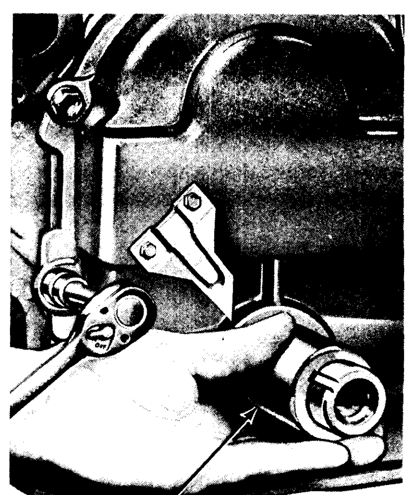


FIG. 34—Cylinder Front Cover Alignment

aligns with the key in the crankshaft. Position the cover and pilot over the end of the crankshaft and against the block (Fig. 34). Install the retaining screws.

On a car with an air conditioner, position the compressor bracket on the cylinder front cover, and install the retaining screws finger-tight.

While pushing in on the pilot, torque the screws to specifications. Remove the pilot.

6. Install the crankshaft sleeve.

7. Lubricate the hub and line up the damper keyway with the key on the crankshaft. Install the damper on the crankshaft (Fig. 35).

8. Install the power steering pump pulley on the damper. Torque the screws to specifications.

9. Install the damper cap screw and washer, and torque the screw to specifications.

10. Clean the oil pan and the oil pump screen. Install the oil pump screen and oil pan following the procedure under "Oil pan and Oil Pump Installation."

11. Clean the water pump gasket surfaces. Coat new gaskets with sealer and position the gaskets on the block. Install the water pump, pulley, fan and alternator adjusting arm as an assembly.

12. Install and adjust the alternator drive belt(s).

On a car with an air conditioner, install and adjust the drive belt.

13. Install the power steering pump drive belt and attach the pump bracket to the water pump. Adjust the drive belt tension.

14. Install the fuel pump, using a new gasket.

15. Connect the carburetor fuel inlet line. Connect the heater hose. Slide the water pump bypass tube clamp forward on the tube.

16. Install the radiator and support as an assembly. Connect the radiator lower hose at the water pump and the radiator upper hose at the radiator supply tank. Connect the battery ground cable. Connect the transmission oil cooler lines.

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

18. Operate the engine at fast idle and check for coolant and oil leaks. Adjust the ignition timing. Install the air cleaner and connect the automatic choke heat chamber air inlet tube.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

CAMSHAFT

The camshaft and related parts are shown in Fig. 36.

REMOVAL

1. Remove the cylinder front cover following steps 1 thru 12 under "Cylinder Front Cover and Timing Chain Removal."
2. Refer to "Valve Rocker Arm Shaft Assembly Removal" and remove the valve rocker arm covers and the valve rocker arm shaft assemblies.
3. Disconnect the coil high tension lead at the coil. Remove the distributor cap and spark plug wire assembly. Disconnect the distributor vacuum line at the distributor. Remove the distributor hold down bolt and clamp. Remove the distributor.
4. Remove the valve push rods in sequence and place them in a rack so that they can be installed in their original positions.
5. Position an inspection light through a push rod opening and into the valve push rod valley (Fig. 37). Remove the valve lifters or tappets with a magnet through the push rod openings. In some cases it will be necessary to transfer the lifter or tappet over to an adjoining push rod opening in order to remove it. Place the lifters or tappets in a rack so that they can be installed in their original positions.
6. Remove the oil pan and oil pump screen by following the procedure under "Oil Pan Removal."
7. Install a dial indicator so that the indicator point is on the camshaft sprocket retaining screw. Push the camshaft toward the rear of the engine and set the dial indicator on zero. Pull the camshaft forward and release it. Compare the indicator reading with the specifications. If the end play is excessive, check the spacer for correct installation before it is removed. **The side of the spacer having a chamfer on the ID must be against the camshaft front journal.** If the spacer is installed correctly, replace the thrust plate.
8. Remove the dial indicator. Remove the timing chain and sprockets following steps 13 thru 18 under

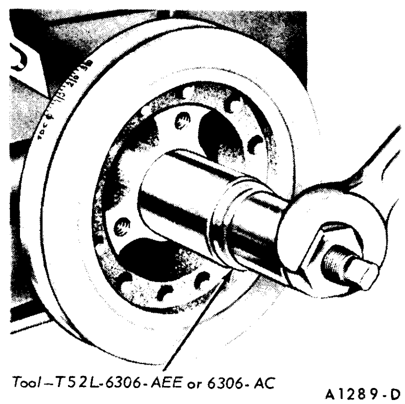


FIG. 35—Crankshaft Damper Installation

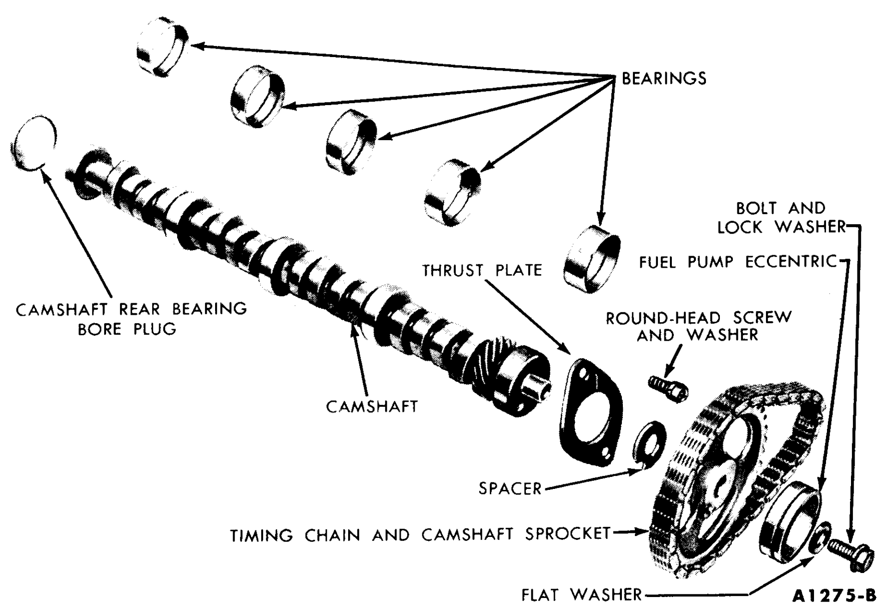


FIG. 36—Camshaft and Related Parts

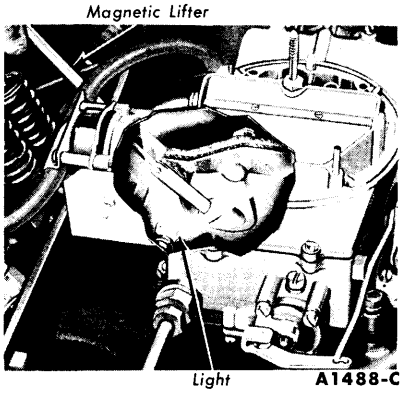


FIG. 37—Hydraulic Valve Lifter Removal—Intake Manifold Installed

"Cylinder Front Cover and Timing Chain Removal."

9. Remove the camshaft thrust plate and spacer. Carefully remove the camshaft by pulling it toward the front of the engine. **Use caution to avoid damaging the camshaft bearings.**

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Refer to Part 8-1, Section 2 for the repair procedure.

INSTALLATION

1. Oil the camshaft and apply Lubriplate to the lobes. Carefully slide the camshaft through the bearings. Install the thrust plate and spacer. **The chamfered ID of the spacer must be toward the camshaft front journal. Be sure the thrust plate oil groove is up and toward the front (next to camshaft sprocket).**
2. Follow the procedure in step 7 of "Camshaft Removal" and check the camshaft end play.
3. Position the sprockets and timing chain on the camshaft and crankshaft (Fig. 31) with the timing marks on the sprockets aligned as shown in Fig. 30.
4. Install the fuel pump eccentric and the camshaft sprocket cap screw (Fig. 33). Torque the sprocket cap screw to specifications. Install the front oil slinger.
5. Replace the crankshaft front oil seal. Install the cylinder front cover, crankshaft damper and related parts following steps 3 thru 16 under "Cylinder Front Cover and Timing Chain Installation."
6. With the No. 1 piston on TDC at the end of the compression stroke, position the distributor in the block with the rotor at the No. 1 firing position and the points open. Install the hold down clamp.
7. Install the distributor cap. Connect the coil high tension lead.
8. Install the valve lifters in the bores from which they were removed. Install the push rods in their original positions.
9. Refer to "Valve Rocker Arm Shaft Assembly Installation" and install the valve rocker arm shaft assembly following steps 1 thru 9.
10. Fill and bleed the cooling system. Fill the crankcase with the proper grade and quantity of engine oil.
11. Start the engine and check and adjust the ignition timing. Connect the distributor vacuum line. Operate the engine at fast idle and check all hose connections and gaskets for leaks.

CAMSHAFT REAR BEARING BORE PLUG REPLACEMENT

1. Remove the transmission and converter housing by following the procedure in Part 7-2.
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 T-7600-E to remove the plug.
4. Clean out the plug bore recess thoroughly.
5. Coat the flange of a new plug with oil-resistant sealer and install it with the flange facing inward (Fig. 59).
6. Install the flywheel.
7. Install the transmission and converter housing by following the procedure in Part 7-2.

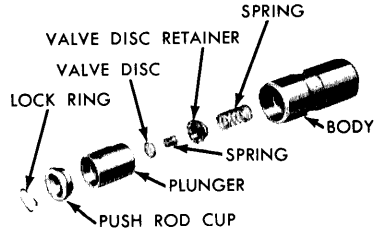


FIG. 38—Typical Hydraulic Valve Lifter Assembly

HYDRAULIC VALVE LIFTER REPLACEMENT

The following procedure is applicable for removing one or all of the valve lifters. This procedure can not be used if the valve lifters are stuck in their bores by excessive varnish, etc. In this case, it will be necessary to remove the intake manifold. After the intake manifold has been removed, remove the valve lifters.

1. Refer to "Valve Rocker Arm Shaft Assembly Removal" and remove the valve rocker arm covers and the valve rocker arm shaft assemblies by following steps 1 thru 4. Remove the push rods and place them in a rack so they can be installed in the same location from which they were removed.
2. Position an inspection light through a push rod opening and into the valve push rod valley (Fig. 37). Remove the valve lifters with a magnet through the push rod openings. In some cases, it will be necessary to transfer the lifter over to an adjoining push rod opening in order to remove it. Place the lifters in a rack so that they can be installed in their original positions.

The internal parts of each hydraulic valve lifter assembly are matched sets. Do not intermix the parts. Keep the assemblies intact until they are to be cleaned.

3. Install the push rods. Install the new (or cleaned) hydraulic valve lifters through the push rod openings with a magnet (Fig. 37).
4. Refer to "Valve Rocker Arm Shaft Assembly Installation" and install the valve rocker arm shaft assemblies and covers by following steps 1 thru 10.

HYDRAULIC VALVE LIFTER DISASSEMBLY

Each valve lifter is a matched assembly. If the parts of one lifter are intermixed with those of another, improper valve operation may result. Disassemble and assemble each lifter separately. Keep the lifter assemblies in proper sequence so that they can be installed in their original bores.

1. Grasp the lock ring with needle nose pliers to release it from the groove. It may be necessary to depress the plunger to fully release the lock ring.
2. Remove the push rod cup, plunger and spring.
3. Invert the plunger assembly and remove the disc valve retainer by

carefully prying up on it with a screw driver. Remove the disc valve and spring.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

HYDRAULIC VALVE LIFTER ASSEMBLY

A typical hydraulic valve lifter assembly is shown in Fig. 38.

1. Place the plunger upside down on a clean work bench.

2. Place the disc valve in position over the oil hole on the bottom of the plunger. Set the disc valve spring on top of the disc.

3. Position the disc valve retainer over the disc and spring, and push the retainer down into place on the plunger.

4. Place the plunger spring and then the plunger (open end up) into the lifter body.

5. Place the push rod seat in the plunger.

6. Depress the plunger, and position the closed end of the lock ring in the groove of the lifter body. With the plunger still depressed, position the open ends of the lock ring in the groove. Release the plunger, then depress it again to fully seat the lock ring.

TESTING

Refer to Part 8-1, Section 1 for the testing procedures.

CRANKSHAFT REAR OIL SEAL REPLACEMENT

Replacement of a crankshaft rear oil seal requires replacement of both the upper and lower seals. Remove the engine; then remove the crankshaft and replace the seals following the procedure under "Crankshaft Removal and Installation" (Section 4).

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 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.** Undersize bearings, which are not selective fit, are available for use on journals that have been refinished.

MAIN BEARING REPLACEMENT

1. Drain the crankcase. Remove the oil level dipstick. Remove the oil pan and oil pump. Remove the spark plugs to allow easy rotation of the crankshaft.

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

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

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

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

6. To install the upper main bearing, place the plain end of the bearing over the shaft on the locking tang side of the block and partially install the bearing so that tool 6331 can be inserted in the oil hole in the crankshaft. With tool 6331 positioned 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.

7. Replace the cap bearing.

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

9. Place a piece of Plastigage on the bearing surface the full width of the bearing cap and about ¼ inch off center (Fig. 39).

10. Install the cap and torque the bolts to specifications. **Do not turn the crankshaft while the Plastigage is in place. 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.**

11. 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.

12. After the bearing has been checked and found to be satisfactory, apply a light coat of engine oil to the journal and bearings; then install the bearing cap. Torque the cap bolts to specifications.

13. Repeat the procedure for the

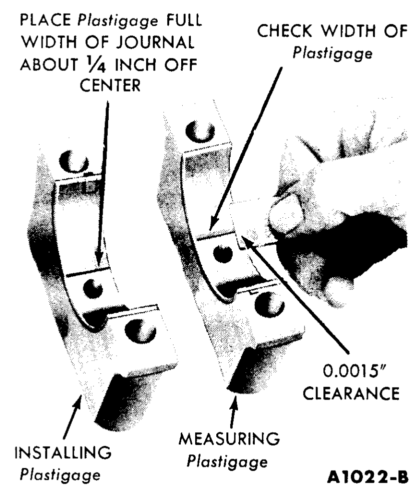


FIG. 39—Installing and Measuring Plastigage—Engine in Chassis

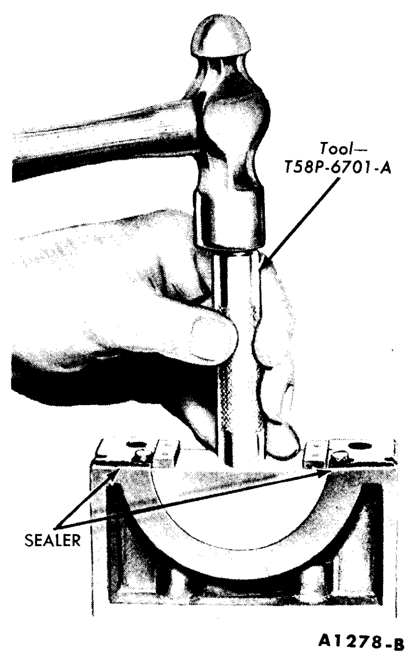


FIG. 40—Seal to Rear Bearing Cap Installation

remaining bearings that require replacement.

14. If the rear main bearing is replaced, remove the rear main bearing cap. Remove and discard the rear seal and side seals.

15. Clean the rear journal oil seal groove.

16. Install a new rear journal oil seal in the rear main bearing cap (Fig. 40). After installation, cut the ends of the seals flush.

17. Apply a thin coating of oil-resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 40). **Do not apply sealer to the area forward of the side seal groove.** Install the rear main bearing cap. Torque the cap bolts to specifications.

18. Dip the side seals in light engine oil; then immediately install them in the grooves. **Do not use sealer on the side seals. The seals are designed to expand when dipped in oil. Using sealer may retard this expansion.** It may be necessary to tap the seals into place for the last ½ inch of travel. Do not cut the seal projecting ends.

19. Check the retainer side seals for leaks by squirting a few drops of oil into the parting lines between the rear main bearing cap and the cylinder block from the outside. Blow compressed air against the seals from the inside of the block. If air bubbles appear in the oil, it indicates possible oil leakage. **This test should not be performed on newly installed seals until sufficient time has been allowed for the seals to expand into the seal grooves.**

20. Disassemble, clean and assemble the oil pump.

21. Install the oil pump and oil pan. Install the oil level dipstick. Fill the crankcase with the proper amount and viscosity oil. Install the spark plugs.

22. Operate the engine and check for oil leaks.

CONNECTING ROD BEARING REPLACEMENT

1. Follow step 1 under "Main Bearing Replacement."

2. Turn the crankshaft until the connecting rod to which new bearings are to be fitted is down.

3. Remove the connecting rod cap. Push the connecting rod up into the cylinder and remove the bearing insert from the rod and cap.

4. Follow step 5 under "Main Bearing Replacement."

5. Install the new bearings in the connecting rod and cap. Pull the connecting rod assembly down firmly on the crankshaft journal.

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

7. Install the cap and torque the connecting rod nuts to specifications. **Do not turn the crankshaft while the Plastigage is in place.**

8. Remove the cap; then, using the Plastigage scale, check the width of the Plastigage following steps 9 thru 11 under "Main Bearing Replacement."

9. After the bearing clearance has been checked and found to be satisfactory, apply a light coat of engine oil to the journal and bearings. Install the connecting rod cap.

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

11. Follow steps 20, 21 and 22 under "Main Bearing Replacement."

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

PISTON AND CONNECTING ROD ASSEMBLY

REMOVAL

1. Drain the cooling system and the crankcase. Remove the intake manifold, cylinder heads, oil pan and oil pump following the procedures in this section.

2. Remove any ridge and/or deposits from the upper end of the cylinder bores as follows:

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.**

3. Make sure all connecting rod caps are marked so that they can be installed in their original locations.

4. Turn the crankshaft until the connecting rod being removed is down.

5. 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 crankshaft journal or the cylinder wall when removing the piston and rod.**

7. Remove the bearing inserts from the connecting rod and cap.

8. Install the cap on the connecting rod from which it was removed.

INSTALLATION

1. If new piston rings are to be installed, remove the cylinder wall glaze. Follow the instructions of the tool manufacturer.

2. Oil the piston rings, pistons and cylinder walls with light engine oil. **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 4 in the right bank and from 5 to 8 in the left bank, 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.**

3. Make sure the ring gaps are properly spaced around the circumference of the piston (Fig. 41).

4. 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. 42). Be sure to guide the connecting rods to avoid damaging the

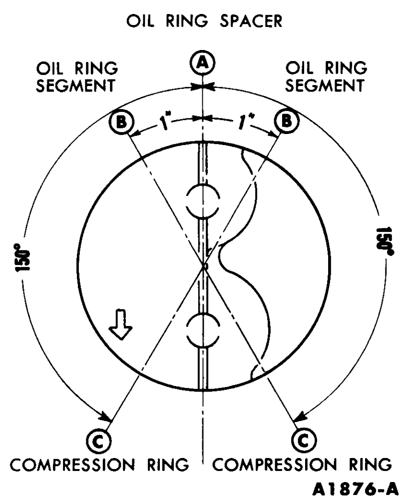


FIG. 41—Piston Ring Gap Spacing

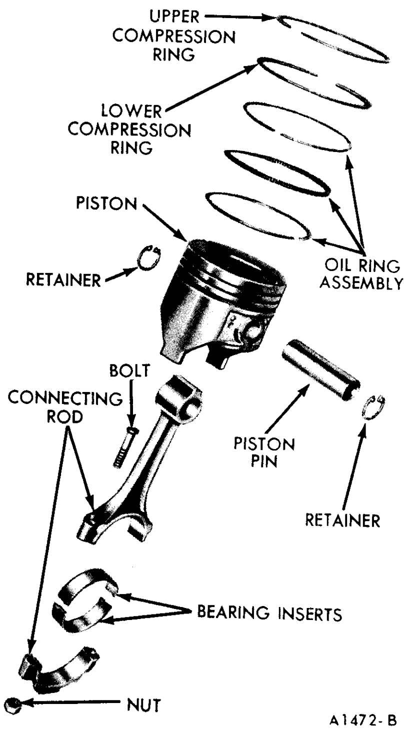


FIG. 45—Piston, Connecting Rod and Related Parts

2. Coat the gasket on the new filter with oil. Place the filter in position on the adapter (Fig. 48). 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 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 AND OIL PUMP

REMOVAL

1. Drain the crankcase and remove the oil level dipstick.

2. Remove the oil pan retaining screws and lower the oil pan to the cross member. Position the crankshaft so that the counterweight will clear the oil pan.

3. Remove the oil pump retaining bolts and place the oil pump, inlet tube screen and intermediate drive shaft in the oil pan. Remove the oil pan and oil pump. Remove the inlet tube and screen assembly from the oil pump. Discard the gasket. Clean the oil pump inlet tube and screen.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

INSTALLATION

1. Clean the oil pan and cylinder block gasket surfaces. Position a new gasket on the oil pan.

2. Position a new oil pump inlet tube gasket on the oil pump and install the inlet tube and screen. 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.

3. Place the oil pump in the oil pan and position the oil pan on the cross member. Position a new oil pump gasket on the cylinder block. Insert the intermediate drive shaft into the oil pump housing and install the oil pump and shaft as an assembly (Fig. 49). **Do not attempt to force the pump into position if it will not seat readily. The drive shaft hex may be misaligned with the distributor shaft. To align, rotate the intermediate shaft into a new position.** Torque the oil pump retaining screws to specifications.

4. Hold the oil pan in place against the cylinder block and install a retaining screw on each side of the oil pan. **Install the oil pan sealer bolts that retain the oil pan to the rear main bearing cap.** Install the remaining screws and torque them, from the center outward, to specifications.

5. Replace the engine oil filter. Fill the crankcase with the proper grade and quantity of engine oil. Operate the engine and check for leaks.

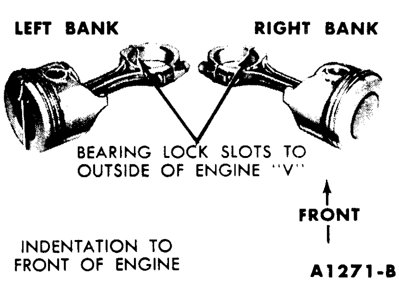


FIG. 46—Connecting Rod and Piston Assembly

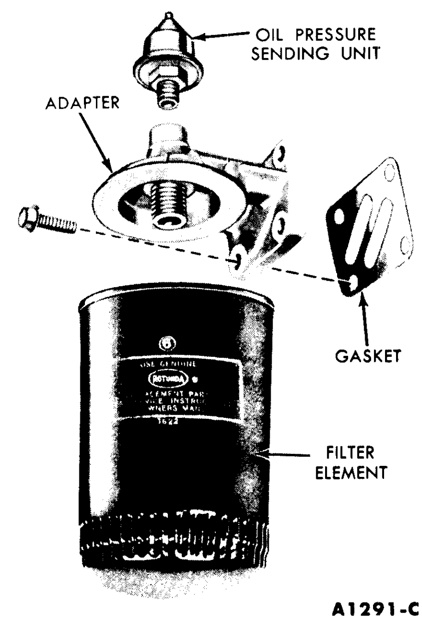


FIG. 47—Rotunda Oil Filter Assembly

FIG. 48—Rotunda Oil Filter Replacement

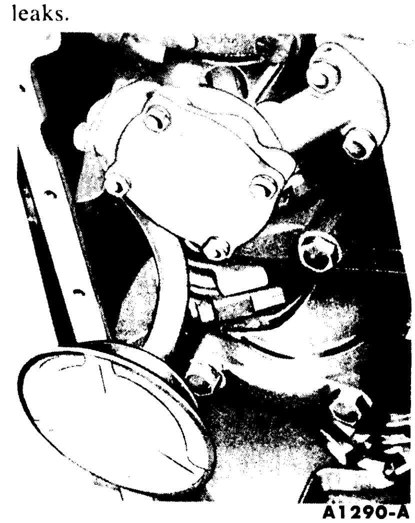


FIG. 49—Oil Pump and Inlet Tube Installed

crankshaft journals. **Install the piston with the indentation 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. Push the piston all the way down until the connecting rod bearing seats on the crankshaft journal.

8. Install the connecting rod cap. Torque the nuts to specifications.

9. After the piston and connecting rod assemblies have been installed, check the side clearance between the connecting rods on each crankshaft journal (Fig. 43).

10. Disassemble, clean and assemble the oil pump. Clean the oil pump inlet tube screen and the oil pan and block gasket surfaces.

11. Prime the oil pump by filling either the inlet port or outlet port with engine oil and rotating the pump shaft to distribute the oil within the housing. Install the oil pump and the oil pan.

12. Install the cylinder heads by following steps 1 thru 6 under "Cylinder Head Installation."

13. Refer to "Intake Manifold Installation" and install the intake manifold by following steps 2 through 19.

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

15. Operate the engine and check for oil and coolant leaks. Check and adjust the ignition timing. Adjust the engine idle speed and fuel mixture.

16. Install the air cleaner and connect the automatic choke heat chamber air inlet tube.

DISASSEMBLY

1. Mark the pistons and pins to assure assembly with the same rod and installation in the same cylinder from which they were removed.

2. Remove the piston rings. Remove the piston pin retainers. Drive the pin out of the piston and connecting rod (Fig. 44). Discard the retainers.

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

Refer to Part 8-1, Section 2 for the repair procedures.

ASSEMBLY

The piston, connecting rod and related parts are shown in Fig. 45.

1. Lubricate all parts with light engine oil. Position the connecting rod in the piston and push the pin into place. Assemble the piston and connecting rod as shown in Fig. 46.

2. Install new piston pin retainers in the piston. Follow the insrtuctions contained on the piston ring package and install the piston rings.

3. Check the ring side clearance of the compression rings with a feeler gauge (step 6 under "Fitting Piston Rings" in Part 8-1, Section 2).

Be sure the piston ring gaps are properly spaced (Fig. 41).

4. 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.

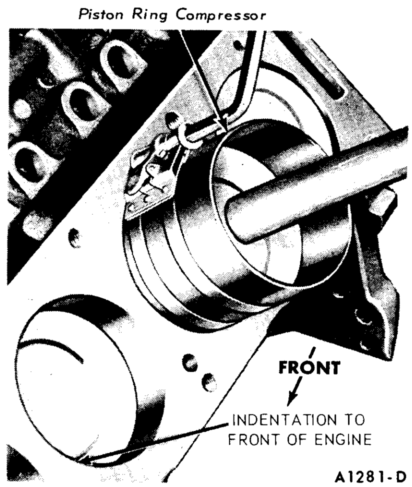


FIG. 42—Piston Installation

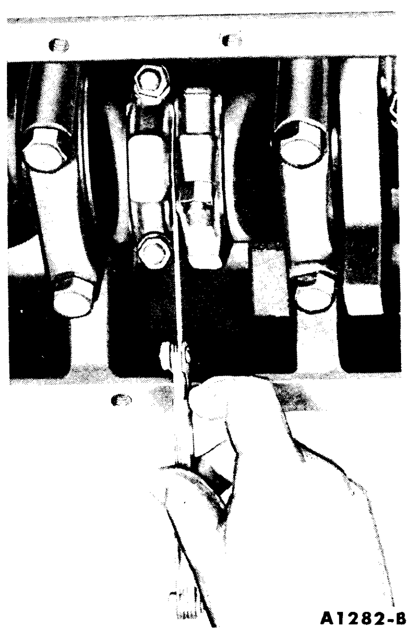


FIG. 43—Connecting Rod Side Clearance

FLYWHEEL

REMOVAL

1. Disconnect the transmission from the engine and slide it to the rear as outlined in Part 7-2.

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

INSPECTION

Refer to Part 8-1, Section 3 for the inspection procedure.

INSTALLATION

1. Install the flywheel on the crankshaft flange and install the retaining bolts. Torque the bolts in sequence across from each other to specifications.

2. Check the flywheel runout, following the procedure in Part 8-1, Section 1.

3. Connect the transmission to the engine as outlined in Part 7-2.

OIL FILTER REPLACEMENT

The Rotunda oil filter assembly is shown in Fig. 47.

1. Place a drip pan under the filter. Unscrew the filter from the adapter fitting. Clean the adapter filter recess.

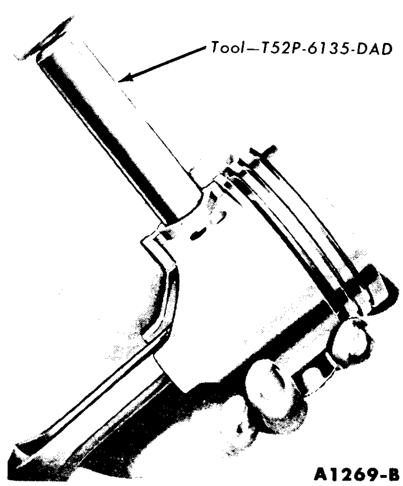


FIG. 44—Piston Pin Removal

OIL PUMP 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 and the outer race.

3. Remove the staking marks at the relief valve chamber cap. Drill a hole in the relief valve chamber cap, and install 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

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

OIL PUMP ASSEMBLY

The oil pump assembly is shown in Fig. 50.

1. Oil all parts thoroughly.

2. Install the oil pressure relief valve plunger, spring and a new cap. Stake the 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. Torque the cover retaining screws to specifications.

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

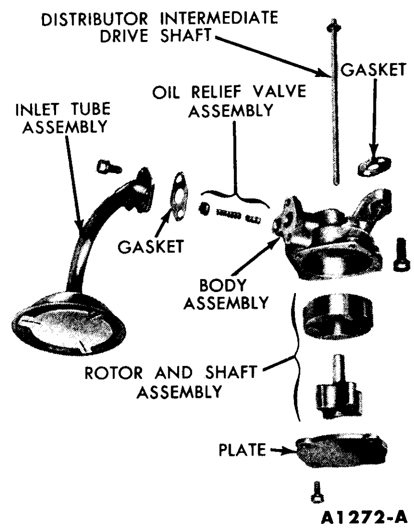


FIG. 50–Oil Pump Assembly

3 ENGINE REMOVAL AND INSTALLATION

The procedures given are for the engine without the transmission attached.

REMOVAL

1. Drain the cooling system and the crankcase. Remove the hood. Disconnect the automatic choke heat chamber air inlet tube and remove the air cleaner.

2. Disconnect the radiator upper hose at the radiator supply tank and the radiator lower hose at the water pump.

3. Disconnect the transmission oil cooler lines at the radiator. Remove the radiator and support as an assembly.

4. Disconnect the battery ground cable at the alternator mounting bracket. Remove the ignition coil and engine identification tag.

5. Disconnect the oil pressure sending unit wire at the sending unit and the flexible fuel line at the fuel tank line.

6. Remove the wire loom from the clips on the left valve rocker arm cover and position the wires out of the way.

7. Disconnect the accelerator rod at the carburetor. Remove the accelerator retracting spring. Remove the accelerator cross shaft bracket from the intake manifold and position it out of the way.

8. Disconnect the power steering pump bracket from the water pump; then wire the power steering pump to the hood left hinge in a position that will prevent the oil from draining out.

9. Disconnect the power brake line at the intake manifold and at the flexible line. Release the line from the brackets on the left valve rocker arm cover and remove the line.

On a car with an air conditioner, disconnect the magnetic clutch wire. Isolate the compressor.

10. Remove the heater hose from the automatic choke housing and disconnect it at the water pump. Disconnect the heater hose at the carburetor spacer. Position the heater hoses out of the way.

On a car with an air conditioner, disconnect the heater hoses at the intake manifold and at the "T" connector in the heater hose to the water pump.

11. Disconnect the alternator wires at the alternator (Part 13-2).

12. Disconnect the coolant temperature sending unit wire at the sending unit.

13. Remove the engine ground strap. Remove the starter cable retaining bracket from the alternator mounting bracket.

14. Raise the front of the car.

15. Remove the No. 2 cross member to underbody brace on the right side to provide clearance for starter removal. Remove the starter and dust seal and the transmission fluid filler tube bracket.

16. Disconnect the muffler inlet pipes from the exhaust manifolds. Remove the engine intermediate support bracket to cross member retaining nut on the right and left engine front supports.

17. Remove the converter housing lower access cover and the cover assembly. Remove the flywheel to converter nuts. Secure the converter assembly in the housing. Remove the converter housing to engine lower bolts, and remove the oil cooler lines retaining clamp from the engine block.

18. Lower the car and support the transmission. Remove the converter housing upper retaining bolts. Remove the front fender to upper dash braces.

19. Install the engine left lifting bracket on the front of the left cylinder head where the coil mounts. Install the engine right lifting bracket at the rear of the right cylinder head. Attach the engine lifting sling (Fig. 51).

20. Raise the engine slightly and carefully pull it from the transmission.

21. Lift the engine out of the engine compartment and install it on a work stand.

INSTALLATION

1. Place a new gasket on the muffler inlet pipes.

2. Attach the engine lifting brackets and sling (Fig. 51). Remove the engine from the work stand.

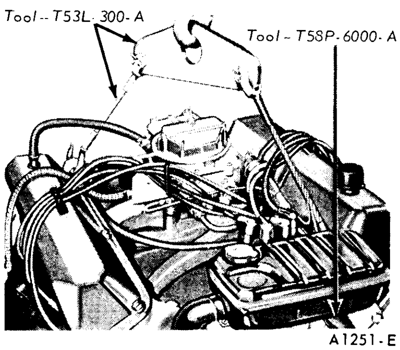


FIG. 51—Engine Lifting Brackets and Sling

3. Lower the engine carefully into the engine compartment. Make sure the exhaust manifolds are properly aligned with the muffler inlet pipes and the dowels in the block engage the holes in the converter housing. Start the converter pilot into the crankshaft.

4. Install the front fender to upper dash braces. Install the converter housing upper bolts. Torque the bolts to specifications.

5. Start the engine intermediate support bracket to cross member retaining nut on the right and left engine front supports. Disconnect the engine lifting sling and remove the lifting brackets.

6. Raise the front of the car. Install the converter housing lower retaining bolts. Torque the bolts to specifications.

7. Remove the retainer securing the converter in the housing. Install the flywheel to converter lock washers and nuts. Torque the nuts to specifications. Install the converter lower access plate and the housing cover assembly. Install the oil cooler lines retaining clamp.

8. Torque the engine intermediate support bracket to cross member retaining nuts to specifications.

9. Connect both exhaust manifolds to the muffler inlet pipes. Torque the nuts to specifications.

10. Position the dust seal and install the starter and the transmission fluid filler tube bracket. Install the No. 2 cross member to underbody brace.

11. Remove the support from the transmission and lower the car.

12. Connect the alternator wires (Part 13-2).

13. Connect the water temperature sending unit wire.

14. Connect the engine ground strap. Install the starter cable retaining clamp.

15. Connect the flexible fuel line and the oil pressure sending unit wire.

16. Install the ignition coil and engine identification tag. Connect the coil primary and high tension wires.

17. Position the wire loom in the retaining clips on the left valve rocker arm cover.

18. Install the accelerator cross shaft bracket and the accelerator retracting spring. Connect the accelerator rod.

19. Connect the power steering pump bracket to the water pump.

20. Connect the power brake line to the intake manifold and to the flexible line. Install the line in the retaining clips on the left valve rocker arm cover.

On a car with an air conditioner, connect the magnetic clutch wire and the compressor lines.

21. Install the radiator and support as an assembly. Connect the radiator upper and lower hoses. Connect the transmission oil cooler lines.

22. Install the heater hose on the automatic choke housing. Connect the heater hose at the carburetor spacer.

On a car with an air conditioner, connect the heater hose at the intake manifold.

23. Fill and bleed the cooling system. Connect the heater hose at the water pump.

On a car with an air conditioner, connect the heater hose at the "T" connector in the heater hose to the water pump.

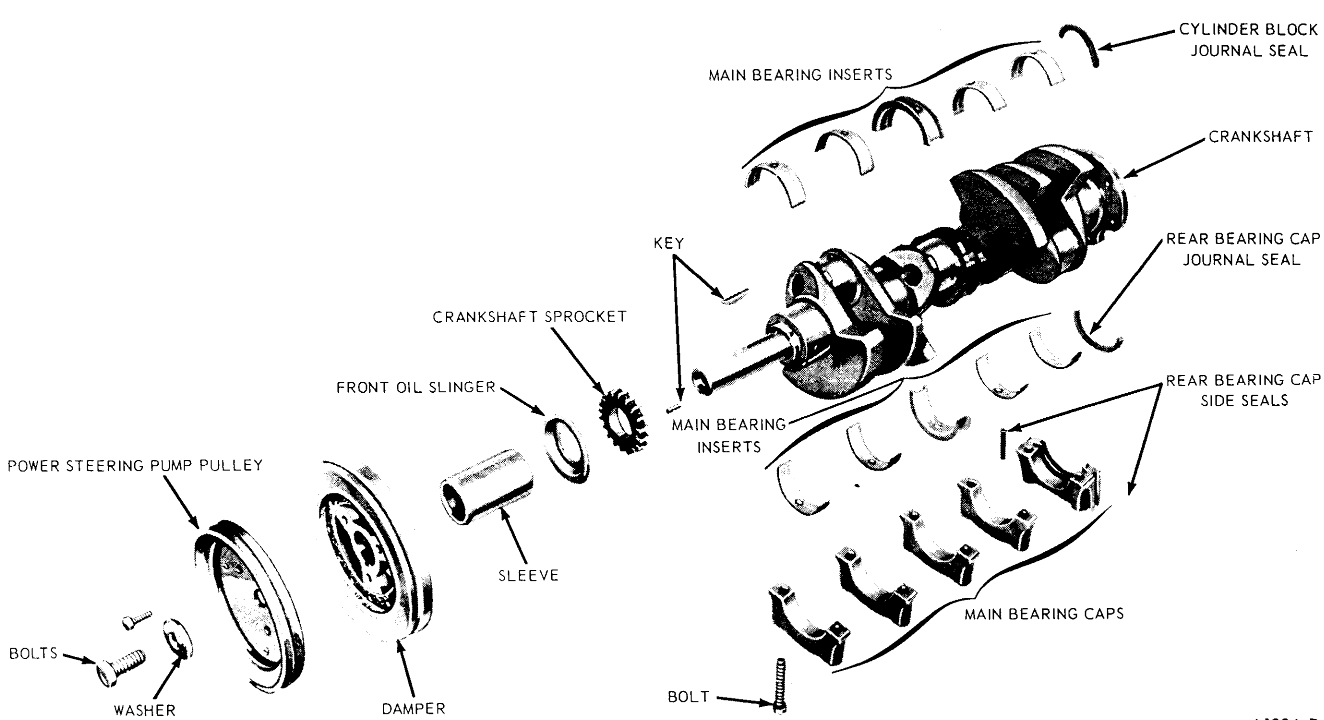


FIG. 52—Typical Crankshaft and Related Parts

24. Fill the crankcase with the proper grade and quantity of engine oil.

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

26. Adjust the transmission control linkage. Adjust the accelerator linkage. Install the air cleaner and connect the automatic choke heat chamber air inlet tube.

27. Install and adjust the hood.

4 MAJOR REPAIR OPERATIONS

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.

CRANKSHAFT

The crankshaft and related parts are shown in Fig. 52.

REMOVAL

1. Remove the alternator adjusting arm bracket bolt from the alternator and the upper support bracket bolt at the water pump. Remove the spark plugs to allow easy rotation of the crankshaft.

2. Remove the fuel pump. Slide the water pump bypass hose clamp toward the rear of the engine. Remove the water pump and fan as an assembly.

3. Remove the crankshaft damper cap screw and washer. Remove the power steering pump pulley. Install the puller on the damper (Fig. 27) and remove the damper.

4. Remove the crankshaft sleeve as shown in Fig. 28.

5. Remove the cylinder front cover.

6. Remove the crankshaft front oil slinger. Check the timing chain deflection, then remove the timing chain and sprockets by following the applicable steps under "Cylinder Front Cover Removal."

FIG. 53—Seal to Block Installation

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

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

9. Remove the main bearing caps.

10. 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.**

CLEANING AND INSPECTION

Refer to Part 8-1, Section 3 for the cleaning and inspection procedures.

REPAIRS

To refinish journals, dress minor imperfections, etc., refer to Part 8-1, Section 2.

INSTALLATION

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

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. 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.

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

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

7. Install a new rear journal oil seal in the block (Fig. 53). After installation, cut the ends of the seals flush. **It is very important that the seal be cut flush with the surface of the cylinder block. This prevents rough edges which may project from the groove and lodge between the bearing cap and cylinder block.**

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

9. Check the clearance of each main bearing as follows:

Place a piece of Plastigage on the crankshaft journal the full width of the journal and about ¼ inch off center (Fig. 54). Follow steps 10 and 11 under "Main Bearing Replacement" in Part 8-2, Section 2.

10. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install a new seal in the rear main bearing cap and install the rear main bearing cap by following steps 15 thru 19 under "Main Bearing Replacement" in Part 8-2, Section 2. 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 specifications.

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

12. Pry the crankshaft forward against the thrust surface of the upper half of the bearing (Fig. 55).

13. Hold the crankshaft forward and pry the thrust bearing cap to the

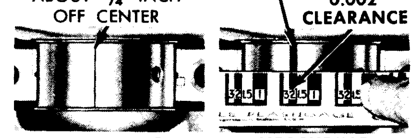


FIG. 54—Installing and Measuring Plastigage—Engine on Work Stand

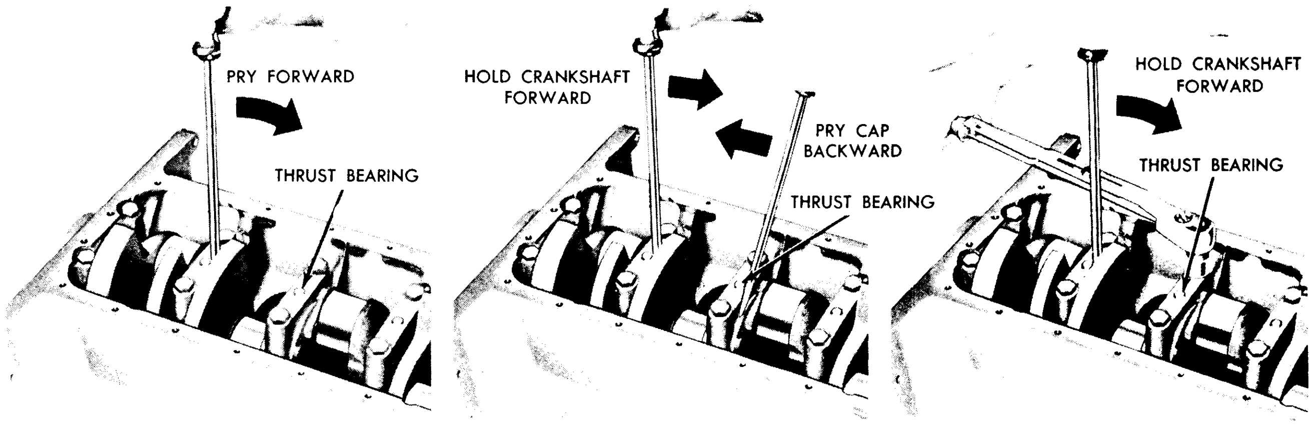


FIG. 55—Thrust Bearing Alignment

rear (Fig. 55). This will align the thrust surfaces of both halves of the bearing.

14. Retain the forward pressure on the crankshaft. Torque the cap bolts to specifications (Fig. 55).

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

16. 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. 56).

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

18. 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 11, 12, 13 and 14). Then check the end play.

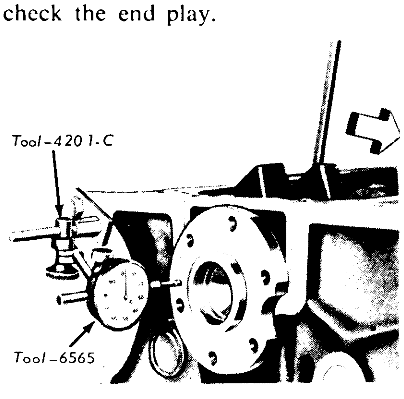


FIG. 56—Crankshaft End Play

19. Install new bearing inserts in the connecting rods and caps. Check the clearance of each bearing following the procedure under "Main Bearing Replacement."

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

21. 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.

22. Install the connecting rod cap. Torque the nuts to specifications.

23. After the piston and connecting rod assemblies have been installed, check the side clearance between the connecting rods on each connecting rod crankshaft journal (Fig. 43).

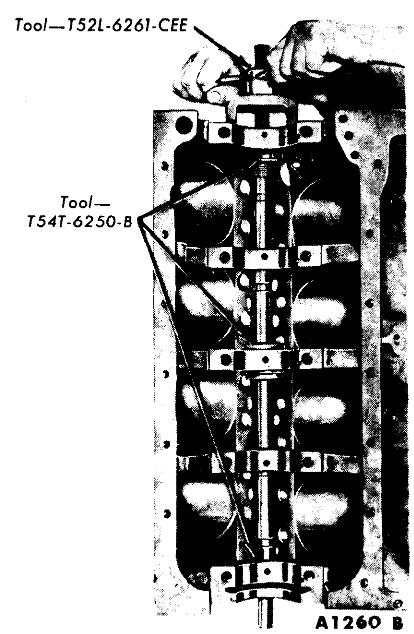


FIG. 57—Camshaft Bearing Replacement

24. Position the flywheel on the crankshaft. Install the retaining bolts. Torque the bolts to specifications.

25. Install the timing chain and sprockets, cylinder front cover and crankshaft damper, following steps 1 thru 9 under "Cylinder Front Cover Installation."

26. Clean the oil pan, oil pump and oil pump inlet screen. Prime the oil pump by filling either the inlet or outlet port with engine oil and rotating the pump shaft to distribute oil within the housing. Install the oil pump and oil pan, following the procedures under "Oil Pan and Oil Pump Installation."

27. Install the oil filter, fuel pump and carburetor fuel inlet line. Install the alternator. Install the spark plugs.

28. Install the engine in the car.

CAMSHAFT BEARING REPLACEMENT

Camshaft bearings are available pre-finished to size for standard and 0.015-inch undersize journal diameters. The bearings are not interchangeable from one bore to another.

1. Remove the camshaft, flywheel and crankshaft, following the appropriate procedures in Section 2 or Section 4. Push the pistons to the top of the cylinders.

2. Remove the camshaft rear bearing bore plug. Remove the camshaft bearings (Figs. 57 or 58).

If the camshaft bearings are being removed with the tool shown in Fig. 58, the following procedure will apply: Select the proper size expanding collet and back-up nut assemble on expanding mandrel. With the expanding collet collapsed, install the collet assembly in the camshaft bearing, and tighten the back-up nut on the expanding mandrel until the collet fits the camshaft bearing. Assemble the puller screw and extension (if necessary) as shown and install on the expanding mandrel. Tighten the pulling nut against the thrust bearing and pulling plate to remove the camshaft bearing. To remove the front bearing, install the puller screw from the rear of the cylinder block.

3. Position the new bearings at the bearing bores, and press them in place with the tool shown in Fig. 57 or Fig. 58. Align the oil holes in the bearings with the oil holes in the cylinder block when the bearings are installed. **Be sure the front bearing is installed 0.005-0.020 inch below the front face of the cylinder block (Fig. 59).**

4. Clean out the camshaft rear bearing bore plug recess thoroughly. Coat the flange of a new plug with oil-resistant sealer and install the plug (Fig. 60) with the flange edge of the plug facing inward.

5. Install the camshaft, crankshaft, flywheel and related parts, following the appropriate procedures in Section 2 or Section 4, except do not check connecting rod and main bearing clearances as a part of "Camshaft Bearing Replacement." Install the engine in the car.

CYLINDER ASSEMBLY REPLACEMENT

DISASSEMBLY

Follow steps 1 thru 11, 13 thru 20, and 24 thru 26 under "Engine Disassembly." Remove 4 cylinder head dowels from the cylinder block. Remove the cylinder block drain plugs, and remove the cylinder assembly from the work stand.

CLEANING

Clean the gasket and seal surfaces of all parts and assemblies (refer to Part 8-1, Section 3).

ASSEMBLY

Install the replacement cylinder block assembly on a work stand. Install the cylinder block drain plugs and cylinder head dowels. Transfer all parts removed from the old cylinder assembly to the new cylinder assembly, following the procedures in steps 21 thru 34 and 41 thru 62 under "Engine Assembly."

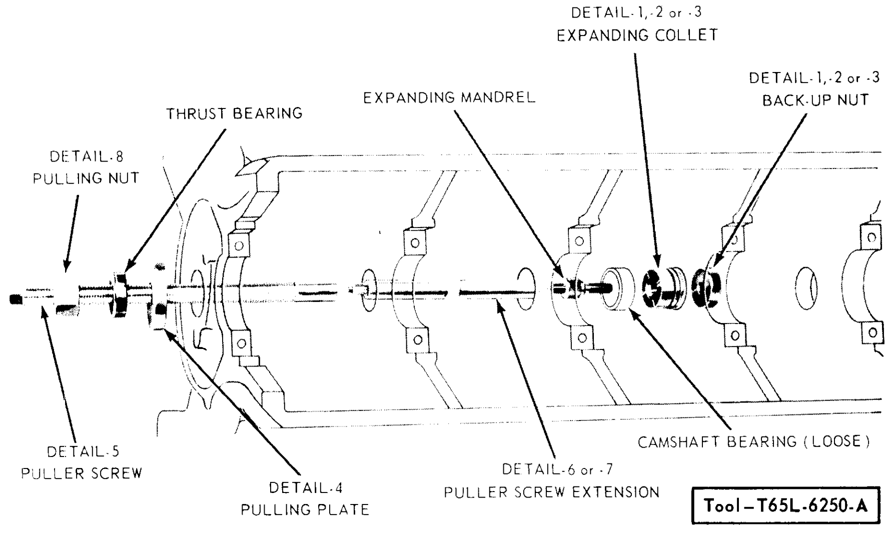


FIG. 58—Typical Camshaft Bearing Replacement

ENGINE DISASSEMBLY

1. Install the engine on the work stand.

2. Remove the distributor cap and spark plug wire assembly.

3. Disconnect the distributor vacuum line at the distributor. Remove the carburetor fuel inlet line. Remove the fuel pump and discard the gasket.

4. Slide the clamp on the water pump bypass hose toward the water pump. Remove the automatic choke air heat tube and air inlet tube. Remove the valve rocker arm covers and crankcase ventilation tube.

Starting at the No. 4 cylinder, loosen the right rocker arm shaft support bolts in sequence, two turns at a time. After the bolts are all loosened, remove the valve rocker arm shaft assembly and the oil baffle plate. Starting at the No. 5 cylinder, follow the same procedure on the left valve rocker arm shaft support bolts.

5. Remove the valve push rods in sequence and put them in a rack so that they can be installed in their original bore.

6. Remove the distributor hold down bolt and clamp and remove the distributor.

7. Remove the intake manifold retaining bolts.

8. Install standard eye bolts with 5/16-18 threads in the left front and right rear rocker arm cover screw holes and attach the engine lifting sling (Fig. 51).

9. Raise the intake manifold and carefully remove it from the engine. Discard the intake manifold gaskets and seals.

10. Remove the baffle plate from the valve push rod chamber floor by prying up on the baffle with a screw driver (Fig. 61).

11. Lift the valve lifters from the cylinder block and place them in a rack so that they can be installed in their original bore (Fig. 62). **The internal parts of each hydraulic valve lifter assembly are matched sets. Do not intermix the parts. Keep the assemblies intact until they are to be cleaned.**

12. Remove the exhaust manifolds and the spark plugs. Remove the automatic choke air chamber cover from the right exhaust manifold.

13. Remove the cylinder head bolts and install the cylinder head

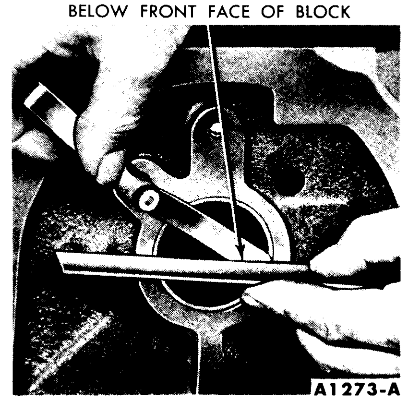


FIG. 59—Camshaft Front Bearing Measurement

holding fixtures (Fig. 20).

14. Lift the cylinder heads off the block. **Do not pry between the head and the block.** Discard the cylinder head gaskets.

15. Remove the oil filter. Remove the oil filter adapter assembly and oil pressure sending unit as an assembly. Discard the gasket.

16. Remove the alternator, brackets and drive belts.

17. Remove the water pump, pulley and fan as an assembly.

18. Remove the power steering pulley. Remove the crankshaft damper (Fig. 27).

19. Remove the crankshaft sleeve as shown in Fig. 28.

20. Remove the cylinder front cover. Discard the gasket. Remove the crankshaft front oil slinger.

21. Check the timing chain deflection by following steps 13, 14 and 15 under "Cylinder Front Cover and Timing Chain Removal."

22. Remove the camshaft sprocket cap screw and the fuel pump eccentric. Remove the crankshaft sprocket key. Remove the sprockets and timing chain as an assembly (Fig. 31).

23. Remove any ridge and/or carbon deposits from the upper end of the cylinder bores. Move the piston to the bottom of its travel and place a cloth on the piston head to collect the cuttings. 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.** After the ridge has been removed, remove the cutter from the cylinder bore.

24. Remove the flywheel.

25. Invert the engine. Remove the oil pan. Discard the gasket.

26. Remove the oil pump and inlet

Tool–T53L-200-A Tool–T58P-6266-A

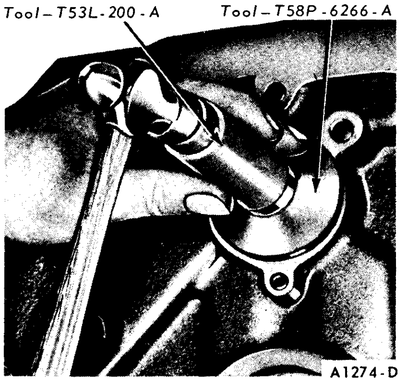


FIG. 60–Camshaft Rear Bearing Bore Plug Installation

tube as an assembly. Remove the oil pump drive shaft. Discard the oil pump gasket.

27. Make sure all connecting rods and caps are marked so that they can be installed in their original locations. Turn the crankshaft until the connecting rod being removed is down. Remove the rod cap.

28. 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.**

29. Remove the bearing inserts from the connecting rods and caps. Install the rod caps on the connecting rods from which they were removed.

30. Remove the main bearing caps.

31. 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.**

32. Remove the rear journal oil seal from the block and rear bearing cap, and remove the cap to block side seals.

33. Remove the main bearing inserts from the block and bearing caps. Install the main bearing caps in their original positions.

34. Carefully remove the camshaft by pulling it toward the front of the engine. Use caution to avoid damaging the journals and lobes.

35. Remove the camshaft rear bearing bore plug. Remove the camshaft bearings (Fig. 57).

CLEANING AND INSPECTION

For cleaning and inspection procedures, refer to Part 8-1, Section 3.

ENGINE ASSEMBLY

If the cylinder block is to be replaced, transfer the cylinder head dowels and cylinder block drain plugs to the new cylinder block.

1. Remove the glaze from the cylinder bores by following the instructions of the tool manufacturer.

2. Invert the engine on the work stand.

3. Position the new camshaft bearings at the bearing bores, and press them in place with the tool shown in Fig. 57 or Fig. 58. Align the oil holes in the cylinder block when the bearings are installed. **Be sure the camshaft front bearing is installed 0.005-0.020 inch below the front face of the cylinder block (Fig. 59).**

4. Check the oil passage that feeds the rocker arm shafts for obstructions by squirting oil into the opening on each cylinder bank and observing the flow through the oil holes at Nos. 2 and 4 bearings.

5. Clean out the camshaft rear bearing bore plug recess thoroughly.

6. Coat the flange of a new plug with oil-resistant sealer and install it with the flange facing inward (Fig. 60). Drive the plug in until it is flush or slightly below the casting surface.

7. Oil the camshaft and apply Lubriplate to all lobes; then carefully slide it through the bearings.

8. Be sure that the rear oil seal grooves are clean. Install a new rear journal oil seal in the block (Fig. 53). After installation, cut the ends of the seals flush.

9. 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.

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

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

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

12. Check the clearance of each main bearing following the procedure under "Main Bearing Replacement."

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

14. Be sure that the oil seal grooves in the rear main bearing cap are clean. Install a new journal seal in the cap (Fig. 40). After installation, cut the ends of the seal flush. Apply a thin coating of oil-resistant sealer to the rear main bearing cap at the rear of the top mating surface (Fig. 40). **Do not apply sealer to the area forward of the side seal groove.** Install the rear main bearing cap and the remainder of the 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 specifications.

15. Install the thrust bearing cap and check crankshaft end play by following steps 11 thru 18 under "Crankshaft Installation."

16. Turn the engine on the work

collet and back-up nut assemble on expanding mandrel. With the expanding collet collapsed, install the collet assembly in the camshaft bearing, and tighten the back-up nut on the expanding mandrel until the collet fits the camshaft bearing. Assemble the puller screw and extension (if necessary) as shown and install on the expanding mandrel. Tighten the pulling nut against the thrust bearing and pulling plate to remove the camshaft bearing. To remove the front bearing, install the puller screw from the rear of the cylinder block.

3. Position the new bearings at

crankshaft front oil slinger.

21. Clean the cylinder front cover and the cylinder block gasket surfaces. Install a new crankshaft front oil seal (Fig. 32).

22. Coat the gasket surface of the block and cover and the cover bolt threads with sealer. Position a new gasket on the block.

23. Install the alignment pilot tool on the cylinder front cover so that the keyway in the pilot aligns with the key in the crankshaft. Position the cover and pilot over the end of the crankshaft and against the block (Fig. 34).

24. Install the cylinder front cover bolts finger-tight. Position the alternator support bracket and the alternator adjusting arm bracket; then install the bolts (on a car equipped with an air conditioner, connect the compressor and brackets to the cylinder front cover). While pushing in on the pilot, torque the cover bolts to specifications. Remove the pilot.

25. Lubricate the crankshaft with a white lead and oil mixture and lubricate the oil seal rubbing surface

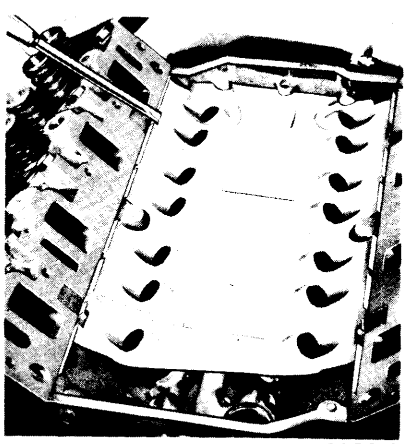
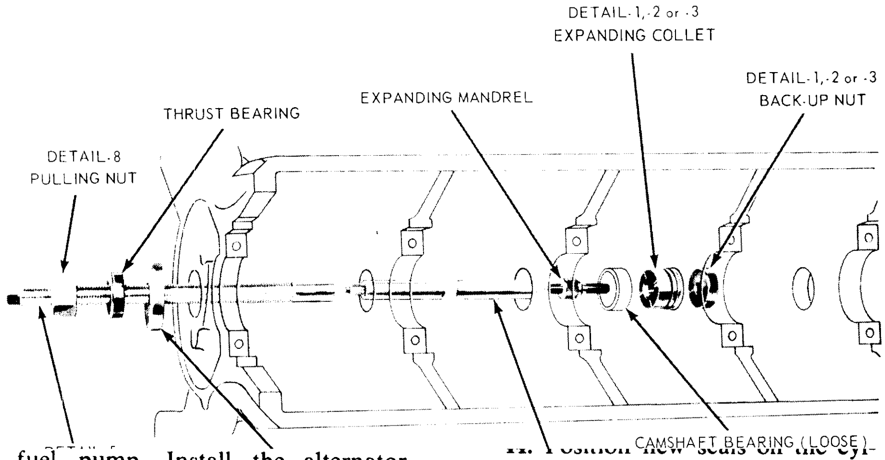


FIG. 61—Baffle Plate Removal



fuel pump. Install the alternator, brackets and drive belts.

31. Turn the engine on the work stand so that the top of the engine is up.

32. Clean the cylinder head and block gasket surfaces. Apply sealer to both sides of a new gasket. Guided by the word "FRONT" on the gasket install the head gasket over the cylinder head dowels.

33. Place the cylinder head on the engine and remove the holding fixtures. Coat the head bolt threads with water-resistant sealer and install the bolts.

34. The cylinder head bolt tightening procedure is performed in three progressive steps. Torque the bolts in sequence (Fig. 21) to 70 ft-lbs, then to 80 ft-lbs, and finally to specifications. **After the cylinder head bolts have been torqued to specifications, the bolts should not be disturbed.**

35. Coat the mating surfaces of the exhaust manifold with a light film of graphite grease.

36. Using a new gasket, install the automatic choke air chamber cover on the right exhaust manifold. **Be sure the cover is securely fastened.**

37. Position a new gasket over the muffler inlet pipe studs of the exhaust manifolds.

38. Position the exhaust manifolds on the cylinder heads and install the retaining bolts and tab washers. Torque the retaining bolts to specifications, working from the center to the ends. Lock the bolts by bending one tab of the washer over a flat on the bolt.

39. Install the spark plugs.

40. Install the baffle plate in the valve push rod chamber. Position one side of the baffle plate and press the other side into place.

44. Position new seals on the cylinder block and new gaskets on the cylinder heads. Position the gasket slots in the end tabs over the ribs on the seals. Be sure the holes in

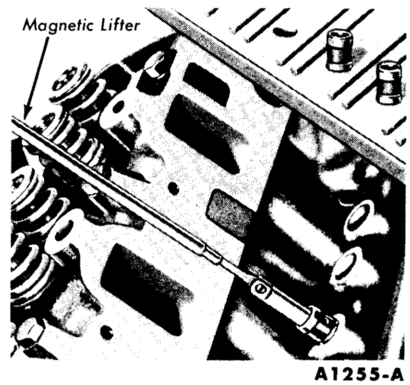


FIG. 62—Valve Lifter Removal—Intake Manifold Removed

the gaskets are aligned with the holes in the cylinder heads.

45. Install the eye bolts in the intake manifold and attach the engine lifting sling and carefully lower the intake manifold on the engine (Fig. 17).

46. Position the intake manifold by inserting the distributor in place. **After the intake manifold is in place, run a finger around the seal area to make sure the seals are in place. If the seals are not in place, remove the intake manifold and position the seals.**

47. Start the water pump bypass hose on the intake manifold.

48. Be sure the holes in the manifold gaskets and manifold are in alignment. Install the manifold retaining bolts and torque them to specifications, in sequence as shown in Fig. 19.

49. Remove the distributor and the engine lifting sling and eye bolts.

50. Refer to "Valve Rocker Arm

Shaft Assembly Installation" and install the valve rocker arm shaft assembly by following steps 1 thru 6.

51. Install the automatic choke air heat tube and air inlet tube.

52. Rotate the crankshaft damper until the No. 1 piston is on TDC then position the distributor in the block with the rotor at the No. 1 firing position and the points open. Install the hold down clamp.

53. Connect the distributor vacuum line. Install the distributor cap. Install the valve rocker arm covers.

54. Connect the spark plug wires. Install the carburetor fuel inlet line.

55. Invert the engine on the work stand. Position the oil pump drive shaft into the distributor socket. With the shaft firmly seated in the distributor socket, the stop on the shaft should touch the roof of the crankcase. Remove the shaft and position the stop as necessary.

56. With the stop properly positioned, insert the oil pump drive shaft into the oil pump.

57. 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.

58. Position a new gasket on the pump housing and install the pump and shaft as an assembly. **Do not attempt to force the pump into position if it will not seat readily. The drive shaft hex may be misaligned with the distributor shaft. To align, rotate the intermediate shaft into a new position.**

59. Install the oil pan assembly on the block following the procedure under "Oil Pan and Oil Pump Installation." Install the retaining screws and torque them from the center outward to specifications.

60. Position the flywheel on the crankshaft and install the retaining bolts. Torque the bolts alternately to specifications.

61. Clean the oil filter adapter gasket surfaces. Apply sealer to a new adapter gasket and install the adapter assembly and gasket.

62. Clean the adapter filter recess. Coat the gasket on a new filter with oil. Place the filter in position on the adapter. Hand tighten the filter until the gasket contacts the adapter face, and then advance it ½-turn.

63. Install the engine in the car. Operate the engine and check for oil and coolant leaks. Check the ignition timing, and adjust the engine idle speed, idle fuel mixture and anti-stall dashpot.

64. Adjust the transmission control linkage.

PART 8-3 SPECIFICATIONS

NOTE: All specifications are given in inches unless otherwise noted.

GENERAL ENGINE

MODEL PREFIX	EES
PISTON DISPLACEMENT—Cubic Inches	390
COMPRESSION RATIO	10.1:1
BRAKE HORSEPOWER @ Specified rpm	300 @ 4600
TORQUE—Ft-lbs @ Specified rpm	427 @ 2800
BORE AND STROKE	4.05 x 3.784
COMPRESSION PRESSURE—psi Sea Level @ Cranking Speed Tolerance Between Cylinders	 170-210 20
TAXABLE HORSEPOWER	52.49
FIRING ORDER	1-5-4-2-6-3-7-8
VALVE ARRANGEMENT—Front to Rear	E-I-E-I-I-E-I-E
ENGINE IDLE RPM* *Refer to Group 10, Part 10-1, Section 2 for proper procedure in setting idle speed.	475-500
ENGINE IDLE MANIFOLD VACUUM—Minimum Inches of Mercury @ Specified Engine Neutral Idle rpm—Sea Level	18
INITIAL IGNITION TIMING—BTDC* *For altitude operation, and/or to obtain optimum engine performance and fuel economy, the initial ignition timing may be advanced 5° over the "normal" setting. No further improvement in engine performance or fuel economy will be achieved by advancing beyond this point. Advance the timing progressively until engine detonation (spark knock) is evident under actual road test acceleration. Retard the timing until the detonation (spark knock) is eliminated. If the individual requirements of the car and/or the use of sub-standard fuels dictate, the initial timing may have to be retarded from the recommended setting to eliminate detonation (spark knock). If retarding is necessary, it should be done progressively and not to exceed 2° BTDC.	6°
CRANKCASE OIL CAPACITY U.S. Measure Imperial Measure *Includes one quart with filter replacement.	 6 quarts* 5 quarts*
OIL PRESSURE—psi hot @ 2000 rpm	35-55

CYLINDER HEAD

GASKET SURFACE FLATNESS 0.003 inch in any 6 inches or 0.006 inch overall.	
VALVE GUIDE BORE DIAMETER—Standard Intake and Exhaust	 0.3728-0.3735
VALVE SEAT WIDTH Intake Exhaust	 0.060-0.080 0.070-0.090
VALVE SEAT ANGLE Intake and Exhaust	 45°
VALVE SEAT RUNOUT—Maximum	0.002
COMBUSTION CHAMBER VOLUME—CC	73.1-76.1

VALVE MECHANISM

VALVE CLEARANCE* *Clearance specified is obtained at the valve stem tip with the hydraulic valve lifter collapsed.	0.050-0.150
VALVE STEM DIAMETER Standard Intake and Exhaust 0.003 Oversize Intake and Exhaust 0.015 Oversize Intake and Exhaust 0.030 Oversize Intake and Exhaust	 0.3711-0.3718 0.3741-0.3748 0.3861-0.3868 0.4011-0.4018
VALVE STEM TO VALVE GUIDE CLEARANCE Intake Exhaust	 0.0010-0.0024—Wear Limit 0.0045 0.0010-0.0024—Wear Limit 0.0055
VALVE HEAD DIAMETER Intake Exhaust	 2.022-2.037 1.551-1.566
VALVE FACE ANGLE Intake and Exhaust	 44°
VALVE FACE RUNOUT—Maximum Intake and Exhaust	 0.002
VALVE SPRING APPROXIMATE FREE LENGTH	2.15
VALVE SPRING MAXIMUM OUT-OF-SQUARE	0.072
VALVE SPRING PRESSURE (LBS.) @ SPECIFIED LENGTH Intake and Exhaust	 74-84 @ 1.820 Wear Limit 67 @ 1.820 190-208 @ 1.420 Wear Limit 171 @ 1.420
VALVE SPRING ASSEMBLED HEIGHT Pad to Underside of Retainer	 1 13/16-1 27/32
VALVE PUSH ROD RUNOUT	0.025
VALVE LIFTER STANDARD DIAMETER	0.8740-0.8745
VALVE LIFTER TO LIFTER BORE CLEARANCE	0.0005-0.0020 Wear Limit 0.005
VALVE LIFTER LEAK DOWN RATE—Wear Limit	10-50 Seconds
ROCKER ARM TO ROCKER SHAFT CLEARANCE	0.0035-0.055 Wear Limit 0.0065
ROCKER ARM SHAFT OUTSIDE DIAMETER	0.8385-0.8395
ROCKER ARM BORE DIAMETER	0.843-0.844
ROCKER ARM LIFT RATIO	1.73:1

CAMSHAFT AND TIMING CHAIN

CAMSHAFT END PLAY	0.001-0.007 Wear Limit 0.012
CAMSHAFT JOURNAL STANDARD DIAMETER	2.1238-2.1248
CAMSHAFT JOURNAL MAXIMUM OUT-OF-ROUND	0.001
CAMSHAFT JOURNAL RUNOUT—Maximum	0.005
CAMSHAFT JOURNAL TO BEARING CLEARANCE	0.001-0.003 Wear Limit 0.006
CAMSHAFT LOBE LIFT	
Intake and Exhaust	0.2316 Wear Limit 0.2266
VALVE LIFTER LIFT	
Intake (Opens)	0.002 @ 26° BTDC
Intake (Closes)	0.004 @ 64° ABDC
Exhaust (Opens)	0.002 @ 67° BBDC
Exhaust (Closes)	0.004 @ 23° ATDC
SPROCKET CONTACT FACE RUNOUT	
Maximum	0.002
ASSEMBLED SPROCKET CONTACT FACE RUNOUT	
Maximum	0.006
TIMING CHAIN DEFLECTION	0.5

CAMSHAFT BEARINGS

INSIDE DIAMETER	2.1258-2.1268
LOCATION IN RELATION TO FRONT FACE OF BLOCK CAM BEARING BORE—NO. 1 BEARING ONLY—BELOW	0.005-0.020

CRANKSHAFT

MAIN BEARING JOURNAL STANDARD DIAMETER	
Coded Red	2.7488-2.7492
Coded Blue	2.7484-2.7488
MAIN BEARING JOURNAL MAXIMUM RUNOUT	0.002 Wear Limit 0.003
CONNECTING ROD AND MAIN BEARING JOURNAL MAXIMUM OUT-OF-ROUND	0.0004
CONNECTING ROD AND MAIN BEARING JOURNAL TAPER	0.0003 per inch
THRUST BEARING JOURNAL LENGTH	1.124-1.126
MAIN BEARING JOURNAL THRUST FACE RUNOUT	0.001
CONNECTING ROD JOURNAL DIAMETER	
Coded Red	2.4384-2.4388
Coded Blue	2.4380-2.4384
CRANKSHAFT FREE END PLAY	0.004-0.010 Wear Limit 0.014
ASSEMBLED FLYWHEEL OUTSIDE (Radial) RUNOUT—MAXIMUM	0.020
ASSEMBLED FLYWHEEL RING GEAR (Lateral) RUNOUT—MAXIMUM	0.037
ASSEMBLED SPROCKET FACE RUNOUT—MAXIMUM	0.006
SPROCKET CONTACT FACE RUNOUT—MAXIMUM	0.001

CRANKSHAFT MAIN BEARINGS

JOURNAL CLEARANCE—No. 1 and 3	0.0007-0.0031
No. 2, 4 and 5	0.0005-0.0028
WALL THICKNESS	
Coded Red	0.0953-0.0958
Coded Blue	0.0957-0.0962
0.002 Undersize	0.0967-0.0972

CONNECTING ROD

PISTON PIN BUSHING INSIDE DIAMETER	0.9752-0.9755
PISTON PIN BUSHING MAXIMUM OUT-OF-ROUND	0.0004
PISTON PIN BUSHING MAXIMUM TAPER	0.0003
BEARING BORE DIAMETER	
Coded Red	2.5907-2.5911
Coded Blue	2.5911-2.5915
BEARING BORE OUT-OF-ROUND AND TAPER	
Maximum	0.0004
CENTER-TO-CENTER LENGTH	6.486-6.490
TWIST TOTAL DIFFERENCE—Maximum	0.012
BEND TOTAL DIFFERENCE—Maximum	0.004
CONNECTING ROD ASSEMBLY—Assembled to Crankshaft	
Side Clearance	0.006-0.016 Wear Limit 0.019

CONNECTING ROD BEARINGS

BEARING TO CRANKSHAFT CLEARANCE	0.0007-0.0028
WALL THICKNESS	
Coded Red	0.07515-0.07565
Coded Blue	0.07555-0.07605
0.002 Undersize	0.07655-0.07705

PISTON

PISTON DIAMETER*	
Coded Red	4.0477-4.0483
Coded Blue	4.0489-4.0495
0.003 Oversize	4.0501-4.0507
*Measured at the piston pin bore centerline at 90° to the bore.	
PISTON TO CYLINDER BORE CLEARANCE	0.0015-0.0023
PISTON PIN BORE DIAMETER	0.9752-0.9755
RING GROOVE WIDTH	
Upper Compression Ring	0.0805-0.0815
Lower Compression Ring	0.0960-0.0970
Oil Ring	0.188-0.189

PISTON PIN

PISTON PIN DIAMETER	
Standard	0.9750-0.9753
0.001 Oversize	0.9760-0.9763
0.002 Oversize	0.9770-0.9773
PISTON PIN LENGTH	3.156-3.170
PISTON PIN TO PISTON CLEARANCE	0.0001-0.0003 Wear Limit 0.0008
PISTON PIN TO CONNECTING ROD BUSHING CLEARANCE	0.0001-0.0005 Wear Limit 0.001

PISTON RINGS

RING WIDTH	
Upper Compression Ring	0.0774-0.0781
Lower Compression Ring	0.0930-0.0940
RING SIDE CLEARANCE	
Upper Compression Ring	0.0024-0.0041 Wear Limit 0.006
Lower Compression Ring	0.002-0.004 Wear Limit 0.006
Oil Ring	Snug
RING GAP WIDTH—Standard Bore	
Upper and Lower Compression Rings	0.010-0.020
Oil Ring (Steel Rail)	0.015-0.066

CYLINDER BLOCK

CYLINDER BORE DIAMETER	
Standard	4.0500-4.0524
0.003 Oversize	4.0524-4.0536
CYLINDER BORE MAXIMUM OUT-OF-ROUND	0.001 Wear Limit 0.005
CYLINDER BORE MAXIMUM TAPER	0.001 Wear Limit 0.010
HEAD GASKET SURFACE FLATNESS 0.003 inch in any 6 inches or 0.006 inch overall.	

OIL PUMP

RELIEF VALVE SPRING TENSION – Lbs @ Specified Length	9.0-9.6–1.53 inches
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

TORQUE LIMITS (Ft-Lbs)

MAIN BEARING CAP BOLTS—Oiled Threads	95-105
CYLINDER HEAD BOLTS	80-90
OIL PAN TO CYLINDER BLOCK	9-11
OIL PAN DRAIN PLUG	15-20
MANIFOLDS TO CYLINDER HEAD	
Intake	32-35
Exhaust	12-18

MANIFOLDS TO CYLINDER HEAD—(Continued)

FLYWHEEL TO CRANKSHAFT	75-85
OIL PUMP TO CYLINDER BLOCK	20-25
OIL PICK-UP TUBE TO OIL PUMP	12-15
OIL PUMP COVER PLATE	6-9
OIL FILTER ADAPTER TO CYLINDER BLOCK	12-15
CYLINDER FRONT COVER	12-15
WATER OUTLET HOUSING	12-15
WATER PUMP TO CYLINDER BLOCK	20-25
CAMSHAFT SPROCKET TO CAMSHAFT	35-45
CAMSHAFT THRUST PLATE TO BLOCK	12-15
DAMPER TO CRANKSHAFT	70-90
CONNECTING ROD NUTS	40-45
VALVE ROCKER ARM COVER	4-7
VALVE ROCKER SHAFT SUPPORT TO CYLINDER HEAD	40-45
FUEL PUMP TO CYLINDER FRONT COVER	20-25
ENGINE SUPPORTS	
Front Insulator to Engine	35-50
Front Insulator to Support	20-30
Front Insulator to Intermediate Bracket	45-60
Intermediate Bracket to Cross Member	45-60
Support Retainer to Extension Housing	40-50
Support to End Bracket	40-50
End Bracket to Floor Pan Reinforcement	20-30

STANDARD TORQUE LIMITS FOR VARIOUS SIZE BOLTS

CAUTION: Special torque limits listed in the preceding tables should be used in preference to these standard limits wherever they apply.

Size (Inches)	1/4-20	1/4-28	5/16-18	5/16-24	3/8-16	3/8-24
Torque (Foot-Pounds)	6-9	6-9	12-15	15-18	23-28	30-35
Size (Inches)	7/16-14	7/16-20	1/2-13	1/2-20	9/16-18	5/8-18
Torque (Foot-Pounds)	45-50	50-60	60-70	70-80	85-95	130-145

SPECIAL TOOLS

Description	Ford Tool No.	Former No.
Hub Bearing Cup (Inner and Outer) Replacer Kit	T53L-200-A	
Engine Lifting Sling	T53L-300-A	6000-BA
Piston Ring Groove Cleaner		RC-500
Valve Spring Compressor		K-D915
Differential Backlash and Runout Gauge, with Universal Bracket Dial Indicator and Bracket	TOOL-4201-C	
Engine Lifting Bracket	T58P-6000-A	6000-BD
Cylinder Front Cover Pilot	T61P-6019-B	6059-F
Cylinder Head Holding Fixture	T58P-6085-A	6085-M
Valve Guide Reamer Kit	T58P-6085-B	6085-H
Piston Pin Remover	T52P-6135-DAD	
Piston Ring Compressor	TOOL-6149-A	
Camshaft Bearing Remover and Replacer Adapter	T65L-6250-A	T54T-6250-B T52L-6261-CEE
Camshaft Bearing Bore Plug Replacer Adapter	T58P-6266-A	
Crankshaft Damper and Sprocket Replacer	T52L-6306-AEE	
Crankshaft Damper Remover	T58P-6316-B	6306-AJ

Description	Ford Tool No.	Former No.
Upper Main Bearing Insert Remover and Replacer	TOOL-6331	
Crankshaft Pulley Spacer Remover	T56P-6362-A	
Hydraulic Tappet Leakdown Tester	TOOL-6500-E	6500-E
Valve Stem Clearance Checking Tool	TOOL-6505-F	8680-A
Tru-Valve Gauge	T64L-6507-A	
Valve Spring Compressor	TOOL-6513-DD	6513-EE
Cam Lift and Push Rod Stroke Dial Indicator	TOOL-6565	
Cup Shaped Adapter to TOOL 6565	TOOL-6565-AB	
Rocker Arm to Valve Stem Clearance Gauge	T58P-6565-A	
Rocker Arm to Valve Stem Clearance Gauge (Use with T58P-6565-A)	T65P-6565-A	
Cylinder Block Front Cover Oil Seal Replacer Adapter	T58P-6700-B	6700-B
Crankshaft Rear Bearing Seal Replacer	T58P-6701-A	6701-C
Cylinder Head Bolt Torque Sequence Tool (Typical)		S-8683
Impact Slide Hammer	T59L-100-B	T-7600-E
Puller Attachment	T58L-101-A	T-7600-E

IGNITION SYSTEM

GROUP 9

PART 9-1 GENERAL IGNITION SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

GENERAL INFORMATION

CONVENTIONAL IGNITION SYSTEM

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.

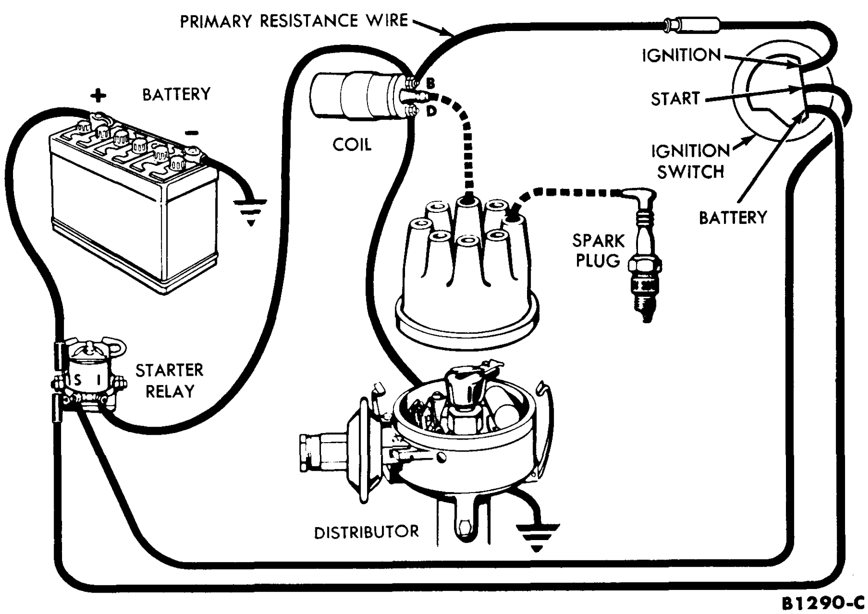


FIG. 1—Typical Conventional Ignition System Circuit

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

TRANSISTOR IGNITION SYSTEM

The permatuned transistor ignition system is available on the Thunderbird engines. Figure 2 shows a schematic of the transistor ignition system.

The ignition coil primary in the transistor system is designed to draw

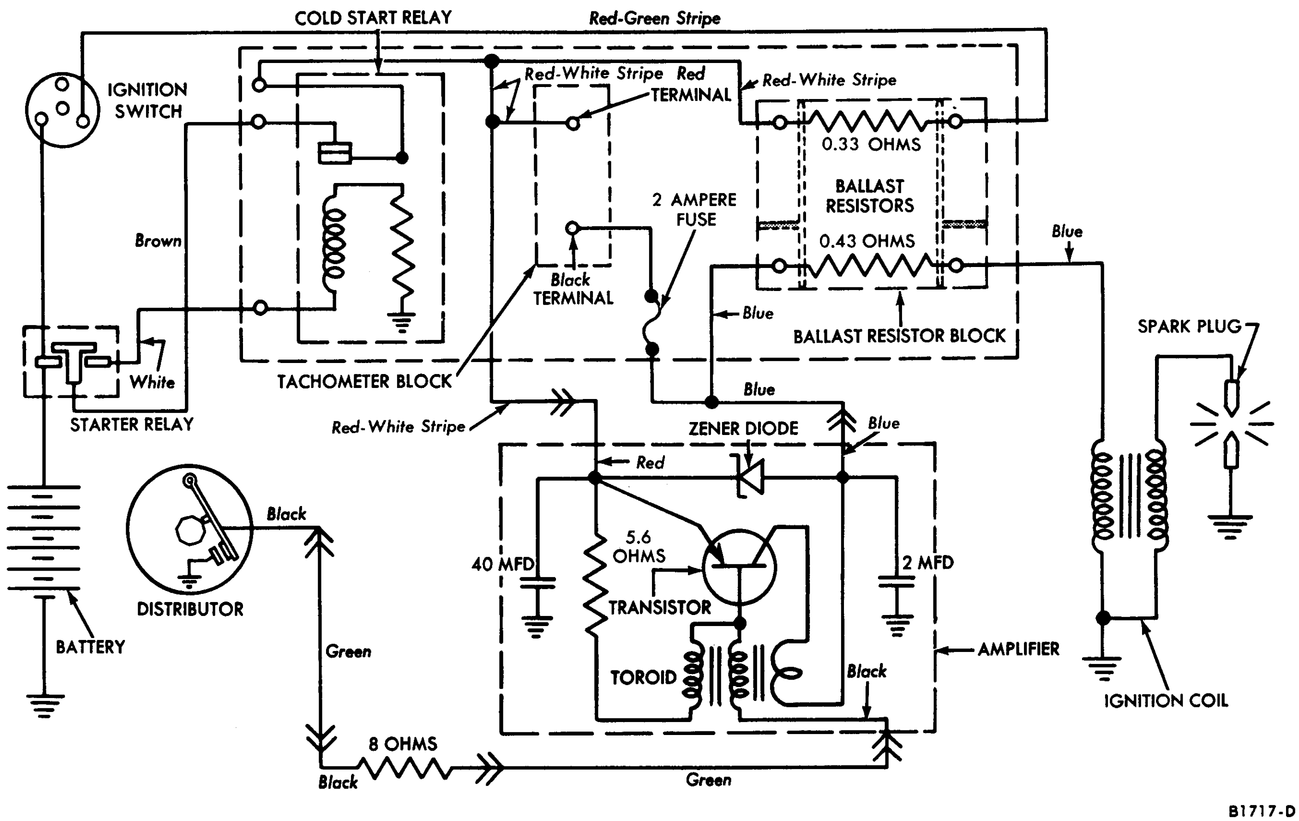


FIG. 2–Typical Transistor Ignition System Schematic

a normal 12 ampere peak current, or approximately 5.5 amperes average current as indicated on an ammeter, in order to provide high spark plug voltage at the higher engine speeds.

The transistor in the system acts as a switch or relay. It is similar in action to a horn relay, except that it has no moving parts, and thus acts with very little time lag. The transistor is connected between the battery and the coil and is used to make and break the coil primary circuit.

The distributor controls the transistor. The 8-ohm resistor, connected between the distributor and the transistor (in the wiring harness), limits the transistor control current (and distributor point current) to 0.5 ampere. The low distributor point current eliminates pitting and gives long distributor point life.

The distributor condenser has been increased in value to 2 mfd. and is located in the amplifier assembly. As in the standard ignition circuit, it absorbs high inductive energy during initial distributor point opening. However, it no longer has any effect on the distributor points as the transistor effectively isolates the points from the coil.

The amplifier assembly (Fig. 3) is mounted under the instrument panel to protect the parts from engine heat.

A ceramic ballast resistor block, a tachometer connector block, and a cold start relay are mounted on a plate in the engine compartment (Fig. 4). A fiber cover encloses the resistor block, tachometer block and cold start relay.

A 2-ampere fuse between the

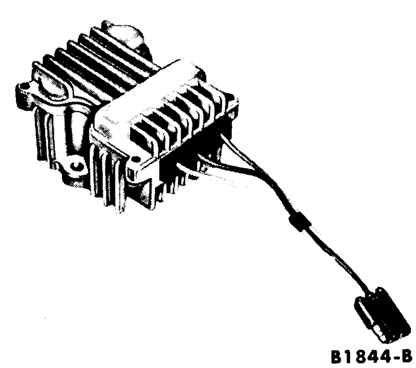


FIG. 3–Amplifier Assembly

black (large) terminal of the tachometer block and the coil primary circuit prevents the transistor from being damaged by the application of external devices other than normal testing equipment.

The cold start relay contacts are normally closed and they are connected into the circuit only during the start cycle. When the starter relay is closed, the cold start relay is actuated and opens its contacts. If, during starting, the available voltage drops below 10.5 volts, the relay contacts close, thus bypassing the 0.33-ohm resistor in the ballast resistor block and applying full available voltage to the system.

The tachometer block is used to connect a tachometer or other test equipment into the circuit. **Do not connect test equipment into the circuit in any other manner, or readings will be inaccurate and damage may occur to the transistor, or change its operating characteristics.**

Connect the tachometer red lead to the tachometer block red terminal and black lead to the black terminal.

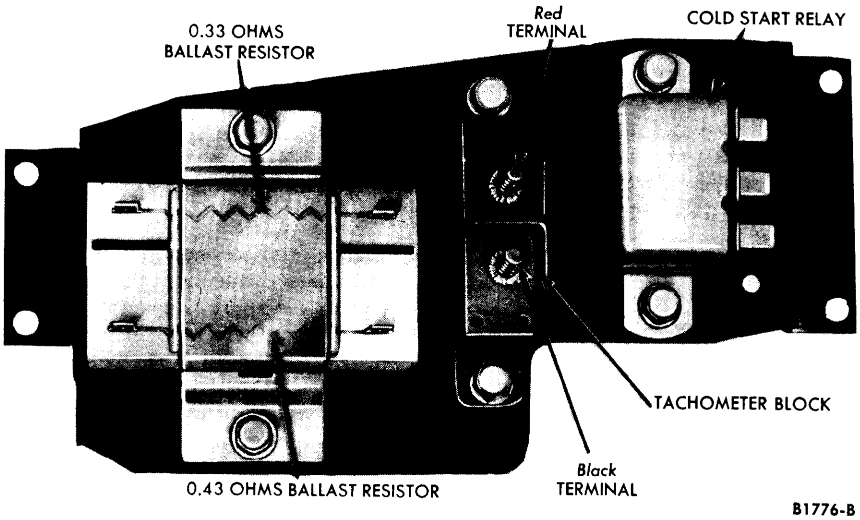


FIG. 4—Ballast Resistors, Tachometer Block and Cold Start Relay With Cover Removed—Typical

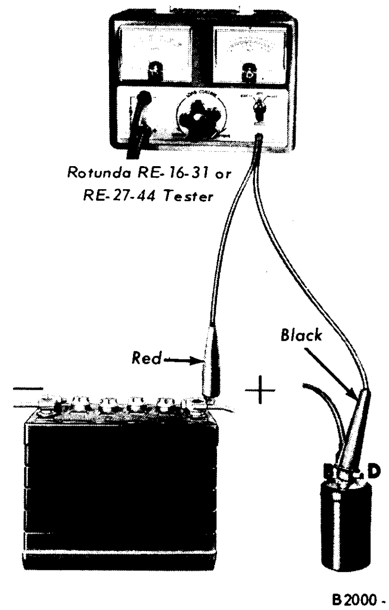


FIG. 5—Battery to Coil Test and Starting Ignition Circuit Test

CONVENTIONAL IGNITION SYSTEM DIAGNOSIS

TROUBLE ISOLATION

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", the trouble can be found by performing an ignition system test on a scope or by further isolating the trouble to the primary or secondary circuit as follows:

1. Disconnect the brown wire from the starter relay "I" terminal and the red and blue wire from the starter relay "S" terminal.
2. Remove the coil high tension lead from the distributor cap.
3. Turn on the ignition switch.
4. While holding the high tension lead approximately $^3/_{16}$ inch from the cylinder head or any other good ground, crank the engine by using an auxiliary starter switch between the starter relay battery and "S" terminals.

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.

Primary Circuit. A breakdown or energy loss in the primary circuit can be caused by:

1. Defective primary wiring, or loose or corroded terminals.
2. Burned, shorted, sticking or improperly adjusted breaker points.
3. A defective coil.
4. A defective condenser.

Secondary Circuit. A breakdown 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, the circuit from the coil to ground, and the starting ignition circuit.

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

Battery to Coil Test

PROCEDURE

1. Connect the voltmeter leads as shown in Fig. 5.
2. Install a jumper wire from the distributor terminal of the coil to a good ground on the distributor housing.
3. Turn the lights and accessories off.
4. Turn the ignition switch on.

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

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

1. The battery and cables for loose connections or corrosion.
2. The primary wiring for worn insulation, broken strands and loose or corroded terminals.
3. The resistance wire for defects.
4. The relay to ignition switch for defects.

Starting Ignition Circuit Test

PROCEDURE

1. Connect the voltmeter leads as shown in Fig. 5.
2. Disconnect and ground the coil to distributor high tension lead at the distributor.
3. With the ignition switch off, crank the engine by jumping between the battery and the "S" terminal of the starter relay while observing the voltage drop.

RESULTS. 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 the terminals in the circuit or replace the wiring as necessary.

Ignition Switch Test

PROCEDURE

1. Connect the voltmeter leads as shown in Fig. 6.
2. Install a jumper wire from the

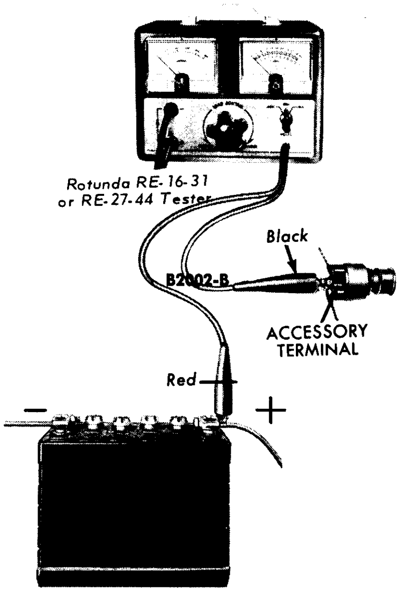


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FIG. 6–Ignition Switch Test

distributor terminal of the coil to a good ground on the distributor body.

3. Turn all of the accessories and lights off.

4. Turn the ignition switch on.

RESULTS. 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.

Resistance Wire Test

PROCEDURE

1. Connect the voltmeter leads as shown in Fig. 7.

2. Install a jumper wire from the distributor terminal of the coil to a good ground on the distributor housing.

3. Turn all of the accessories and lights off.

4. Turn the ignition switch on.

RESULTS. 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.

Coil to Ground Test

PROCEDURE

1. Connect the voltmeter leads as shown in Fig. 8.

2. Close the breaker points.

3. Turn all lights and accessories off.

4. Turn the ignition switch on.

RESULTS. 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 movable breaker point and the breaker plate.

3. The breaker plate and the distributor housing.

4. The distributor housing and engine ground.

Breaker Points. The breaker points are tested by following the procedure under "Ignition System Tests."

Coil. The coil is tested by following the instructions under "Ignition System Tests."

Condenser. The condenser is tested by following the instructions under "Ignition System Tests."

SECONDARY CIRCUIT TESTS

The following procedure is used on both ignition systems.

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 defects. 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 setting ignition timing, do not puncture the wires with a probe. The probe may cause a separation in the conductor.**

At regular intervals, clean and inspect the wires for cracked insulation and loose terminals. Repair or replace the wires as required. A spark plug wire set is available for service.

When removing the wires from the spark plugs, grasp and twist the moulded cap, then pull the cap off the spark plug. Do not pull on the wire because the wire connection inside the cap may become separated or the insulator seal may be damaged.

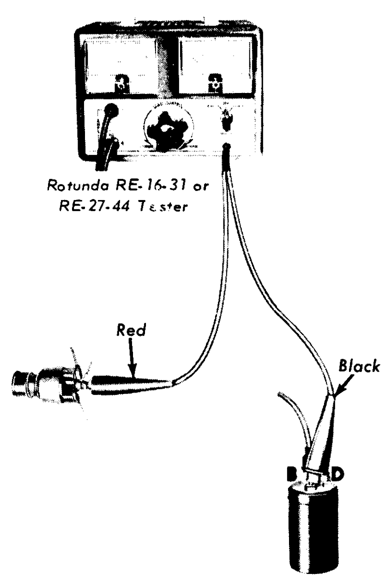

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FIG. 7–Resistance Wire Test

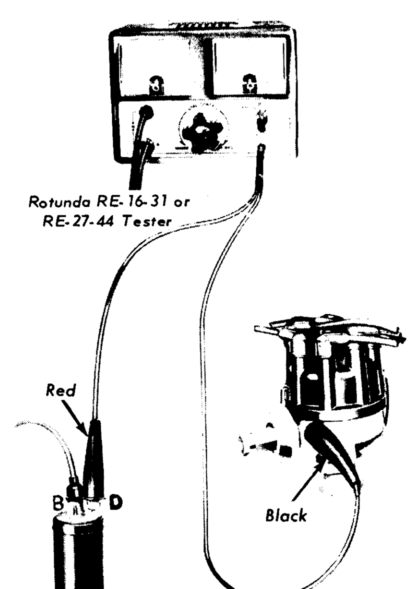

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FIG. 8–Coil to Ground Test

SPARK INTENSITY

1. Disconnect a spark plug wire. **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 3/16-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 the wires 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 wire.

Spark Plugs. Clean, inspect and gap the plugs following the instructions in Sections 2 and 3. After the proper gap is obtained, 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 70% of the new plug performance.

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 with the tester's high tension wire removed from the spark plug. 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. Defective centrifugal advance.

TRANSISTOR IGNITION SYSTEM DIAGNOSIS

Do not use any other testing procedures or conventional short-cuts than those listed below, or extensive damage can result to the system.

TROUBLE ISOLATION

Ignition troubles are caused by a failure in the primary or secondary circuit, or incorrect ignition timing. Isolate the trouble as follows:

1. Remove the coil high tension lead from the distributor cap.

2. Disconnect the brown wire from the starter relay "I" terminal and the red and blue wire from the starter relay "S" terminal.

3. Turn the ignition switch on.

4. While holding the high tension lead approximately 1/4 inch from the cylinder head, crank the engine by using an auxiliary starter switch between the starter relay battery and "S" terminals.

If the spark is good, the trouble lies in the secondary (high voltage) circuit. If there is no spark or a weak spark, the trouble is in the primary (low voltage) circuit.

Primary Circuit. A breakdown or energy loss in the primary circuit can be caused by:

1. Defective primary wiring.

2. Improperly adjusted, contaminated or defective distributor points.

3. Defective amplifier assembly.

The trouble can be isolated by performing a primary circuit test.

Secondary Circuit. A breakdown or energy loss in the secondary circuit can be caused by:

1. Fouled or improperly adjusted spark plugs.

2. Defective high voltage wiring.

3. High voltage leakage across the coil, distributor cap or rotor.

To isolate a trouble in the secondary circuit, proceed as follows:

Turn the ignition switch off and remove the auxiliary starter switch from the starter relay.

Install the coil high tension lead in the distributor cap, the red and blue wire on the starter relay (this goes to the "S" terminal) and the brown wire on the starter relay (this goes on the "I" terminal) and perform a secondary circuit test.

PRIMARY CIRCUIT TESTS

When diagnosis procedures isolate trouble to the primary circuit, make the following tests to locate the defective item. **Do not use any other procedure, conventional short-cut, or connect test equipment in any other manner than that described, or extensive damage can be caused to the transistor ignition system.** Figure 9 shows the transistor ignition system tests in outline form.

Connect a dwell meter to the tachometer block (Fig. 4). Connect the black lead to the black (large) terminal and the red lead to the red (small) terminal. Turn the ignition on and crank the engine. Observe the dwell meter reading.

0° Dwell. A dwell reading of 0° indicates:

1. The distributor points are contaminated or are not closing.

2. An open circuit in the distributor lead to the amplifier.

To determine which item listed is causing the trouble, proceed as follows:

Disconnect the distributor lead at the bullet connector and connect a voltmeter red lead to the red tach block terminal (red-white striped lead) and the voltmeter black lead to the distributor lead from the distributor. **Do not connect the voltmeter to the lead from the amplifier.** Crank the engine and note the voltmeter reading.

If a steady indication of voltage is obtained, the trouble is in the distributor lead to the amplifier. Absence of any voltage indication on the voltmeter shows that there is an open circuit between the distributor lead and the breaker point ground.

0° to 45° Dwell. A dwell reading between 0° and 45° indicates:

1. The transistor and the primary circuit are functioning properly.

2. The trouble could be in the secondary circuit.

45° Dwell. A dwell reading of 45° indicates:

1. No power from the ignition switch.

2. The distributor points are closed and not opening.

3. Defective amplifier assembly.

To determine which of the three items listed are causing the trouble, proceed as follows:

Disconnect the distributor lead at the bullet connector, and crank the engine. If the dwell meter indicates 0° dwell, the distributor points are not opening. If 45° dwell is indicated, the amplifier is malfunctioning or there is no power from the ignition switch.

Use a voltmeter or test light to determine if the transistor (amplifier assembly) is at fault. Connect the voltmeter to the red-green lead

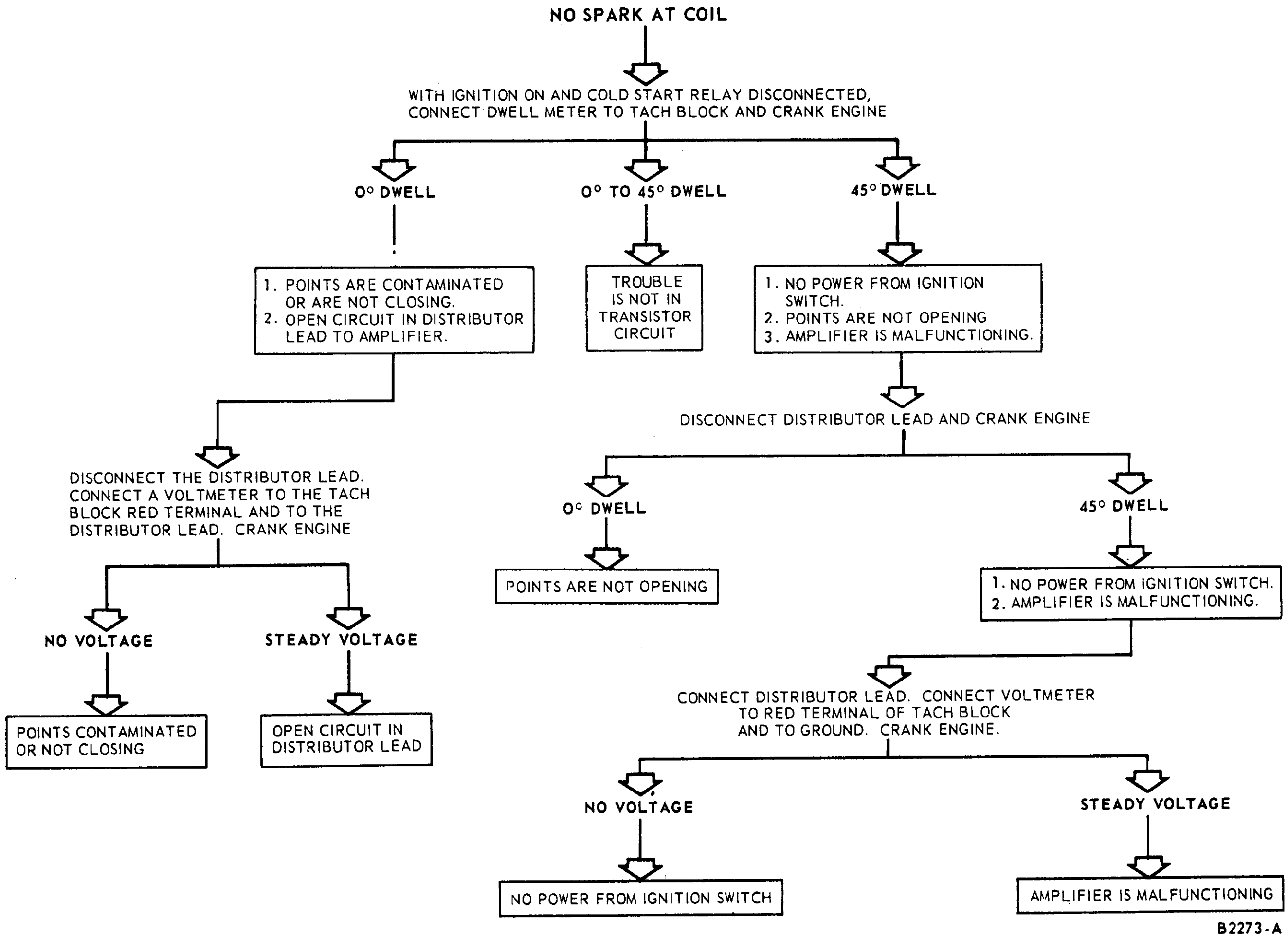


FIG. 9—Transistor Ignition System Test Procedure

terminal of the ballast resistor and to ground. Crank the engine.

If a steady indication of voltage is obtained, the trouble is in the amplifier. Absence of any voltage indication on the voltmeter shows there is an open circuit, or no power between the ignition switch and the amplifier. The ballast resistor could be defective. Replace it with a known good ballast resistor, and repeat the test.

If the test procedure indicates a defective amplifier, replace it with a known good amplifier, and proceed as follows:

Connect the distributor high tension lead at the bullet connector. Then, with the cold start relay disconnected and the dwell meter connected to the tachometer block, crank the engine and observe the indicated dwell. Zero to 45° indicates satisfactory ignition; thus, the amplifier is at fault.

If the dwell reading is still 45°, the wiring from the amplifier through the ballast resistor to the coil is defective. Replace the defective item.

After a repair has been made, run through the test again to check for any other malfunctions.

SECONDARY CIRCUIT TESTS

Refer to the conventional ignition system secondary circuit tests for the proper procedure.

IGNITION SYSTEM TESTS — ROTUNDA TESTERS

TEST CONNECTIONS — RE-27-55, RE-651 AND RE-881

The test connections for the RE-27-55 tester are shown in Fig. 10, the test connections for the RE-651 tester are shown in Fig. 11, and the test connections for the RE-881 tester are shown in Fig. 12.

1. With the tester turned off, plug the power plug into a proper AC outlet.

2. Connect the green lead to the distributor terminal of the coil. **On a car equipped with a transistor ignition, connect this green lead to the terminal on the red side of the tachometer block.**

3. Remove the No. 1 plug wire from the distributor cap; place the blue pickup in the cap, and place the plug wire in the pickup.

4. On the RE-27-55 tester, connect the black lead to a good ground. **If the car has a transistor ignition, connect the black lead to the terminal on the black side of the tachometer block.**

5. Clip the red pickup over the coil-to-distributor high tension wire.

6. If the engine timing is to be checked, plug the timing light into its socket.

The following steps pertain to the RE-651 and RE-881 testers only.

7. Disconnect the battery positive cable at the battery.

8. Install the battery adapter to the battery post.

9. Connect the battery positive cable to the battery adapter.

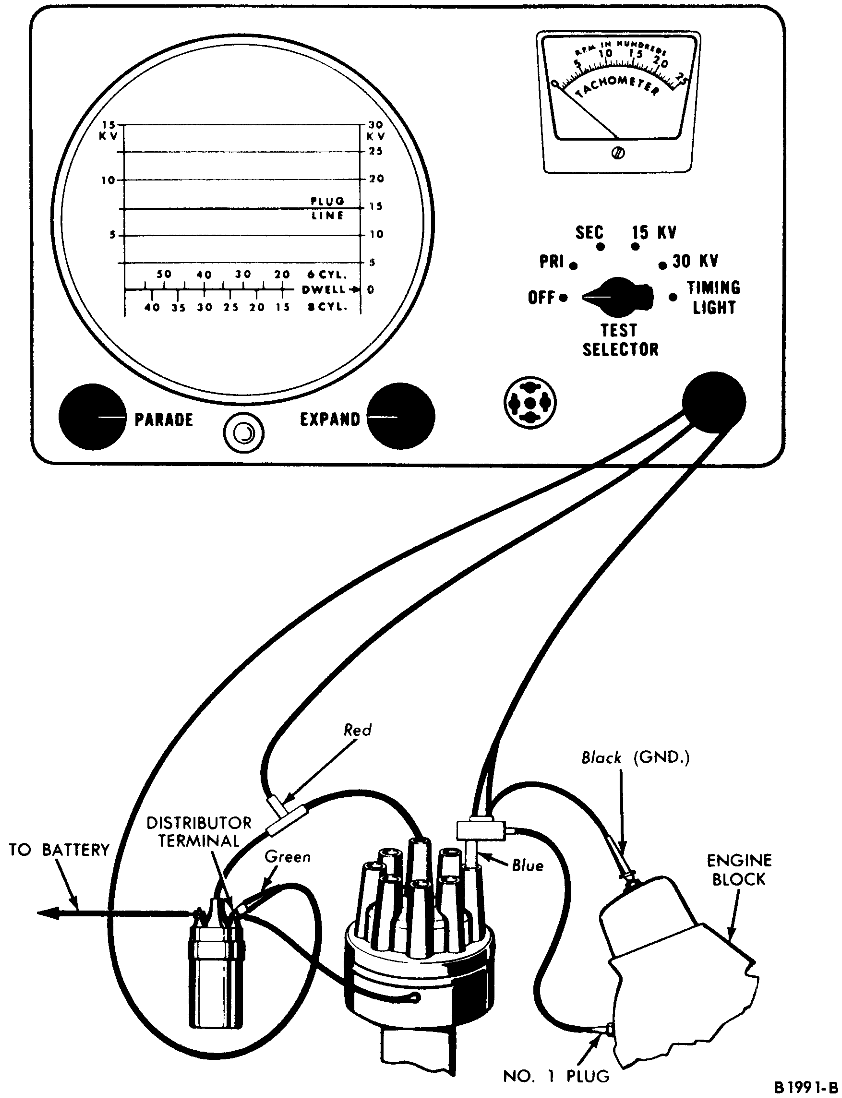


FIG. 10–Rotunda RE-27-55 Test Connections

10. Connect the shunt to the adapter.

11. Connect the shunt spade terminal and the yellow lead to the battery cable post on the battery adapter.

12. Turn the ground polarity switch to the minus position. On the RE-881 tester, turn the volts switch to the 20 volt position.

POINT RESISTANCE TEST

RE-651 Tester

1. Remove and ground the high tension wire from the center of the distributor.

2. Turn the volts switch to the point resistance (PT. RES.) position. The points should be closed for this test. If the breaker points are open, the meter will read the battery voltage (0 to 40 scale).

3. Disconnect the brown lead ("I" terminal) and the red and blue lead ("S" terminal) at the starter relay. Install the auxiliary starter switch between the battery and "S" terminals of the starter relay. With the ignition switch "ON", tap the auxiliary starter switch until the lowest voltmeter reading is obtained.

4. Depress the PT. RES. pushbutton.

5. The voltmeter pointer should read within the 12V area as shown in black on the meter dial. If not, check for incorrect breaker point spring tension or for burned or pitted points.

6. Connect the high tension wire to the distributor.

RE-881 Tester

1. Remove and ground the high tension wire from the center of the distributor.

2. Disconnect the brown lead ("I" terminal) and the red and blue lead ("S" terminal) at the starter relay. Install an auxiliary starter switch between the battery and "S" terminals of the starter relay. With the ignition switch "ON", tap the auxiliary starter switch until the lowest voltmeter reading is obtained.

3. The voltmeter pointer should read in the black, OK PT. RES. area. If it does not, check for improper breaker point spring tension or for burned or pitted points.

4. Connect the high tension wire to the distributor.

IGNITION TIMING

Refer to Section 2 of this part for timing mark locations.

Disconnect the vacuum line. If necessary, clean and mark the desired timing mark.

RE-27-55 Tester

1. Start the engine and allow it to warm up.

2. Operate the engine below 550 rpm and point the timing light toward the pointer. The desired timing mark should line up with the pointer. If it does not, loosen the distributor hold down bolt and rotate the distributor until the mark lines up with the pointer. Now tighten the hold down bolt and check the timing.

RE-651 Tester

1. Turn the rpm selector to the 1000 position.

2. Depress the advance timing pushbutton.

3. Start the engine and allow it to warm up.

4. Operate the engine below 550 rpm.

5. Turn the advance knob until the ignition advance meter reads 0°.

6. Point the timing light toward the timing pointer. The desired timing marks should line up. If they do not, loosen the distributor hold down bolt and rotate the distributor until the desired timing marks line up. Tighten the distributor hold down bolt and check the timing.

RE-881 Tester. The method of testing is the same as the RE-651 tester with the exception of Step 1 which should (for the RE-881) read "turn the rpm selector to the 800 position".

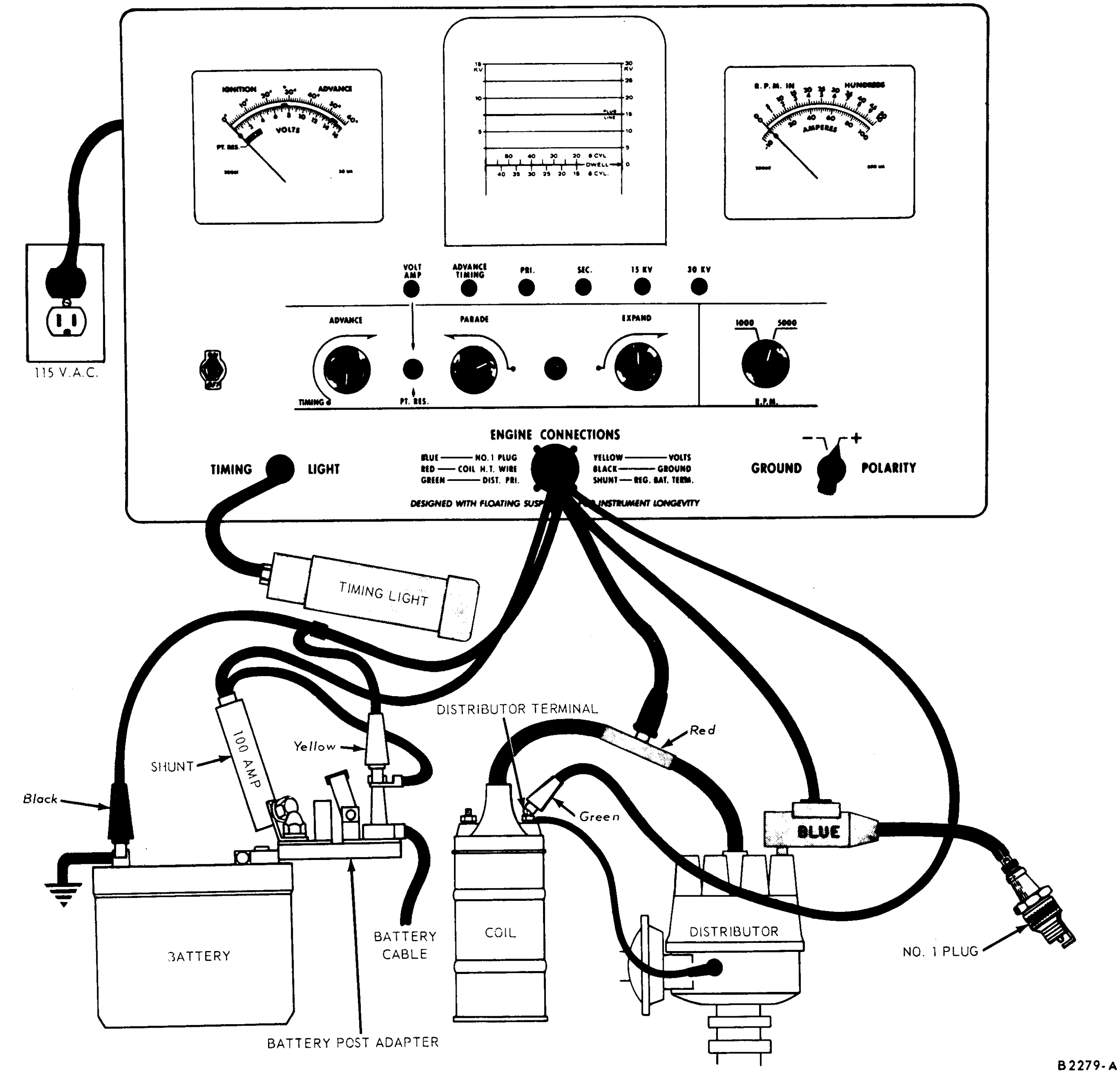


FIG. 11—Rotunda RE-651 Test Connections

SUPERIMPOSED PRIMARY PATTERN

Procedure

RE-27-55 TESTER

1. With the engine running at 1000 rpm, turn the test selector switch to the primary (PRI.) position.

2. Adjust the parade control to position the left end of the pattern at the left vertical line on the screen.

3. Adjust the expand control so that the right end of the pattern is at the right vertical line on the screen.

RE-651 TESTER

1. Turn the rpm selector to the 5000 position. Start the engine and adjust it to 1000 rpm.

2. Depress the PRI. pushbutton on the console panel.

3. Adjust the parade and expand controls to position the left end of the pattern at the left vertical line on the screen and the right end of the pattern at the right vertical line on the screen.

RE-881 TESTER. The test procedure for the RE-881 is the same as the test procedure for the RE-651 except for the setting of the rpm selector. For the RE-881 tester, the rpm selector is turned to the 1600 position.

Results. A normal test pattern is shown in Fig. 13.

Point A indicates the spark plug line which is the time when the points open. At B, the coil energy is used up sufficiently so that the plug no longer fires and only the energy stored in the breaker point condenser remains. This coil/condenser oscillation which is indicated in the pattern between B and C is completely used up at C which is

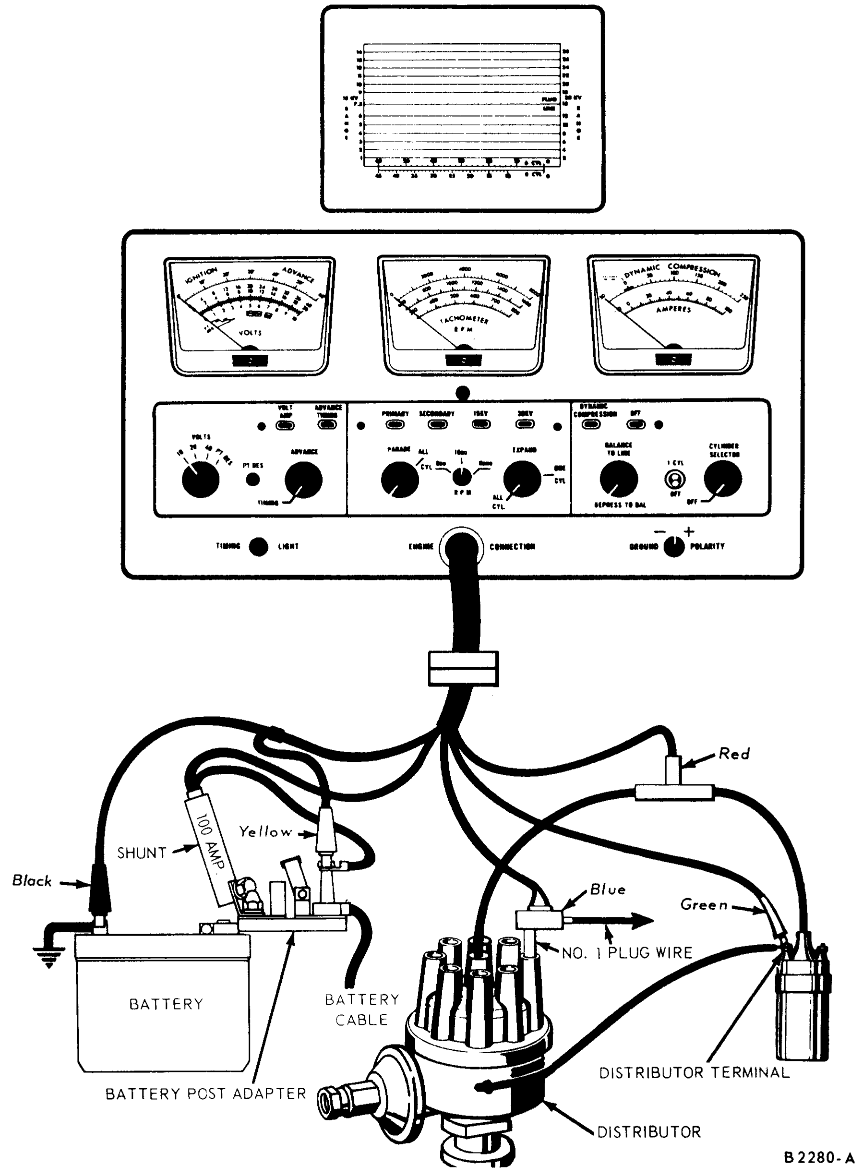


FIG. 12—Rotunda RE-881 Test Connections

the points close mark. The portion of the pattern between C and D is the points close time, which is cam angle or dwell time. The points close time on a transistorized ignition system is below the 0 line. At D, the points again open and the firing cycle repeats.

If points A and C are below the 0 line, the battery polarity is incorrect. This could be caused by a battery that is either installed incorrectly or improperly charged, causing a polarity reversal.

If the firing line is not below the 0 horizontal line and there are no oscillations at point C, there is an open circuit at the coil high tension tower. This could be caused by a broken wire inside the coil tower, or a broken center contact on the distributor rotor.

If the dwell time is too short, the breaker points are incorrectly set (the larger the gap, the smaller the dwell).

If point A is at a reduced height, and the distance to B is short or nonexistent, and the oscillations at point C are reduced in height, there is a high resistance in the coil primary circuit. This could be caused by a fouled plug, defective ignition switch, or a bad wire or connection. If the scope pattern is still the same after the above ignition parts have been checked and proven satisfactory, run the 15 KV test to check for a gasket

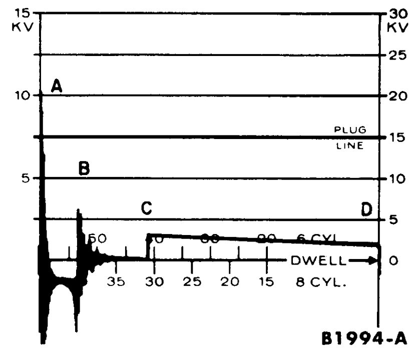


FIG. 13—Normal Superimposed Primary Pattern

leak or a lean fuel mixture.

If point A is at a greatly reduced height and there are no oscillations at point B, the coil has a defective primary winding or the condenser has an excessive series resistance.

If there is a variation at points C and D, the cam lobes are uneven, the distributor shaft is bent, or the distributor bushings are worn.

SUPERIMPOSED SECONDARY PATTERN

Procedure

RE-27-55 TESTER

1. With the engine running at 1000 rpm, turn the test selector switch to the secondary (SEC.) position.

2. Adjust the parade and expand controls so that the left end of the pattern is at the left vertical line on the screen and the right end of the pattern is at the right vertical line on the screen.

RE-651 AND RE-881 TESTERS. The procedure is the same as the procedure for the primary (superimposed) except the SEC. pushbutton is depressed instead of the primary pushbutton.

Results. A normal test pattern is shown in Fig. 14.

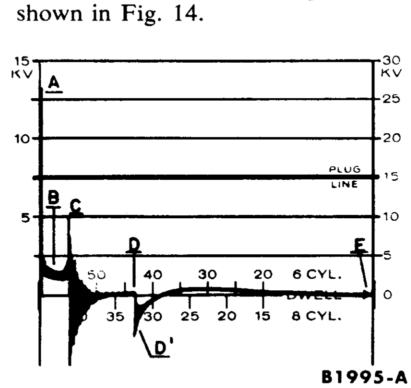


FIG. 14—Normal Superimposed Secondary Pattern

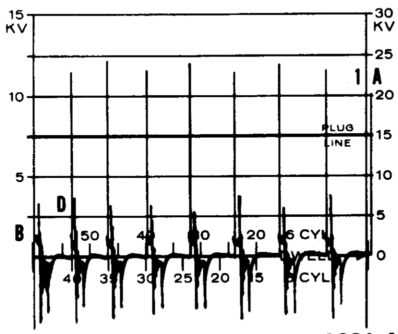


FIG. 15—Normal 15 KV Pattern

Point A is the points open time. The height of the pattern at point A indicates the high tension voltage required to overcome the spark plug gap resistance.

Point B is the plug firing line. Notice that this portion of the pattern is quite thick. Remember that this pattern is actually 8 firing patterns superimposed one on top of the other. This increase in thickness of the pattern at B is caused by slight variations in the plug gap, distributor rotor gap and slight differences in the resistance of the individual spark plug circuits.

The pattern area between points C and D shows the coil/condenser oscillations to be correct. No point bounce at D indicates correct breaker point spring tension.

The few so-called damped oscillations appearing at D are normal and are caused by the surge of current through the coil primary winding when the breaker points first close.

This current levels off and decreases slightly toward the points open position at E as indicated by the slight downward slope of the curve at about the 15° mark on the cam angle scale.

To observe the coil/condenser oscillations and the damped oscillations at D^1 in greater detail, adjust the expand control so that the pattern area between points C and D^1 nearly fills the screen.

If there is erratic action at points C and D and there is a blotch above point E, the breaker points are burned or badly pitted.

If the length of B is reduced and the pattern between C and D is not superimposed, there is a series gap in the coil high tension tower or wire.

If the line at B is sloping downward greatly (resistor plugs will cause a slight slope), there is a

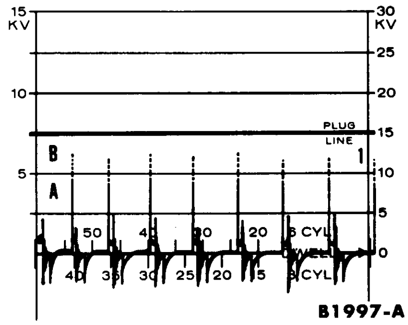


FIG. 16—Normal 30 KV Pattern

high resistance in the spark plug wires, distributor cap or rotor.

If point D^1 is varying erratically, the distributor is badly worn. If this variation is definite instead of erratic, the advance mechanism in the distributor is defective.

If the dwell line between points D^1 and E is not the smooth line shown, there is a loose connection in the primary circuit. Check the primary circuit for loose connections, damaged wires or a defective starter switch.

15 KV PATTERN

Procedure

RE-27-55 TESTER. with the engine operating at 1000 rpm, turn the test selector switch to the 15 KV position. Adjust the expand and parade controls to produce the pattern shown in Fig. 15.

RE-651 TESTER. With the rpm selector at the 5000 position and the engine operating at 1000 rpm, depress the 15 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 15.

RE-881 TESTER. With the rpm selector at the 1600 position and the engine operating at 1000 rpm, depress the 15 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 15.

Results. A normal 15 KV pattern is shown in Fig. 15. The spark plug line (A) for the No. 1 spark plug is on the extreme right hand side of the screen. The remainder of the No. 1 firing pattern is on the left side of the screen. The remainder of the patterns are shown from left to right in their firing order.

With the exception of the No. 1 spark plug line (which should be shorter than the others), the patterns should be similar. If one of the patterns differs from the others, adjust the expand and parade controls until that pattern fills the screen in the same manner as in the secondary test (Fig. 14).

The following list of symptoms will refer to Fig. 14.

If the points open line (A) is higher than the rest and the plug firing line (B) is sloped downward at an unusually large slope, there is excessive resistance in the high tension wire to that cylinder or in the distributor cap.

If the points open line (A) is low and the firing line (B) is long and nearly straight, the spark plug is shorted out.

If the points open line (A) is low and the firing line (B) is long and wide, the spark plug gap is out of adjustment.

If there are no oscillations at points C or D, the coil primary windings are partially shorted.

If the points open line (A) and the oscillations at point D are both displaced to the right on all cylinders, check the breaker points.

If all of the points open lines (A) are at varied heights, check the idle adjustment of the carburetor (always adjust the idle mixture on the rich side).

30 KV PATTERN

Procedure

RE-27-55 TESTER. With the engine running at 600 rpm, turn the test selector switch to the 30 KV position. Adjust the expand and parade controls to produce the pattern shown in Fig. 16.

RE-651 TESTER. With the rpm selector at the 5000 position and the engine operating at 600 rpm, depress the 30 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 16.

RE-881 TESTER. With the rpm selector at the 1600 position and the engine operating at 600 rpm, depress the 30 KV pushbutton. Adjust the expand and parade controls to produce the pattern shown in Fig. 16.

Results. A normal 30 KV pattern is shown in Fig. 16. The spark plug line (A) for the No. 1 spark plug is on the extreme right hand side of the screen. The remainder of the No. 1 firing pattern is on the left side of the screen. The remainder of the patterns are shown from left to right in their firing order.

Notice the average height of the solid part of the points open line. Increase the speed of the engine and notice the height of the dotted lines. The difference is the required ignition output under load. The maximum output should be between 13.5 and 15 KV.

If the maximum for one or more of the plugs is above 15 KV, check the complete circuit (s) of the plug (s) for any trouble that would cause this resistance. If the maximum does not increase during the increase in engine speed, check for a fouled or improperly gapped spark plug or for very low compression.

Remove the high tension wire **at the distributor cap** for any plug except No. 1. Notice the change between the average points open line and the points open line of the cylinder with the high tension wire removed. This height difference is the coil reserve. The coil reserve should be at least 30% of the maximum output. If it is less than 30%, replace the coil.

Remove and do not ground one spark plug wire at the spark plug. If a plug firing line shows up on the scope for that cylinder, check the plug wire and distributor cap for bad insulation.

DISTRIBUTOR CHECKS

DISTRIBUTOR 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 the distributor spark advance on a distributor test set.

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. Remove the vacuum line from the distributor. Adjust the vacuum pressure of a distributor tester to its maximum position. Hold your hand over the end of the tester's vacuum hose and note the maximum reading obtained. **Do not exceed 25 inches Hg.**

2. If the maximum reading is 25 inches Hg or less, connect the tester's vacuum line to the vacuum fitting on the diaphragm **without changing any of the adjustments.** The maximum gauge reading should not be less than it was in Step 1. If it is less, the diaphragm is leaking and should be replaced.

DISTRIBUTOR SHAFT END PLAY

1. Remove the distributor from the engine.

2. Place the distributor in the holding tool and clamp it in a vise.

3. Push the distributor shaft upward as far as it will go. Then check the end play with a feeler gauge placed between the collar and the distributor base. The end play should be within the specified limits.

If the shaft end play is not to specifications, check the location of the distributor shaft collar.

DISTRIBUTOR TESTS— ROTUNDA RE-27-44 TESTER

TEST CONNECTIONS

Conventional Ignition System Distributor

1. Connect the red lead to the distributor terminal of the coil.

2. Connect the black lead to a good ground on the engine.

Transistor Ignition System Distributor

1. Connect the red lead to the red (small) tach block terminal.

2. Connect the black lead to the black (large) tach block terminal.

DWELL ANGLE CHECK

1. Connect the tester.

2. Turn the test control knob to the set position.

3. Adjust the set control knob until the needle on the dwell meter lines up with the set line.

4. Start the engine and let it idle.

5. Turn the test control knob to the 8 CYL position.

6. Read the dwell angle on the dwell meter and compare the reading to specifications.

7. Turn off the engine.

8. If the dwell angle was below the specified amount, the breaker point gap is too large. If the dwell angle was above the specified amount, the breaker point gap is too small.

If the dwell is to specifications, turn the test selector knob to the OFF position and disconnect the tester leads.

DWELL ANGLE ADUSTMENT

If the dwell angle is not within specifications, proceed as follows:

1. Remove the coil high tension lead from the distributor and ground it.

2. Remove the distributor cap and place it out of the way.

3. Disconnect the brown wire ("I" terminal) and the red and blue wire ("S" terminal) from the starter relay.

4. Loosen the breaker point assembly retaining screw near the breaker point contacts.

5. With the ignition on, crank the engine with an auxiliary starter switch connected between the battery and "S" terminals of the starter relay and adjust the gap to specifications.

6. Release the auxiliary starter switch and tighten the breaker point assembly retaining screw.

7. Since the adjustment may have changed when the retaining screw was tightened, crank the engine again with the auxiliary starter switch and check the dwell.

DISTRIBUTOR TESTS — ROTUNDA RE-236 TESTER

MOUNTING DISTRIBUTOR

1. Adjust the distributor support arm in relation to the distributor shaft length.

2. Set the distributor in the support arm and enter the lower end of the distributor shaft in the Syncrograph chuck.

3. Tighten the chuck on the distributor shaft, using the wrench located near the support arm column.

4. Align the distributor shaft by shifting the support arm and distributor, then tighten the clamp screw.

5. Clamp the distributor securely in the distributor support arm clamp so that it will not turn in its mounting.

6. Connect the Synchrograph test lead to the primary or distributor-transistor lead wire of the distributor. Since the resistor ignition distributor does not have a condenser, it will be necessary to install one in the circuit of the tester (Fig. 17).

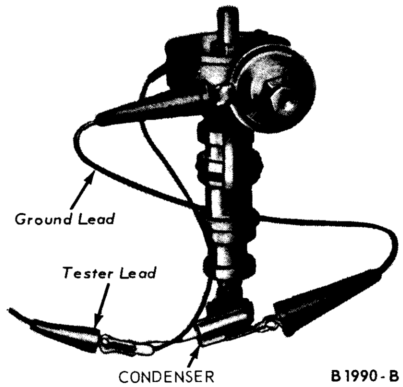


FIG. 17—Testing Transistor Ignition Distributor

MECHANICAL OPERATIONS

1. Turn the OFF, SET, CAM, SYNC. switch to SET.

2. Adjust the SET TACH control so the tachometer pointer is on the SET line.

3. Turn the OFF, SET, CAM, SYNC. switch to SYNC. position.

4. Turn the MOTOR switch to the LEFT.

5. Adjust the speed control to vary the distributor speed between 400 and 4000 engine rpm, or at the maximum speed of the engine on which the distributor is used. Erratic or thin faint flashes of light preceding the regular flashes as the speed of rotation is increased can be due to weak breaker arm spring tension or binding of the breaker arm on the pivot pin.

6. Operate the distributor at approximately 2500 engine rpm and move the protractor scale so that the zero degree mark on the scale is opposite one of the neon flashes. The balance of all the flashes should come within 1°, plus or minus, evenly around the protractor scale. A variation larger than 1° or erratic or wandering flashes may be caused by a worn cam or distributor shaft or a bent distributor shaft.

DWELL ANGLE

1. Turn the OFF, SET, CAM, SYNC. switch to the CAM position. Operate the distributor at about 1000 rpm.

2. Adjust the breaker point gap until the cam angle is to specifications.

BREAKER PLATE WEAR

A worn breaker plate on a dual advance distributor will cause the breaker point gap and contact dwell to change as engine speed and load conditions are varied.

On a dual advance distributor, adjust the test set to 0° advance, 0 inches vacuum, and 1000 rpm. Adjust the dwell angle to 26°. Apply vacuum to the distributor diaphragm and increase it very slowly while observing the indicated dwell angle. The maximum dwell angle variation should not exceed 6° when going from zero to maximum vacuum at constant rpm. If the dwell angle variation exceeds this limit, there is excessive wear at the stationary subplate pin or the diaphragm rod is bent or distorted.

DISTRIBUTOR SPARK ADVANCE

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

1. Check the contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension and adjust it, if necessary.

The dual advance distributor has two independently operated spark advance systems. Each system is adjusted separately. **Adjust the centrifugal advance before adjusting the vacuum advance.**

Centrifugal Advance

1. Operate the distributor in the direction of rotation (counterclockwise) and adjust the speed to the initial rpm setting listed in the specifications. Move the protractor scale so that one of the flashes lines up with the zero degree mark.

2. Slowly increase the rpm to the setting specified for the first advance reading listed in the specifications.

If the correct advance is not indicated at this rpm, stop the distributor and bend one spring adjustment bracket to change its tension (Fig. 18). Bend the adjustment bracket away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decrease spring tension). After the adjustment is made, identify the bracket.

3. After an adjustment has been made to one spring, check the minimum advance point again.

4. Operate the distributor at the specified rpm to give an advance just below the maximum. If this advance is not to specifications, stop the distributor and bend the other spring bracket to give the correct advance.

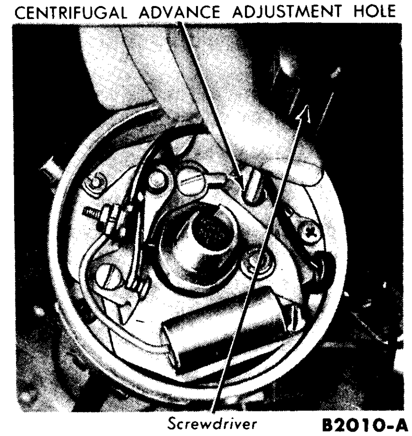


FIG. 18—Centrifugal Advance Adjustment

5. Check the advance at all rpm settings listed in the specifications. Operate the distributor both up and down the rpm range.

Vacuum Advance

1. Connect the test set vacuum line to the fitting on the diaphragm.

2. Set the test set to 0° advance, 0 vacuum, and at 1000 rpm.

3. Check the advance at the first vacuum setting given in the specifications.

4. If the advance is incorrect, change the calibration washers between the vacuum chamber spring and nut (Fig. 19). After installing or removing the washers, position the gasket in place and tighten the nut. **The addition of a washer will decrease advance and the removal of a washer will increase advance.**

5. After one vacuum setting has been adjusted, the others should be checked. **Do not change the original rpm setting when going to a different vacuum setting.** If the other

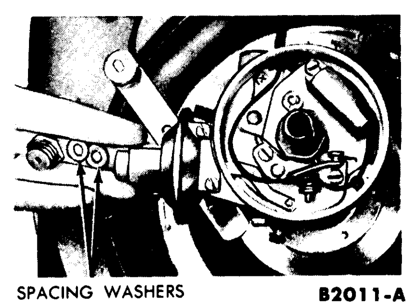


FIG. 19—Vacuum Advance Adjustment

settings are not within limits, there is incorrect spring tension, leakage in the vacuum chamber and/or line, or the wrong fiber stop has been installed in the vacuum chamber of the diaphragm housing.

DISTRIBUTOR TESTS — ROTUNDA RE-1416 TESTER

MOUNTING DISTRIBUTOR

1. Clamp the distributor securely in the distributor support arm clamp so that it will not turn in its mounting.

2. Loosen the hand-operated locking screw on the side of distributor support arm, and adjust the support arm column up or down by turning the crank on the knob at the top of the column until the distributor shaft or adapter shaft can be securely fastened in the driving chuck. Use adapter shafts provided when driving distributors have short shafts.

3. Securely tighten the drive chuck to the distributor drive shaft by means of the chuck key, attached by a chain to the Syncrograph.

4. Rotate the drive chuck by hand to make sure the distributor shaft turns freely and then tighten the locking screw on the distributor support arm.

5. Connect the Syncrograph test lead to the primary or distributor-transistor lead wire of the distributor. Since the transistor ignition distributor does not have a condenser, it will be necessary to install one in the circuit of the tester (Fig. 17).

BREAKER POINT RESISTANCE

1. Turn the test selector to the POINT RES. position.

2. Revolve the chuck by hand until the distributor breaker contacts are closed.

3. The meter pointer on the cam angle meter should read in the OK zone at the left side of the meter scale. If the meter pointer does not fall in the OK zone, there is excessive resistance caused by a faulty contact across the distributor points, a faulty primary lead, or a poorly grounded base plate. A faulty contact across the distributor points indicates improper spring tension or burned or pitted points.

INSULATION AND LEAKAGE

1. Turn the test selector to the cam angle position and revolve the chuck by hand until the distributor breaker contacts are open.

2. The cam angle meter should show a zero reading. If a zero reading is not obtained, a short circuit to ground exists.

A short could be caused by poor primary or distributor-transistor lead wire insulation, a shorted condenser or a short between the breaker arm and breaker plate.

MECHANICAL OPERATION

1. Turn the test selector to the SYNCHRO. position and check to make sure that the drive chuck is securely tightened on the distributor shaft.

2. Turn the motor control switch to the left to correspond with the direction of rotation, as listed in the rotation column of the distributor specifications.

If it is necessary to reverse the rotation of the drive motor, turn the motor control switch to the OFF position and allow the chuck to come to a complete stop before reversing the switch.

3. Adjust the rpm control to vary the distributor speed between 400 and 4000 engine rpm or at the maximum speed of the engine on which the distributor is used. Erratic or thin, faint flashes of light proceding the regular flashes as the speed of rotation is increased can be due to weak breaker arm spring tension or binding of the breaker arm on the pivot pin.

4. Operate the distributor at approximately 2500 engine rpm.

5. Move the protractor scale with the adjustment control so that the zero degree mark on the scale is opposite one of the neon flashes. The balance of all the flashes should come within 1°, plus or minus, evenly around the protractor scale. A larger variation than 1° or erratic or wandering flashes may be caused by a worn cam or distributor shaft or a bent distributor shaft.

DWELL ANGLE

1. Turn the cylinder selector to the figure corresponding to the number of lobes on the cam of the distributor being tested.

2. Turn the test selector switch to the cam angle position and operate the distributor at approximately 1000 engine rpm.

3. Adjust the distributor breaker point gap to the dwell angle shown in the specifications.

BREAKER PLATE WEAR

A worn breaker plate will cause the breaker point gap and contact dwell to change as engine speed and load conditions are varied.

Adjust the test set to 0° advance, 0 inches vacuum, and 1000 rpm. Adjust the dwell angle to 26°. Apply vacuum to the distributor diaphragm and increase it very slowly while observing the indicated dwell angle. The maximum dwell angle variation should not exceed 6° when going from 0 to maximum vacuum at a constant rpm. If the dwell angle variation exceeds this limit, there is excessive wear at the stationary subplate pin or the diaphragm rod is bent or distorted.

DISTRIBUTOR SPARK ADVANCE

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

1. Check the contact dwell. If the contact dwell or the breaker point gap is not within specifications, adjust the breaker points.

2. Check the breaker arm spring tension and adjust it, if necessary.

The dual advance distributor has two independently operated spark advance systems. Each system is adjusted separately. **Adjust the centrifugal advance before adjusting the vacuum advance.**

Centrifugal Advance

1. Operate the distributor in the direction of rotation (counterclockwise) and adjust the speed to the initial rpm setting listed in the specifications. Move the protractor scale so that one of the flashes lines up with the zero degree mark.

2. Slowly increase the rpm to the setting specified for the first advance reading listed in the specifications.

If the correct advance is not indicated at this rpm, stop the distributor and bend one spring adjustment bracket to change its tension (Fig. 18). **Bend the adjustment bracket away from the distributor shaft to decrease advance (increase spring tension) and toward the shaft to increase advance (decreaes spring tension).** After the adjustment is made, identify the bracket.

3. After an adjustment has been made to one spring, check the minimum advance point again.

4. Operate the distributor at the

specified rpm to give an advance just below the maximum. If this advance is not to specifications, stop the distributor and bend the other spring bracket to give the correct advance.

5. Check the advance at all rpm settings listed in the specifications. Operate the distributor both up and down the rpm range.

Vacuum Advance

1. Connect the test set vacuum line to the fitting on the diaphragm and turn the vacuum supply switch on.

2. Set the test set to 0° advance, 0 vacuum, and at 1000 rpm.

3. Check the advance at the first vacuum setting given in the specifications.

4. If the advance is incorrect, change the calibration washers between the vacuum chamber spring and nut (Fig. 19). After installing or removing the washers, position the gasket in place and tighten the nut. **The addition of a washer will decrease advance and the removal of a washer will increase advance.**

5. After one vacuum setting has been adjusted, the others should be checked. **Do not change the original rpm setting when going to a different vacuum setting.** If the other settings are not within limits, it indicates incorrect spring tension, leakage in the vacuum chamber and/or line, or the wrong fiber stop has been installed in the vacuum chamber of the diaphragm housing.

2 COMMON ADJUSTMENTS AND REPAIRS

BREAKER POINTS

REPLACEMENT

The breaker point replacement procedure is in Part 9-2, Section 2.

ALIGNMENT

The vented-type breaker points must be accurately aligned and strike squarely 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 cam so that the breaker points are closed and check the alignment of the points (Fig. 20).

If the distributor is in the engine, close the points by proceeding as follows:

Disconnect the brown and the red and blue wires from the starter relay and, with the ignition switch off, crank the engine by using an auxiliary starter switch between the "S" and the battery terimnals of the starter relay.

2. Align the breaker points to make full face contact by bending the stationary breaker point bracket (Fig. 21). **Do not bend the breaker arm.**

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

GAP AJDUSTMENT

A scope, a dwell meter, or a feeler gauge can be used to check the gap of new breaker points.

A scope or a dwell meter can be used to check the gap of used breaker points. Due to the roughness of used points, it is not advisable to use a feeler gauge to check the gap.

To check and adjust the breaker points with a feeler gauge:

1. Check and adjust the breaker point alignment.

2. Rotate the distributor until the rubbing block rests on the peak of a cam lobe.

If the distributor is in the engine, place the rubbing block on the peak of the cam by proceeding as follows:

Disconnect the brown and the red and blue wires from the starter relay and, with the ignition switch off, crank the engine by using an auxiliary starter switch between the "S" and battery terminals of the starter relay.

Insert the correct blade of a clean feeler gauge between the breaker points (Fig. 22). The gap should be set to the larger opening because the rubbing block will wear down slightly while seating to the cam.

Apply a light film of distributor cam lubricant to the cam when new points are installed. **Do not use engine oil to lubricate the distributor cam.**

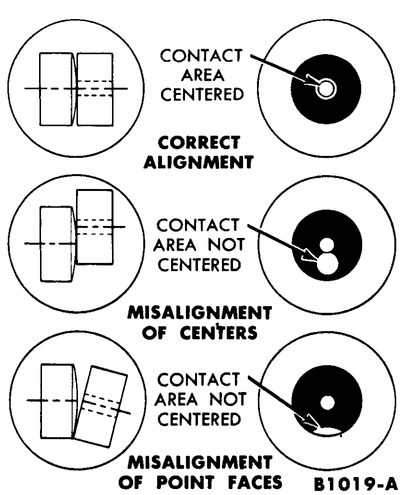


FIG. 20—Breaker Point Alignment

FIG. 21—Aligning Breaker Points

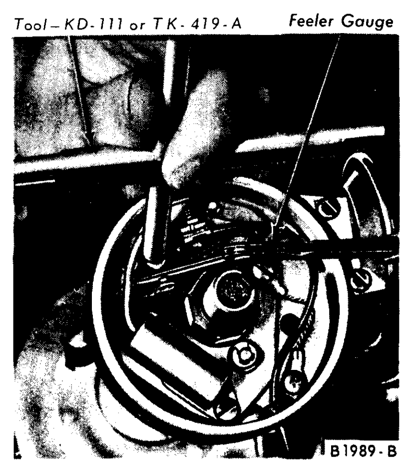


FIG. 22—Adjusting New Breaker Point Gap

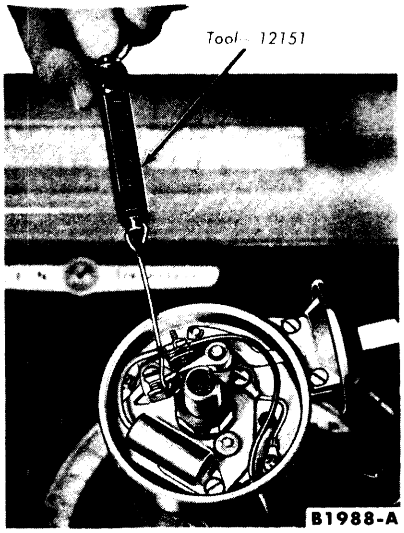


FIG. 23—Checking Breaker Point Spring Tension

Set the ignition timing.

If a scope or 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. New points must be set to the low dwell as the rubbing block will wear down slightly while seating to the cam.

To check and adjust the breaker points with a scope, refer to "Ignition System Tests".

To check and adjust the breaker points with a dwell meter, refer to "Distributor Tests."

SPRING TENSION ADJUSTMENT

Correct breaker point spring tension is essential to proper engine operation 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.

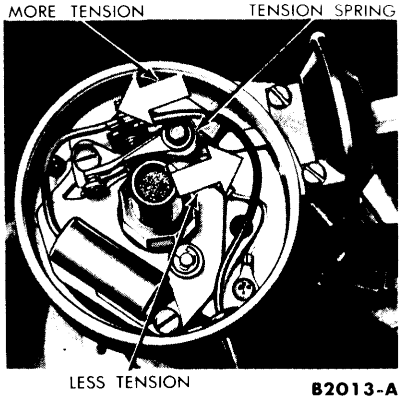


FIG. 24—Adjusting Breaker Point Spring Tension

FIG. 25—Typical Timing Marks

To check the spring tension on either the pivot-type or the pivotless breaker points, place the hooked end of the spring tension gauge over the movable breaker point. Pull the gauge at a right angle (90°) to the movable arm until the breaker points just start to open (Fig. 23). If the tension is not within specifications, adjust the spring tension on the pivot-type points or replace the breaker point assembly on the pivotless points.

To adjust the spring tension (Fig. 24).

1. Disconnect the primary or distributor-transistor lead wire and the condenser lead (if so equipped) 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 lock nut, then check spring tension. Repeat the adjustment until the specified spring tension is obtainea.
4. Install the primary or distributor-transistor lead wire and the condenser lead (if so equipped) with the lockwasher and tighten the nut securely.

IGNITION TIMING

TIMING MARK LOCATIONS

The crankshaft damper (Fig. 25) has 15 timing marks ranging from top dead center (TDC) to 30° before top dead center (BTDC).

Refer to the specifications (Part 9-3) for the correct ignition timing.

ADJUSTMENT

The procedure for adjusting the ignition timing is covered under "Ignition System Tests."

SPARK PLUG WIRE REPLACEMENT

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

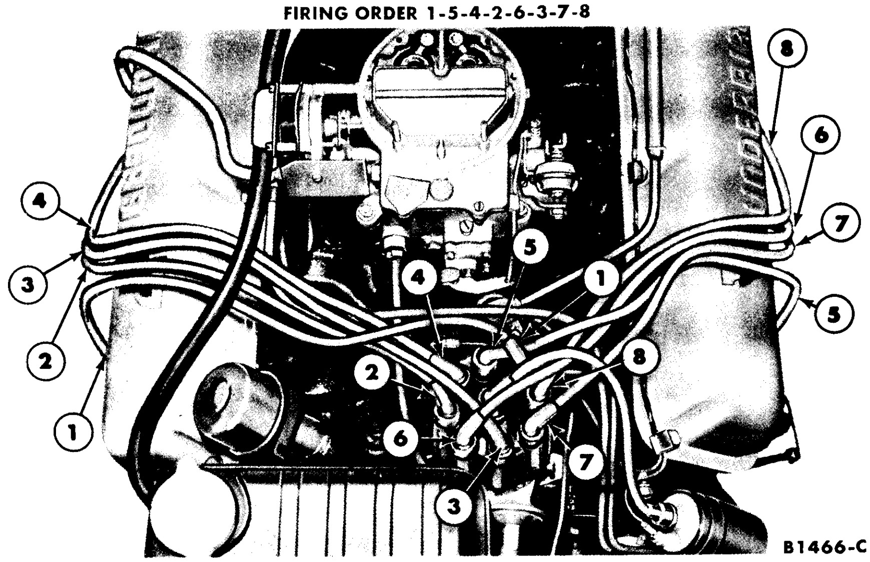


FIG. 26—Ignition Wiring

the cap may become separated or the weather seal may be damaged.

A typical ignition wiring installation is shown in Fig. 26.

Removal

1. Disconnect the wires from the spark plugs and distributor cap.
2. Pull the wires from the brackets on the valve rocker arm covers and remove the wires.
3. Remove the coil high tension lead.

Cleaning and Inspection

Refer to Section 3 of this part for the proper cleaning and inspection procedure.

Installation

1. Insert each wire in the proper socket of the distributor cap. Be sure the wires are forced all the way down into their sockets. The No. 1 socket is identified on the cap. Install the wires in a counterclockwise direction in the firing order (1-5-4-2-6-3-7-8) starting at the No. 1 socket. Cylinders are numbered from front to rear; right bank 1-2-3-4, left bank 5-6-7-8.
2. Remove the brackets from the old spark plug wire set and install them on the new set in the same relative position. Install the wires in the brackets on the valve rocker arm covers (Fig. 26). Connect the wires to the proper spark plugs. Install the coil high tension lead. **Be sure the No. 7 spark plug wire is positioned in the bracket as shown in Fig. 26.**

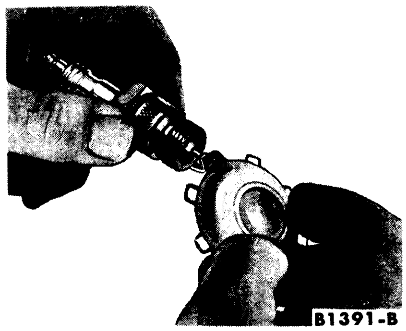


FIG. 27—Gapping Spark Plugs

SPARK PLUG REPLACEMENT

Removal

1. Remove the wire from each spark plug by grasping the moulded cap of the wire 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 port with compressed air, then remove the spark plugs.

Cleaning and Inspection. Refer to Section 3 of this part for the proper cleaning and inspection procedure.

ADJUSTMENT

Set the spark plug gap by bending the ground electrode (Fig. 27).

INSTALLATION

1. Install the spark plugs and torque each plug to specifications.
2. Connect the spark plug wires. Push all weather seals into position.

RESISTANCE WIRE REPLACEMENT

The primary resistance wire is checked for excessive resistance as outlined under "Resistance Wire Test."

To replace the resistance wire:

1. Fabricate a 3-inch, 16-gauge jumper wire with a bullet-type terminal on one end and an eyelet-type terminal on the other end. Solder the terminals to the wire.
2. Disconnect the defective resistance wire (pink or black) from the coil terminal of the ignition switch. Cut the wire off at the point where it enters the taped area of the harness.
3. Connect the 3-inch jumper wire to the coil terminal of the ignition switch. Connect the replacement resistance wire to the other end of the jumper wire, using a bullet terminal connector.
4. Route the replacement resistance wire along the harness and through the grommet in the dash panel. Tape the wire to the harness where necessary to prevent it from hanging loose.
5. Disconnect the defective resistance wire from the bullet connector in the engine compartment, and connect the replacement wire in its place.
6. Cut the defective wire off at the point where it enters the taped area of the harness.

3 CLEANING AND INSPECTION

SPARK PLUGS

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 carbon and other deposits from the threads with a stiff wire brush. Any deposits will retard the heat flow from the plug to the cylinder head causing spark plug overheating and pre-ignition.

Clean the electrode surfaces with a small file (Fig. 28). 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, and other signs of failure. Replace as required.

Examine the firing ends of the spark plugs, noting the type of deposits and the degree of electrode erosion. Refer to Fig. 29 for the various types of spark plug fouling and their causes.

DISTRIBUTOR

Soak all parts of the distributor assembly (except the condenser, breaker point assembly, lubricating wick, vacuum diaphragm, distributor base oil seal and electrical wiring) in a mild cleaning solvent or mineral spirits. Do not use a harsh cleaning solution. Wipe all parts that can not 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 surface of the distributor shaft and the bushings for wear. The dual advance distributor has two bushings. The minimum allowable shaft diameter at the bushing is 0.4675 inch and the maximum allowable inside diameter of

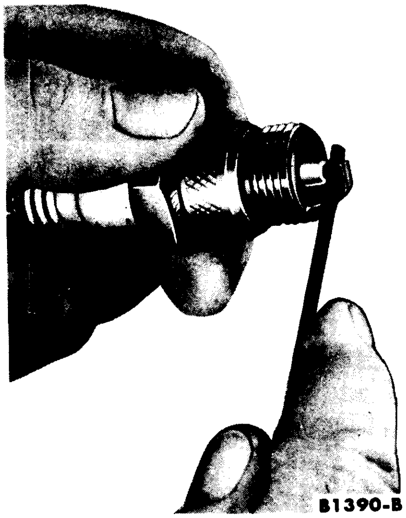


FIG. 28—Cleaning Spark Plug Electrode

the bushing should be within specifications. Replace worn parts.

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

Inspect the breaker plate assembly for signs of distortion. In addition, inspect the stationary sub-plate for worn nylon contact buttons. Replace the breaker plate assembly if it is defective.

The breaker point assembly and condenser (if so equipped) 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 for stripped threads or other damage. Test the vacuum fittings, case and diaphragm for leakage as explained under "Distributor Tests." Replace all defective parts.

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 as necessary. Breaker points can be cleaned with chloroform and a stiff bristle brush. Replace the breaker point

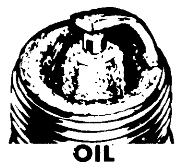
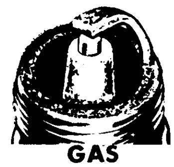
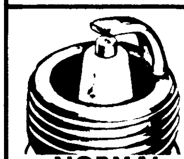
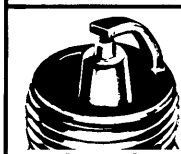
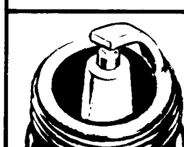
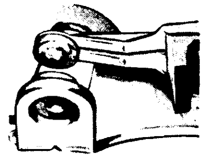
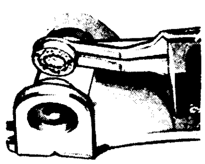
CONDITION	IDENTIFICATION	CAUSED BY
 OIL FOULING	Wet, sludgy deposits.	Excessive oil entering combustion chamber through worn rings and pistons, excessive clearance between valve guides and stems, or worn or loose bearings.
 GAS FOULING	Dry, black, fluffy deposits.	Incomplete combustion caused by too 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, loose spark plugs, or too hot a plug, low fuel pump pressure.
 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. Weak ignition, defective fuel pump, dirty air cleaner, too rich a fuel mixture.
 SILICONE DEPOSIT	Hard and scratchy	Formed when fine sand particles combine with anti-knock compounds in the fuel. Most common industry areas. The plugs cannot be cleaned.
 SPLASHED FOULING		Deposits, accumulated after a long period of misfiring, suddenly loosened when normal combustion chamber deposits are restored after new plugs are installed. During a high speed run these deposits are thrown into the plug. B1005-E

FIG. 29—Spark Plug Inspection

CONDITION	CAUSED BY
 BURNED	Any discoloration other than a frosted slate grey shall be considered as burned points.
 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-B

FIG. 30—Breaker Point Inspection

assembly if the contacts are badly burned or excessive metal transfer between the points is evident (Fig. 30). Metal transfer is considered excessive when it equals or exceeds the gap setting.

SECONDARY WIRING

Wipe the wires with a damp cloth and check for fraying, breaks, etc. Replace any wires that are not in good condition.

COIL

Wipe the coil with a damp cloth and check for any cracks or other defects.

PART 9-2 DUAL ADVANCE DISTRIBUTORS

1 DESCRIPTION AND OPERATION

The dual advance distributor (Figs. 1 and 2) has two independently operated spark advance systems. A centrifugal advance mechanism is located below the stationary sub-plate assembly, and a vacuum operated spark control diaphragm is located on the side of the distributor base. As speed increases, the centrifugal weights cause the cam to advance or move ahead with respect to the distributor drive shaft. The rate of advance is controlled by calibrated springs.

The vacuum advance mechanism has a spring-loaded diaphragm which is connected to the breaker plate. The spring-loaded side of the diaphragm is airtight and is connected through a vacuum line to the carburetor throttle bore. When the throttle plates open, the distributor vacuum passage is exposed to manifold vacuum, which causes the diaphragm to move against the tension of the spring. This action causes the movable breaker plate to pivot on the stationary sub-plate. The breaker point rubbing block, which is positioned on the opposite side of the cam from the pivot pin, then moves against distributor rotation and advances the spark timing. As the movable breaker plate is rotated from retard position to full advance position, the dwell decreases slightly. This is because the breaker point rubbing block and the cam rotate on different axes.

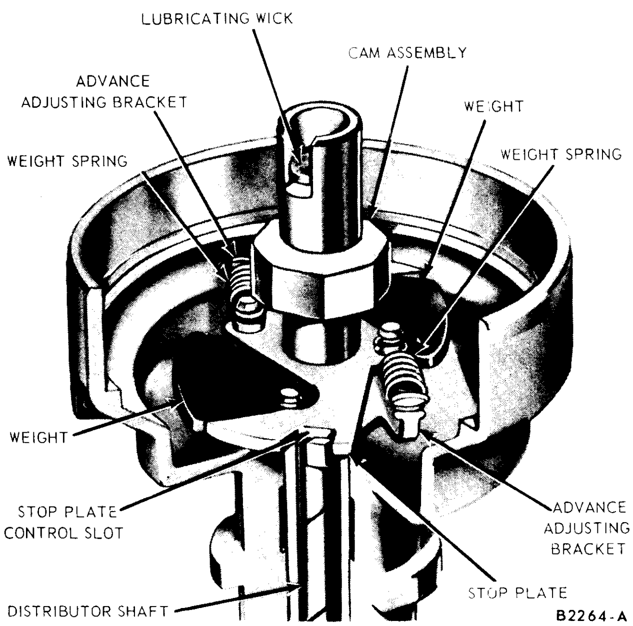


FIG. 1—Centrifugal Advance Mechanism

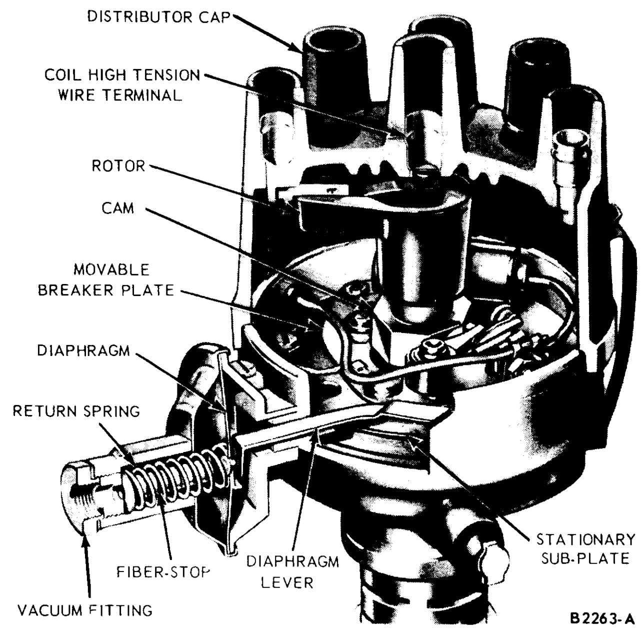


FIG. 2—Vacuum Advance Mechanism

2 IN-CAR ADJUSTMENTS AND REPAIRS

BREAKER POINT AND CONDENSER REPLACEMENT

CONVENTIONAL IGNITION SYSTEM DISTRIBUTOR

Removal

1. Remove the distributor cap and the rotor.

2. Disconnect the primary and the condenser wires from the breaker point assembly.

3. Remove the breaker point assembly and condenser retaining screws. Lift the breaker point assembly and condenser out of the distributor.

Installation

1. Place the breaker point assembly and the condenser in position and install the retaining screws. Be sure to place the ground wire under the breaker point assembly screw farthest from the breaker point contacts (Figs. 3 and 4).

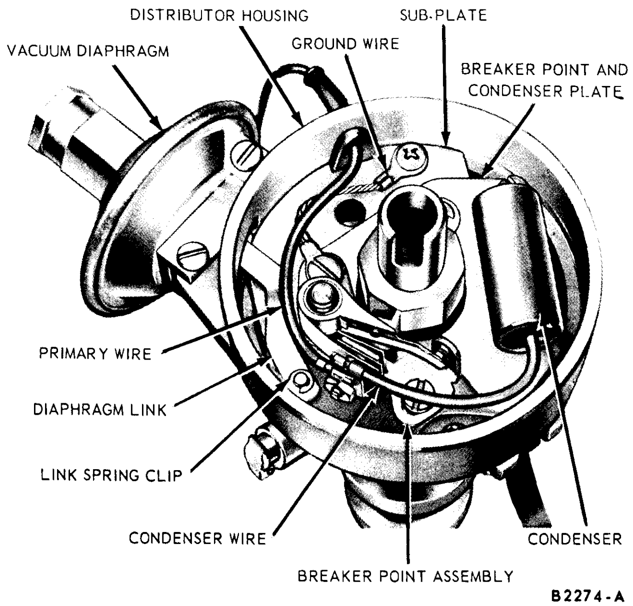


FIG. 3—Breaker Plate Installed—Pivot-Type Points

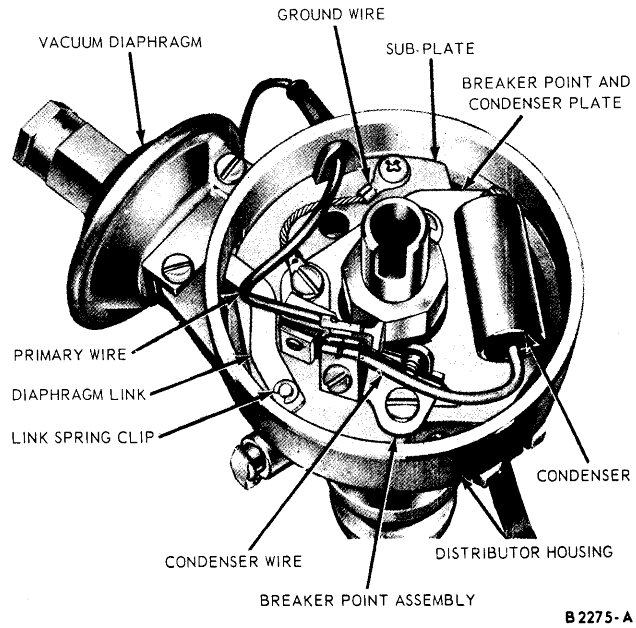


FIG. 4—Breaker Plate Installed—Pivotless Points

2. Align and adjust the breaker point assembly by following the procedure in Part 9-1.

3. Connect the primary and condenser wires to the breaker point assembly.

4. Install the rotor and the distributor cap.

TRANSISTOR IGNITION SYSTEM DISTRIBUTOR

Removal

1. Remove the distributor cap, the rotor, and the dust cover.

2. Disconnect the distributor-transistor wire from the breaker point assembly.

3. Remove the retaining screws from the breaker point assembly and lift the breaker point assembly out of the distributor.

Installation

1. Place the breaker point assembly in position and install the retaining screws. Be sure to place the ground wire under the breaker point assembly screw farthest from the breaker point contacts (Fig. 3).

2. Align and adjust the breaker point assembly by following the procedure in Part 9-1.

3. Connect the distributor-transistor wire to the breaker point assembly.

4. Install the dust cover, the rotor, and the distributor cap.

VACUUM DIAPHRAGM REPLACEMENT

CONVENTIONAL AND TRANSISTOR IGNITION SYSTEM DISTRIBUTORS

Removal

1. Remove the distributor cap, the rotor, and the dust cover (if so equipped).

2. Remove the vacuum line from the diaphragm fitting.

3. Remove the spring clip that secures the diaphragm link to the movable breaker plate.

4. Remove the diaphragm retaining screws and slide the diaphragm out of the distributor.

Installation

1. Slide the diaphragm into the opening in the distributor and place the link in its position.

2. Install the spring clip that secures the diaphragm link to the movable breaker plate and install the diaphragm retaining screws.

3. Install the vacuum line on the diaphragm fitting.

4. Install the dust cover (if so equipped), the rotor, and the distributor cap.

BREAKER PLATE AND SUB-PLATE REPLACEMENT

CONVENTIONAL IGNITION SYSTEM DISTRIBUTOR

Refer to Figs. 3 and 4 for the correct location of parts.

Removal

1. Remove the distributor cap and the rotor.

2. Remove the breaker point assembly, the condenser, and the vacuum diaphragm.

3. Working from the inside of the distributor, pull the primary wire through the opening in the distributor.

4. Remove the spring clip, the flat washer, and the spring washer securing the breaker plate to the sub-plate.

5. Remove the sub-plate retaining screws and lift both plates out of the distributor.

Installation

1. Place the breaker plate in position on the sub-plate.

2. Install the spring washer, the flat washer, and the spring clip that secures the breaker plate to the sub-plate.

3. Install the sub-plate hold down screws (the ground wire should be under the sub-plate hold down screw near the primary wire opening in the distributor).

4. Working from the inside of the distributor, push the primary wire through the opening in the distributor.

5. Install the breaker point assembly, the condenser, and the vacuum diaphragm.

6. Install the rotor and the distributor cap.

TRANSISTOR IGNITION SYSTEM DISTRIBUTOR

The transistor ignition system distributor does not have a condenser. It does have a lubricating wick on the breaker point assembly rubbing block. With the exception of these two items, Fig. 3 shows the correct location of parts.

Removal

1. Remove the distributor cap, the rotor, and the dust cover.

2. Remove the breaker point assembly and the vacuum diaphragm.

3. Working from the inside of the distributor, pull the distributor-transistor wire through the opening in the distributor.

4. Remove the spring clip, the flat washer, and the spring washer securing the breaker plate to the sub-plate.

5. Remove the sub-plate retaining screws and lift both plates out of the distributor.

Installation

1. Place the breaker plate in position on the sub-plate.

2. Install the spring washer, the flat washer, and the spring clip that secures the breaker plate to the sub-plate.

3. Install the sub-plate hold down screws (the ground wire should be under the sub-plate hold down screw near the distributor-transistor wire opening in the distributor).

4. Working from the inside of the distributor, push the distributor-transistor wire through the opening in the distributor.

5. Install the breaker point assembly and the vacuum diaphragm.

6. Install the dust cover, the rotor, and the distributor cap.

CAM AND CENTRIFUGAL ADVANCE MECHANISM REPLACEMENT

CONVENTIONAL AND TRANSISTOR IGNITION SYSTEM DISTRIBUTORS

Removal

1. Remove the distributor cap, the rotor, and the dust cover (if so equipped).

2. Working from the inside of the distributor, pull the primary or distributor-transistor wire through the opening in the distibutor.

3. Remove the breaker point and condenser plate retaining screws and lift the plate assembly out of the distributor.

4. Mark one of the distributor weight springs and its brackets. Also mark one of the weights and its pivot pin.

5. Carefully unhook and remove the weight springs.

6. Lift the lubricating wick from the cam assembly. Remove the cam assembly retainer and lift the cam assembly off the distributor shaft. Remove the thrust washer.

7. Remove the weight retainers and lift the weights out of the distributor.

Installation

1. Fill the grooves in the weight pivot pins with distributor cam lubricant.

2. Position the weights in the distributor (the marked weight is placed on the marked pivot pin) and install the weight retainers.

3. Place the thrust washer on the shaft.

4. Fill the grooves in the upper portion of the distributor shaft with distributor cam lubricant.

5. Install the cam assembly. Be sure that the marked spring bracket on the cam assembly is near the marked spring bracket on the stop plate. Place a light film of distributor cam lubricant on the distributor cam lobes. Install the retainer and the wick. Saturate the wick with SAE 10W engine oil.

6. Install the weight springs. Be sure that the marked spring is attached to the marked spring brackets.

7. Install the breaker point and condenser plate assembly.

8. Working from the inside of the distributor, push the primary or distributor-transistor wire through the opening in the distributor.

9. Install the dust cover (if so equipped), the rotor, and the distributor cap.

ADJUSTMENTS

Refer to Part 9-1, Section 3 for the adjustment procedures.

3 REMOVAL AND INSTALLATION

REMOVAL

1. On a conventional ignition system, disconnect the primary wire at the coil. On a transistor ignition system, disconnect the distributor-transistor lead from the quick disconnect. Disconnect the vacuum advance line at the distributor. Remove the distributor cap.

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

3. Remove the distributor hold down cap screw and clamp. Lift 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

1. If the crankshaft was rotated while the distributor was removed from the engine, it will be necessary to time the engine. Rotate the crankshaft until No. 1 piston is on TDC (after the compression stroke). Align the TDC mark on the timing pointer with the timing pin on the crankshaft damper. Position the distributor in the block with the rotor at the No. 1 firing position.

Make sure the oil pump intermediate shaft properly engages the distributor shaft. It may be necessary to crank the engine with the starter, after the distributor drive gear is partially engaged, in order to engage the oil pump intermediate shaft.

Install, but do not tighten, the retaining clamp and screw. Rotate the distributor body counterclockwise until the breaker points are just starting to open. Tighten the clamp.

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

3. Install the distributor cap.

4. On a conventional ignition system, connect the primary wire to the coil. On a transistor ignition system, connect the distributor-transistor lead to the quick disconnect.

5. Check the ignition timing with a timing light and adjust if necessary. Connect the vacuum line, and check the advance with the timing light when the engine is accelerated.

4 MAJOR REPAIR OPERATIONS

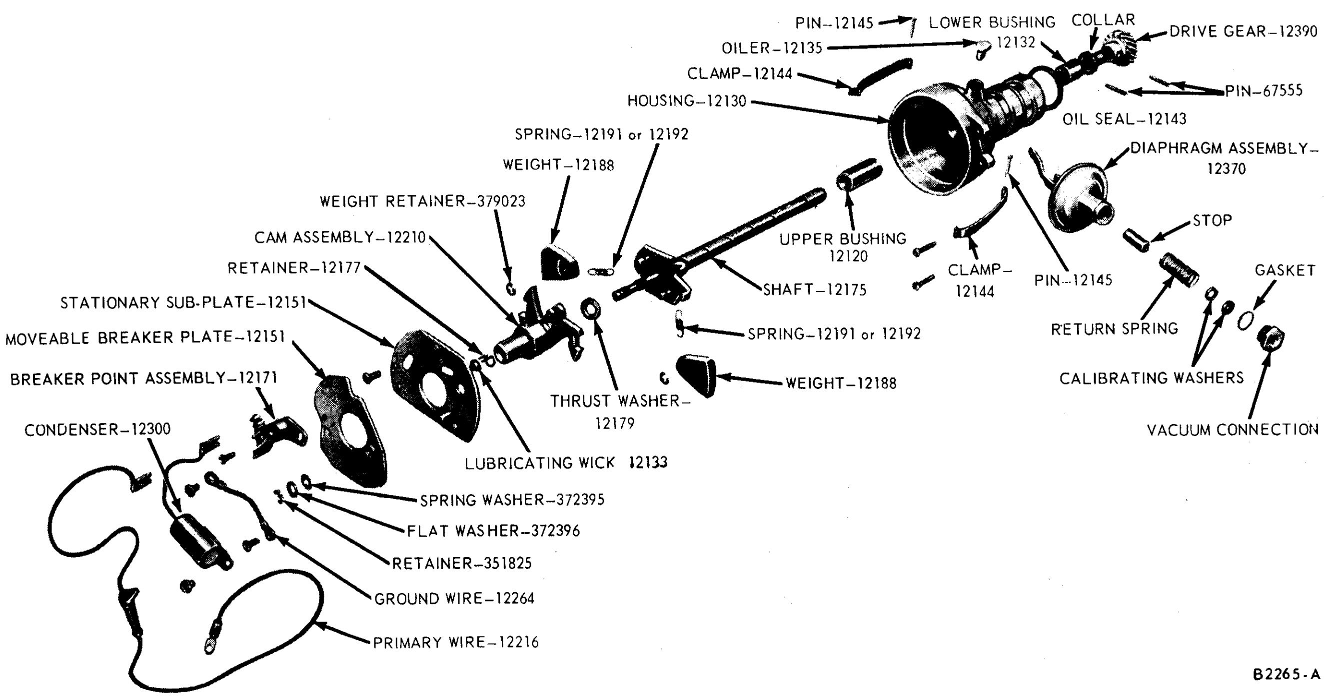


FIG. 5—Typical Dual Advance Distributor

To perform the operations in this section, it will be necessary to remove the distributor from the car and install it in a vise.

BENCH DISASSEMBLY

The distributor assembly is shown in Fig. 5.

CONVENTIONAL IGNITION SYSTEM DISTRIBUTOR

1. Remove the rotor.
2. Disconnect the primary and the condenser wires from the breaker point assembly.
3. Remove the breaker point assembly and condenser retaining screws. Lift the breaker point assembly and condenser out of the distributor.
4. Remove the spring clip that secures the diaphragm link to the movable breaker plate.
5. Remove the diaphragm retaining screws and slide the diaphragm out of the distributor.
6. Working from the inside of the distributor, pull the primary wire through the opening in the distributor.
7. Remove the spring clip, the flat washer, and the spring washer securing the breaker plate to the sub-plate.
8. Remove the sub-plate retaining screws and lift both plates out of the distributor.
9. Mark one of the distributor weight springs and its brackets. Also mark one of the weights and its pivot pin.
10. Carefully unhook and remove the weight springs.
11. Lift the lubricating wick from the cam assembly. Remove the cam assembly retainer and lift the cam assembly off the distributor shaft. Remove the thrust washer.
12. Remove the weight retainers and lift the weights out of the distributor.
13. Remove the distributor cap clamps.

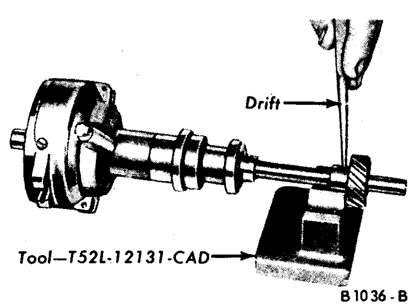


FIG. 6—Gear Pin Removal or Installation

14. **If the gear and shaft are to be used again, mark the gear and the shaft so that the pin holes can be easily aligned for assembly.** Remove the gear roll pin (Fig. 6), and then remove the gear (Fig. 7).
15. Remove the shaft collar roll pin (Fig. 8).
16. Invert the distributor and place it on a support plate in a position that will allow the distributor shaft to clear the support plate and press the shaft out of the collar and the distributor housing (Fig. 9).
17. Remove the distributor shaft upper bushing (Fig. 10). Invert the distributor and remove the lower bushing in a similar manner.

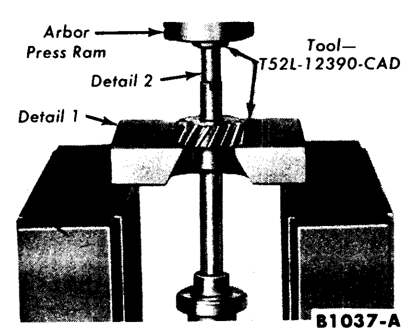


FIG. 7—Gear Removal

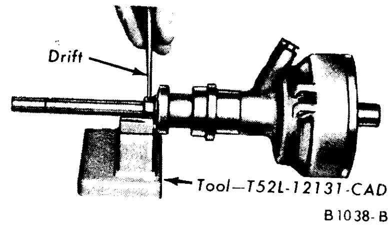


FIG. 8—Collar Retaining Pin Removal or Installation

TRANSISTOR IGNITION SYSTEM DISTRIBUTOR

1. Remove the rotor and the dust cover.
2. Disconnect the distributor-transistor lead from the breaker point assembly.
3. Remove the retaining screws from the breaker point assembly and lift the breaker point assembly out of the distributor.
4. Remove the spring clip that secures the diaphragm link to the movable breaker plate.
5. Remove the diaphragm retaining screws and slide the diaphragm out of the distributor.
6. Working from the inside of the distributor, pull the distributor-transistor wire through the opening in the distributor.

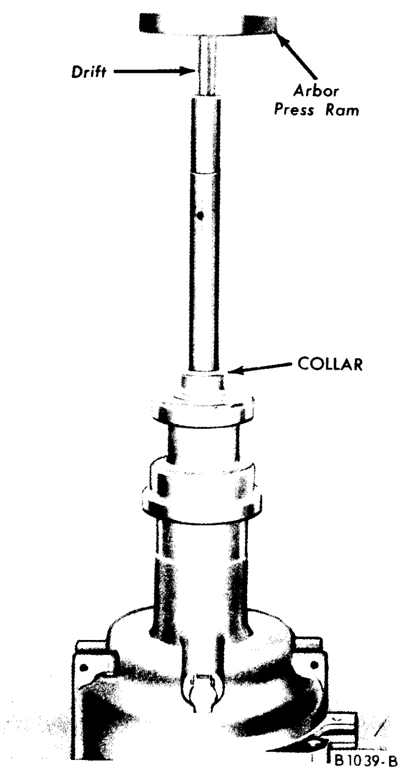


FIG. 9—Shaft Removal

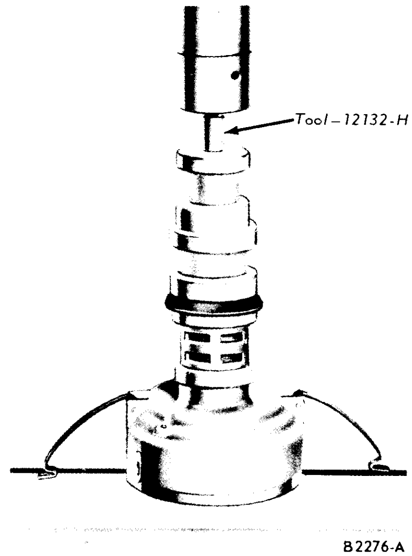


FIG. 10—Upper Bushing Removal

7. Follow steps 7-17 under "Conventional Ignition System Distributor".

BENCH ASSEMBLY

ORIGINAL SHAFT AND GEAR

Conventional Ignition System Distributors

1. Oil the new upper bushing, and position it on the bushing replacer tool. Install the upper bushing (Fig. 11). When the tool bottoms against the distributor base, the bushing will be installed to the correct depth.

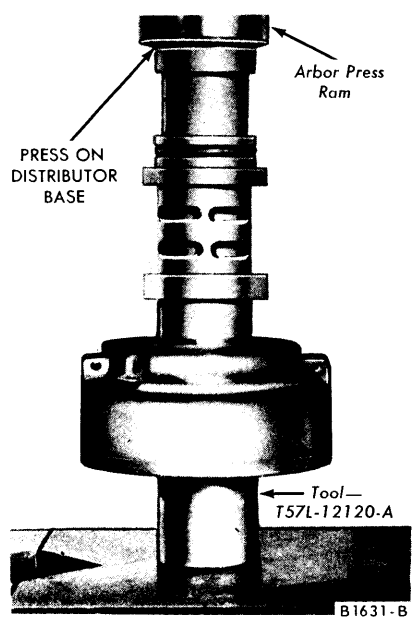


FIG. 11—Upper Bushing Installation

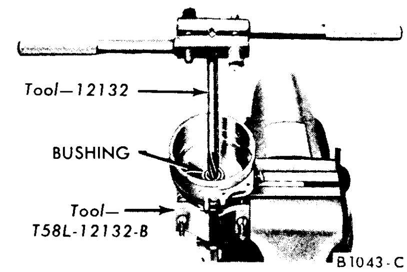


FIG. 12—Burnishing Bushing

Invert the distributor and install the lower bushing in a similar manner.

2. Burnish the bushing to the proper size (Fig. 12).
3. Oil the shaft and slide it into the distributor body.
4. Place the collar in position on the shaft and align the holes in the collar and the shaft, then install a new pin. Install the distributor cap clamps.
5. Check the shaft end play with a feeler gauge placed between the collar and the base of the distributor. If the end play is not within specifications, replace the shaft and gear.
6. Attach the distributor shaft supporting tool to the distributor. Tighten the backing screw in the tool enough to remove all shaft end play.
7. Install the assembly in a press. Press the gear on the shaft (Fig. 13), using the marks made on the gear and shaft as guides to align the pin holes.
8. Remove the distributor from the press. Install the gear retaining pin (Fig. 6).
9. Position the distributor in a vise. Fill the grooves in the weight pivot

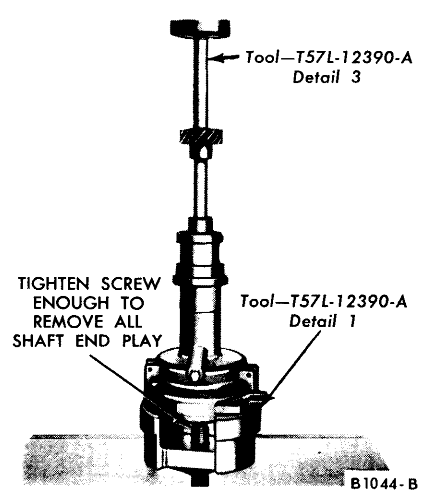


FIG. 13—Original Shaft and Gear Installation

pins with a distributor cam lubricant.

10. Position the weights in the distributor (the marked weight is placed on the marked pivot pin) and install the weight retainers.

11. Place the thrust washer on the shaft.

12. Fill the grooves in the upper portion of the distributor shaft with distributor cam lubricant.

13. Install the cam assembly. Be sure that the marked spring bracket on the cam assembly is near the marked spring bracket on the stop plate. Place a light film of distributor cam lubricant on the distributor cam lobes. Install the retainer and the wick. Saturate the wick with SAE 10W engine oil.

14. Install the weight springs. Be sure that the marked spring is attached to the marked spring brackets.

15. Place the breaker plate in position on the sub-plate.

16. Install the spring washer, the flat washer, and the spring clip that secures the breaker plate to the sub-plate.

17. Install the sub-plate hold down screws (the ground wire should be under the sub-plate hold down screw near the primary wire opening in the distributor).

18. Working from the inside of the distributor, push the primary wire through the opening in the distributor.

19. Slide the diaphragm into the opening in the distributor and place the link in its position.

20. Install the spring clip that secures the diaphragm link to the movable breaker plate and install the diaphragm retaining screws.

21. Place the breaker point assembly and the condenser in position and install the retaining screws. Be sure to place the ground wire under the breaker point assembly screw farthest from the breaker point contacts. Align and adjust the breaker point assembly by following the procedure in Part 9-1.

22. Connect the primary and condenser leads to the breaker point assembly.

23. Install the rotor and the distributor cap.

24. Check and adjust (if necessary) the centrifugal and vacuum advance (Refer to Part 9-1).

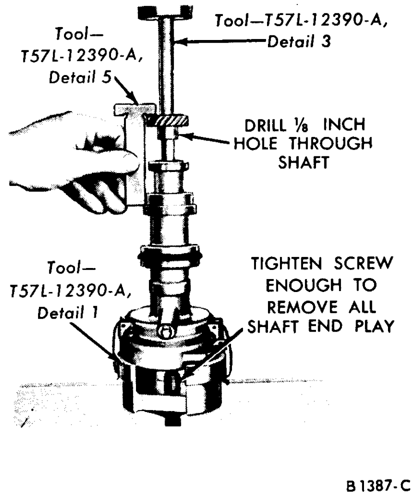


FIG. 14—New Shaft and Gear Installation

Transistor Ignition System Distributor

1. Follow steps 1-16 under "Conventional Ignition System Distributor."

2. Install the sub-plate hold down screws (the ground wire should be under the sub-plate hold down screw near the distributor-transistor wire opening in the distributor).

3. Working from the inside of the distributor, push the distributor-transistor wire through the opening in the distributor.

4. Slide the diaphragm into the opening in the distributor and place the link in its position.

5. Install the spring clip that secures the diaphragm link to the movable breaker plate and the diaphragm retaining screws.

6. Place the breaker point assembly in position and install the retaining screws.

7. Align and adjust the breaker point assembly by following the procedure in Part 9-1.

8. Connect the distributor-transistor wire to the breaker point assembly.

9. Check and adjust (if necessary) the centrifugal and vacuum advance (Refer to Part 9-1).

10. Install the dust cover and the rotor.

NEW SHAFT AND GEAR

Conventional and Transistor Ignition Distributor

The shaft and gear are placed as an assembly. One part should not be replaced without replacing the other. Refer to Fig. 5 for the correct location of the parts.

1. Follow steps 1, 2, and 3 under "Installing Original Shaft and Gear—Conventional Ignition System Distributor."

2. Attach the distributor shaft supporting tool to the distributor and install the assembly in a vise. Insert a 0.002-inch feeler gauge between the backing screw and the shaft. Tighten the backing screw on the tool enough to remove all shaft end play. Remove the feeler gauge and allow the shaft to rest on the backing screw. Slide the collar on the shaft. While holding the collar in place against the distributor base (Fig. 14), drill a ⅛-inch hole through the shaft using the access opening in the collar as a pilot.

3. Position the gear on the end of the shaft. Install the assembly in a press.

4. With the backing screw on the support tool tightened enough to remove all end play, press the gear on the shaft to the specified distance from the bottom face of the gear to the bottom face of the distributor mounting flange (Fig. 14). Drill a ⅛-inch hole through the shaft using the hole in the gear as a pilot.

5. Remove the distributor from the press and remove the support tool. Install the collar retaining pin (Fig. 8) and the gear retaining pin (Fig. 6).

6. On a conventional ignition system distributor, complete the assembly by following steps 8 thru 24 under "Installing Original Shaft and Gear—Conventional Ignition System Distributor."

On a transistor ignition system distributor, complete the assembly by following steps 8-16 under "Installing Original Shaft and Gear—Conventional Ignition System Distributor" and steps 2-10 under "Installing Original Shaft and Gear—Transistor Ignition System Distributor."

PART 9-3 SPECIFICATIONS

DISTRIBUTOR

GENERAL

Conventional Ignition System

Breaker Arm Spring Tension (Ounces) 17-20
Contact Spacing (Inches) 0.014-0.016
Dwell Angle at Idle Speed .... 26°-28½°

Transistor Ignition System

Breaker Arm Spring Tension (Ounces) 17-20
Contact Spacing (Inches) 0.019-0.021
Dwell Angle at Idle Speed .... 22°-24°

DIMENSIONS

Shaft End Play With Distributor
Removed (Inches) 0.022-0.032
Gear Location Dimension, From Bottom of Gear
to Bottom of Mounting Rib (Inches) 3.071-3.077

CONDENSER

Capacity (Microfarads) 0.21-0.25
Minimum Leakage (Megohms) 5
Maximum Series Resistance (Ohms) 1

IGNITION TIMING

Recommended Setting* .... 6°BTDC

*For altitude operation, and/or to obtain optimum engine performance and fuel economy, the initial ignition timing may be advanced 5° over the "normal" setting. No further improvement in engine performance or fuel economy will be achieved by advancing beyond this point. Advance the timing progressively until engine detonation (spark knock) is evident under actual roadtest acceleration. Retard the timing until the detonation (spark knock) is eliminated. If the individual requirements of the ear and/or the use of sub-standard fuels dictate, the initial timing may have to be retarded from the recommended setting to eliminate detonation (spark knock). If retiming is necessary, it should be done progressively and not to exceed 2°BTDC.

ADVANCE CHARACTERISTICS

Note: The advance characteristics given apply to the distributor with the indicated number only. The distributor number is stamped on the distributor housing or on a plate attached to the distributor housing.

Conventional Ignition System (Distributor No. C5AF-12127-C) and Transistor Ignition System (Distributor No. C5SF-12127-B).

CENTRIFUGAL ADVANCE. Set the test stand to 0° at 250 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
450	1¼-2¼	0
500	3½-4½	0
800	5¾-6¾	0
1600	9-10½	0
2000	10¾-12	0

Maximum Advance Limit .... 13°

ADVANCE CHARACTERISTICS (continued)

VACUUM ADVANCE. Set the test stand to 0° at 1000 rpm and 0 inches of vacuum.

Distributor (rpm)	Advance (Degrees)	Vacuum (Inches of Mercury)
1000	2-5	8
1000	4-7	10
1000	5½-8½	14

Maximum Advance Limit .... 8½°

SPARK PLUGS

Type .... Autolite BF-42
Size .... 18 mm.
Gap (inches) 0.032-0.036
Torque (ft-lbs.) 15-20*

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

COIL

Conventional Ignition System

Primary Resistance (Ohms)* .... 1.40-1.54 (75° F.)
Secondary Resistance (Ohms) .. 8000-8800 (75° F.)
Amperage Draw
Engine Stopped 4.5
Engine Idling 2.5
*Primary Circuit Resistor ...... 1.30-1.40 (75° F.)

Transistor Ignition System

Primary Resistance (Ohms)* ... 0.226-0.252 (75° F.)
Secondary Resistance (Ohms)* ... 4900-5680 (75° F.)
Amperage Draw
Engine Cranking 4.0
Engine Idling 5.0
*Primary Circuit Resistor
Emittor .... 0.30-0.36 (75° F.)
Collector .... 0.39-0.47 (75° F.)
Base .... 7.00-9.00 (75° F.)

SPECIAL TOOLS

DESCRIPTION	TOOL NO.
Breaker point aligning tool	KD-111 or TK-419-A
Breaker point spring tension scale	12151
Bushing burnisher	12132
Bushing remover	12132-A
Bushing installer	T57L-12120-A
Distributor holding clamp	T58L-12132-B
Distributor testers	RE-236
	RE-1416
Drive gear installing fixture	T57L-12390-A
Drive gear locating gauge	T57L-12390-A5
Drive gear remover kit	T52L-12390-CAD
Ignition scopes	RE-27-55
	RE-651
	RE-881
Tach-dwell tester	RE-27-44
Timing light	13-07

FUEL SYSTEM

GROUP 10

PART 10-1 GENERAL FUEL SYSTEM SERVICE

This part covers general fuel system diagnosis, tests, adjustment and repair procedures. In addition, the cleaning and inspection procedures are covered.

For fuel system component removal, disassembly, assembly, installation, major repair procedures and specifications, refer to the pertinent part of this group.

The carburetor identification tag is attached to the carburetor. The basic part number for all carburetors is 9510. To procure replacement parts, it is necessary to know the part No. prefix and suffix and, in some cases, the design change code (Fig. 1).

Always refer to the Master Parts Catalog for parts usage and interchangeability before replacing a carburetor or a component part for a carburetor.

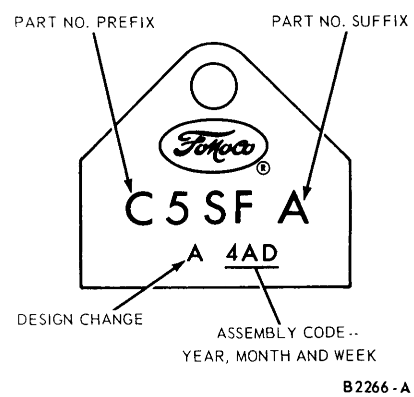


FIG. 1—Carburetor Identification Tag

1 DIAGNOSIS AND TESTING

FUEL TANK, LINES AND FILTER

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

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

Leakage in the fuel inlet line can cause low vacuum, pressure and volume conditions, and loss of fuel.

A restricted fuel tank vent can cause low fuel pump pressure and volume, and may, in some instances, result in collapsed inlet line hoses or a collapsed fuel tank.

FUEL PUMP

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

Tests for fuel pump static pressure and fuel volume are necessary to determine that the fuel pump is in satisfactory condition.

If both the fuel pump volume and

pressure are within specifications (Part 10-6) and the pump and lines are in satisfactory condition, a vacuum test is not required.

If the pump volume is low, but the pressure is within specifications, a fuel pump capacity test must be made with the filter removed. If the pump volume meets specifications with the filter removed, replace the filter. If the pump volume is still below specifications, repeat the capacity test, using an auxiliary fuel supply. If the pump volume still does not meet specifications, replace the pump. If the pump does meet specifications, there is a restriction in the fuel supply from the tank or the tank is not venting properly.

The tests are performed with the fuel pump installed on the engine and engine temperature stabilized. **Make certain the replaceable fuel filter element has been changed within the recommended maintenance mileage interval.** When in doubt, install a new filter prior to performing the tests. A clogged or restricted filter is often the cause of fuel system malfunction.

PRESSURE TEST

1. Remove the air cleaner assembly. Disconnect the fuel inlet line at the carburetor. **Use care to prevent combustion due to fuel spillage.**
2. Connect a pressure gauge, petcock and flexible hose (Fig. 2) between the carburetor inlet connector and the fuel inlet line connector.
3. Position the flexible hose in the petcock so that the fuel can be expelled into a suitable container (Fig. 2) for the capacity (volume) test.
4. Operate the engine. Vent the system into the container by opening the hose restrictor momentarily before taking a pressure reading.
5. Operate the engine at 500 rpm. After the pressure has stabilized, it should be to specification (Part 10-6).

CAPACITY (VOLUME) TEST

Perform this test only when the fuel pump pressure is within specifications (Part 10-6).

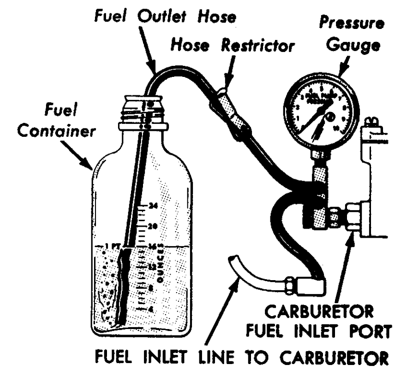


FIG. 2—Fuel Pump Pressure and Capacity Tests

1. Operate the engine at 500 rpm.
2. Open the hose restrictor and expel the fuel into the container (Fig. 2) while observing the time required to expel one pint; then, close the petcock. At least one pint of fuel should be expelled within the specified time limit.
3. Remove the test equipment, and connect the fuel inlet line to the carburetor.

FUEL PUMP, TANK AND LINES TROUBLE DIAGNOSIS GUIDE

LOW FUEL PUMP PRESSURE OR VOLUME	Diaphragm stretched or leaking. Fuel pump diaphragm spring is weak. Rocker arm or eccentric worn or undersize. Excessive clearance between rocker arm and fuel pump link. Fittings loose or cracked.	Fuel line cracked or broken. Fuel pump valves improperly seating. Dirt in fuel tank and/or lines. Fuel tank vent restricted. Diaphragm ruptured. Main body retaining screws loose. Fuel filter clogged (low volume).
HIGH FUEL PUMP PRESSURE OR VOLUME	Diaphragm spring too strong or improper spring. Diaphragm surface too tight (over-tensioned).	Pump link has no free play (frozen). Pump diaphragm vent hole plugged or omitted.
LOW FUEL PUMP VOLUME WITH NORMAL PRESSURE	Fuel filter clogged. Fuel pump to carburetor inlet line obstructed, crimped or leaks.	Restriction in fuel supply line to fuel pump.
FUEL PUMP LEAKS FUEL	Diaphragm defective. Fittings loose.	Threads on fittings stripped. Body cracked.
FUEL PUMP LEAKS OIL	Fuel pump retaining bolts loose. Mounting gasket defective.	Pump diaphragm pull rod oil seal defective.
FUEL PUMP NOISE	Rocker arm or eccentric worn. Mounting bolts loose. Rocker arm spring is weak or broken.	Diaphragm pull rod bumper pad defective.
FUEL TANK AND/OR INLET LINE HOSES COLLAPSED	Fuel tank vent restricted.	

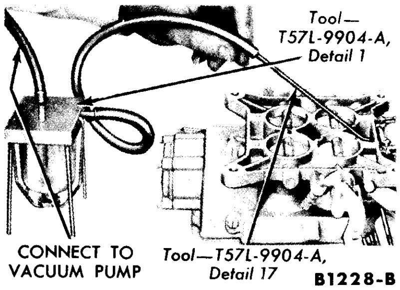


FIG. 3—Power Valve Test

CARBURETOR

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

TESTS

Accelerating Pump Discharge.

1. Remove the air cleaner.

2. Open the primary throttle plates and observe the fuel flow from the accelerating pump discharge nozzles. If the system is operating correctly, a quick, steady stream of fuel will flow from the discharge nozzles.

Power Valve. A power valve must not be replaced unless it is leaking sufficiently to cause an unadjustable rough engine idle condition. Fuel accumulation in the power valve cover does not necessarily indicate a defective power valve. Fuel vapors will be drawn into the vacuum side of the power valve and condense during periods of deceleration. Leakage in the power valve area can be caused by an improperly tightened cover or defective gaskets. Any gasket sealing defect must be corrected before the power valve is replaced.

Power valve leakage that causes an unadjustable rough engine idle condition can be diagnosed, in most instances, by the fact that the idle mixture needles must be nearly, or completely, seated in order to obtain a relatively smooth engine idle condition. If power valve leakage is suspected, the following test procedure must be performed:

1. Remove the carburetor from the intake manifold and invert it.

2. Remove the glass bowl from the fixture (Fig. 3). Fill the bowl half-full of water. Install the bowl on the fixture.

3. Connect a line from the vacuum pump to the fitting on top of the fixture. Insert the large OD end of the wand into the tube and attach the other end of the tube to the fitting on the side of the fixture. Slip the rubber gasket (furnished with the tool) over the small OD end of the wand. Hold this end against the power valve vacuum pick-up port.

4. Look for bubble formations in the water in the bowl. A continuous stream of bubbles indicates leakage through the power valve diaphragm or gasket, or the cover or gasket.

If leakage is encountered, the power valve, power valve gasket, cover, and cover gasket should be replaced one at a time with a new part and the test repeated until the source of leakage has been found. If the leakage can not be found, the gasket seats are damaged and the defective parts should be replaced.

A few bubbles may be noticed immediately upon attaching the vacuum line. The bubbling should stop within approximately 15 seconds or after the air has been removed from the system. If no bubbles are seen, the power valve, gaskets, and cover are sealing properly.

Secondary Vacuum System. Vacuum is transmitted from the secondary throttle control vacuum tube through passages in the air horn, air horn mounting gasket, and main body area behind the secondary operating diaphragm. The diaphragm spring, ball check and a vacuum bleed in the ball check seat (located in the vacuum passage in the diaphragm housing) controls the rate at which the secondary throttle plates are allowed to open (high vacuum) or close (low vacuum).

With the engine operating temperature stabilized and the air cleaner removed, check the secondary system:

1. Position the transmission selector lever in neutral. Start the engine. Open the throttle gradually from the fully-closed to the fully-open position. Hold the throttle fully open for 5 seconds before allowing the throttle to close, and observe the operation of the secondary throttle lever. **To prevent injury due to combustion back-lash thru the carburetor air horn, do not position any part of the body (head, hands, etc.) near the top of the carburetor air horn when checking the secondary system.**

2. If the secondary throttle lever doesn't open fully as the throttle reaches the maximum open position, air leakage at the diaphragm or the air horn mounting gasket may be causing the malfunction. Tighten the air horn and secondary diaphragm retaining screws. Check the secondary throttle plate operating rod for binds. Check the secondary vacuum tube to make certain it is properly positioned.

3. Gradually open and close the throttle and observe the action of the secondary throttle lever. If the secondary throttle lever doesn't fully open and close, the trouble may be caused by an air leak where the secondary vacuum tube fits into the air horn, air leakage between the secondary diaphragm housing cover and the housing, air leakage between the air horn and main body, the secondary diaphragm return spring is too stiff, a restricted vacuum pick-up tube, secondary throttle plates wedged in the barrels or a bent secondary throttle shaft.

CARBURETOR DIAGNOSIS GUIDE

FLOODING OR LEAKING CARBURETOR	Cracked carburetor body. Defective main body gasket. 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.

CONTINUED ON NEXT PAGE

CARBURETOR DIAGNOSIS GUIDE (Continued)

HARD STARTING	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. Incorrect setting of choke thermostatic spring housing. Choke linkage or plate binding. Restrictions or air leaks in the choke vacuum or hot air passages.
STALLING	**ENGINE HOT OR COLD** Incorrect idle fuel mixture. Engine idle speed too slow (fast or cold idle adjustments). Dirt, water or ice in fuel filter. Positive crankcase ventilation system malfunctioning, or restricted. Fuel lines restricted or leaking air. Fuel tank vent restricted. Leaking intake manifold or carburetor gaskets. Carburetor icing (cold, wet or humid weather).	Incorrect throttle linkage adjustment to carburetor. Clogged air bleeds or idle passages. Defective fuel pump. **ENGINE HOT ONLY** Improperly adjusted or defective carburetor dashpot. Idle compensator malfunctioning. Coolant control thermostat defective. Excessive looseness of throttle shaft in bores of throttle body.
ROUGH IDLE	Positive crankcase ventilation system malfunctioning, or restricted. Incorrect idle mixture adjustment. Idle compensator, malfunction. Idle adjusting 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 throttle plates. Excessive dirt in air cleaner. High or low fuel level or float setting.	Fuel inlet needle not seating properly, or worn needle or seat. Power valve leaking. Restricted air bleeds. Worn or damaged main metering jet. Accelerating pump discharge ball check and/or weight not seating properly. Fuel pump pressure too low, or excessive. Fuel siphoning from secondary main fuel system. Restriction in main fuel passage.
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, and defects or improper adjustments in the ignition system. **A LEAN MIXTURE ON ACCELERATION CAN BE CAUSED BY:** Low fuel pump pressure. Sticking fuel inlet needle. Low fuel level or float setting. Restriction in main fuel passage. Air leak between the carburetor	and the manifold caused by loose mounting bolts or defective gasket. Air leak at the throttle shaft caused by a worn throttle shaft. Accelerating pump diaphragm defective. Incorrect accelerating pump stroke adjustment. Accelerating pump elastomer valve not seating on acceleration. Restriction in the accelerating pump discharge passage. Accelerating pump discharge ball check or weight not coming fully off its seat, or failing to seat properly on the reverse stroke of the pump diaphragm. Air leak at the accelerating pump cover caused by a defective gasket or warped pump cover.

CONTINUED ON NEXT PAGE

CARBURETOR DIAGNOSIS GUIDE (Continued)

POOR ACCELERATION (Continued)	Defective secondary diaphragm or air horn mounting gasket (leakage). Air leak where secondary vacuum pick-up tube fits into air horn, between air horn and main body, or between the secondary diaphragm housing cover and housing. Secondary throttle plates wedged in barrels. Bent secondary throttle shaft. Secondary throttle plate operating rod binding, or disconnected from secondary diaphragm or secondary throttle lever. Secondary vacuum probe restricted or not properly positioned. Defective power valve.	**A RICH MIXTURE ON ACCELERATION CAN BE CAUSED BY:** Excessive fuel pump pressure. High fuel level or float setting. Fuel inlet needle not seating properly or worn needle and/or seat. Malfunctioning automatic choke. Excessively dirty air cleaner. Incorrect accelerating pump stroke adjustment. Power valve leakage. Restricted air bleeds. Worn or damaged main metering jet. Accelerating pump ball check and/or weight not seating properly.
INCONSISTENT ENGINE IDLE SPEED	Fast idle screw contacting low step of cam at curb idle. Incorrect throttle linkage adjustment to carburetor. Binding or sticking throttle linkage or accelerator pedal. Sticking carburetor throttle shaft. Excessive looseness of throttle shaft in bores of throttle body.	Improperly adjusted or defective carburetor dashpot. Incorrectly installed throttle plates. Idle compensator malfunctioning. Positive crankcase ventilation system malfunctioning. Sticking fuel inlet needle.
AUTOMATIC CHOKE SLOW WARM-UP, ON TOO OFTEN	Thermostatic choke setting too rich. Choke linkage sticking or binding. Incorrect choke linkage adjustment. Choke plate misaligned or binding in air horn.	Defective coolant thermostat. Restricted coolant line at carburetor. Choke heat inlet tube restricted.
SEVERE TRANSMISSION ENGAGEMENT AFTER COLD ENGINE START	Carburetor fast idle speed setting too high. Throttle operating on starting step (highest step) of fast idle cam.	Binding or sticking throttle linkage or accelerator pedal.
SURGING (CRUISING SPEEDS TO TOP SPEEDS)	Clogged main jets. Improper size main jets. Low fuel level or float setting. Low fuel pump pressure or volume.	Clogged filter screen. Distributor vacuum passage clogged. Power valve not opening.
REDUCED TOP SPEED	Float setting too high or too low. Fuel pump pressure or volume too high or too low. Improper size or obstructed main jets. Faulty choke operation. Air leak where secondary vacuum pick-up tube fits into air horn and main body; or air leakage between the secondary diaphragm housing cover and housing or the air horn mounting gasket. Secondary diaphragm return spring too stiff. Secondary throttle plates wedged in barrels.	Bent secondary throttle shaft. Secondary throttle plate operating rod binding. Secondary vacuum passage ball check sticking on its seat. Secondary vacuum pick-up tube restricted or not properly positioned. Power valve spring weak, or power valve restricted. Restricted air bleeds. Restriction in main fuel passages. Excessive dirt in air cleaner. Throttle plates not fully open.

2 COMMON ADJUSTMENTS AND REPAIRS

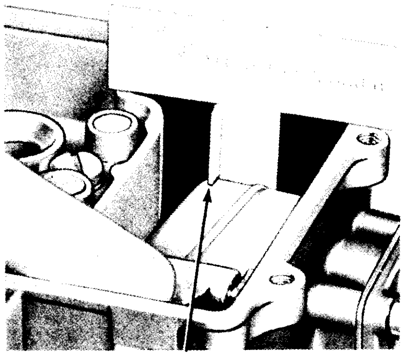


FIG. 4—Fuel Level Float Adjustment (Dry)

CARBURETOR

The fuel level float adjustment (dry) and the secondary throttle plate adjustments are performed only as bench adjustments.

The automatic choke plate clearance (pull-down) and fast idle cam linkage adjustment, automatic choke thermostatic spring housing adjustment and the accelerating pump stroke adjustment can be performed with the carburetor on the bench or in the car.

The fuel level float adjustment (wet), idle fuel mixture and idle speed adjustments, and the anti-stall dashpot adjustment are performed only with the carburetor installed in the car.

FLOAT ADJUSTMENT (DRY)

The dry float fuel level adjustment is a preliminary adjustment only. The final float adjustment must be made after the carburetor is mounted on the engine.

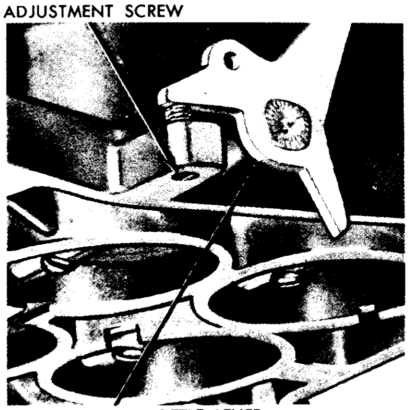


FIG. 5—Secondary Throttle Plate Adjustment

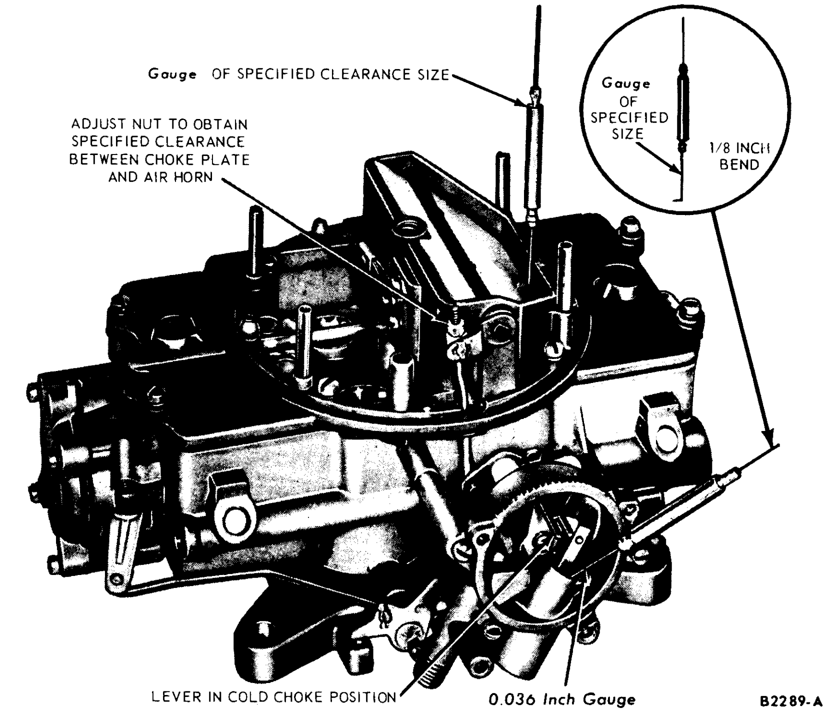


FIG. 6—Choke Plate Clearance (Pull-Down) Adjustment

1. Remove the air horn.

2. With the float raised and the fuel inlet needle seated, check the distance between the top surface of the main body and the top surface of the float for conformance to specifications. Take the measurement at a point 1/8 inch from the free end of the float and 3/16 inch in from the side of the float adjacent to the inside wall of the fuel bowl. **If the cardboard gauge is used, place the float gauge in the corner of the enlarged end section of the fuel bowl (Fig. 4). The gauge should touch the float near the end, but not on the end radius.** Depress the float tab to seat the fuel inlet needle. The float height is measured from the gasket surface of the main body with the gasket removed. If necessary, bend the tab on the float to bring the setting within the specified limits. This should provide the proper fuel level.

SECONDARY THROTTLE PLATE ADJUSTMENT

1. Hold the secondary throttle plates closed.

2. Turn the secondary throttle shaft lever adjusting screw out (counterclockwise) (Fig. 5) until the secondary throttle plates stick in the throttle bores.

3. Turn the screw in (clockwise) until the screw just contacts the secondary lever:

4. Turn the screw in (clockwise) the specified distance (Part 10-6).

AUTOMATIC CHOKE PLATE CLEARANCE (PULL-DOWN) AND FAST IDLE CAM LINKAGE ADJUSTMENT

1. If the air cleaner, heater hose and mounting bracket have not been removed previously, remove them from the carburetor.

2. Bend a specified size (Part 10-6) wire gauge (tool) at a 90° angle, approximately 1/8 inch from its end (Fig. 6).

3. Remove the choke thermostatic spring housing if it has not been removed. Block the throttle about half-open so that the fast idle cam does not contact the fast idle adjustment screw.

4. Insert the bent end of the

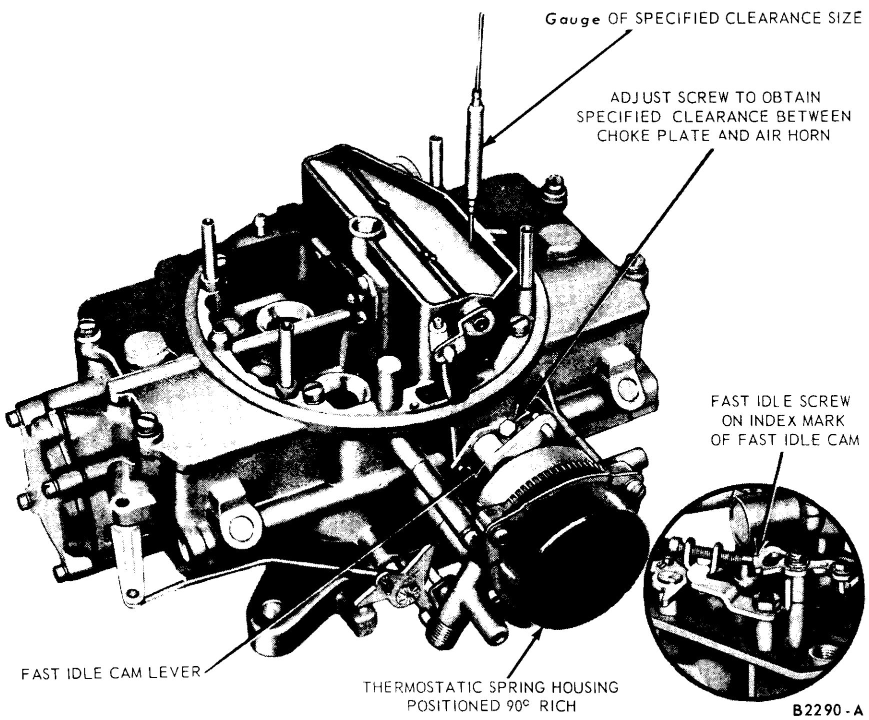


FIG. 7—Fast Idle Cam Linkage Adjustment

gauge between the lower edge of the piston slot and the upper edge of the right hand slot in the choke housing (Fig. 6), and pull the choke countershaft lever counterclockwise until the gauge is snug in the piston slot. Hold the wire gauge in place by exerting light pressure on the countershaft lever, and adjust the choke plate clevis (pull-down) adjusting nut to obtain the specified clearance (Part 10-6) between the front of the choke plate and the air horn (Fig. 6).

5. Install the choke thermostatic spring housing and gasket. Install the housing retainer and the retaining screws.

6. Position the fast idle (rpm) adjustment screw on the index mark of the fast idle cam (Fig. 7).

7. Turn the choke thermostatic cover 90° rich (counterclockwise) and check the clearance between the front of the choke plate and the air horn (Fig. 7). Adjust the clearance to specification (Part 10-6), if required. **Turn the fast idle cam lever adjusting screw clockwise (inward) to increase the clearance and counterclockwise (outward) to decrease the clearance. Make certain the fast idle screw remains on the index mark (kickdown step) of the fast idle cam during the adjustment procedure.**

8. Set the choke thermostatic housing to the specified index mark. Tighten the housing clamp retaining screws. Install the heater hose and mounting bracket on the carburetor. Adjust the engine idle speed and idle fuel mixture, and the dashpot.

AUTOMATIC CHOKE THERMOSTATIC SPRING HOUSING ADJUSTMENT

1. If the heater hose and mounting bracket, and the carburetor air cleaner assembly have not been previously removed, remove them from the carburetor.

2. Loosen the thermostatic spring housing clamp retaining screws. Set the spring housing to the specified (Part 10-6) index mark (Fig. 8) and tighten the clamp retaining screws.

3. Install the heater hose and bracket on the carburetor and tighten the bracket retaining screws. If other carburetor adjustments are not required, install the carburetor air cleaner assembly.

FUEL LEVEL FLOAT ADJUSTMENT (WET)

The dry (bench) float fuel level settings are preliminary adjustments performed during carburetor overhaul procedures on the bench. These settings are used as a guide only; therefore, a final check and adjustment of the wet fuel level should be made as follows:

1. Operate the engine for 30 minutes at 1200 rpm to normalize engine temperatures, and place the car on a flat surface as near level as possible. Stop the engine.

2. Remove the carburetor air cleaner assembly and anchor screw (if they have not been previously removed), the carburetor air horn assembly and gasket.

3. Temporarily place the air horn gasket in position on the carburetor main body and start the engine. Let the engine idle for several minutes, then remove the air horn gasket.

4. While the engine is idling, use a standard depth scale to measure the vertical distance from the top machined surface of the carburetor main body to the level of the fuel in the fuel bowl (Fig. 9). The measurement must be made at least ¼ inch away from any vertical surface to assure an accurate reading, because the surface of the fuel is concave (higher at the edges than in the center). Care must be exercised to measure the fuel level at the point of contact with the fuel. Refer to the specifications (Part 10-6) for the correct fuel level (wet) setting.

5. **If any adjustment is required, stop the engine to minimize the hazard of fire due to fuel spray when the float setting is disturbed.** To adjust the fuel level, bend the

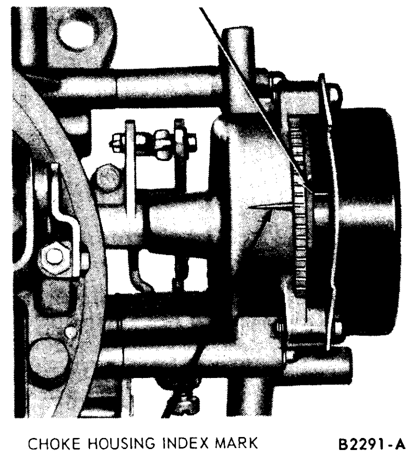


FIG. 8—Automatic Choke Thermostatic Spring Housing Adjustment

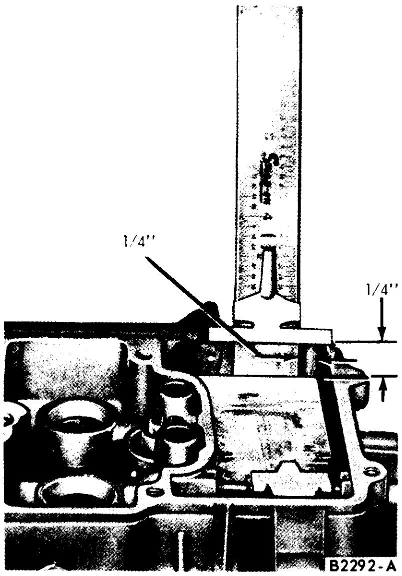


FIG. 9—Fuel Level Float Adjustment (Wet)

float tab (contacting the fuel inlet valve) upward in relation to the original position to raise the fuel level, and downward to lower it. Each time an adjustment is made to the float tab to alter the fuel level, the engine must be started and permitted to idle for at least three minutes to stabilize the fuel level. Check the fuel level after each adjustment until the specified level is achieved.

6. Install the new air horn gasket and the carburetor air horn assembly.

7. Check the idle fuel mixture and the idle speed adjustment, and the carburetor dashpot. Adjust the carburetor as required.

8. Install the anchor screw and the air cleaner assembly.

IDLE FUEL MIXTURE AND IDLE SPEED ADJUSTMENTS

The engine idle speed is adjusted to settings for a hot engine, and a cold engine (fast idle speed) during choke operation. With the air cleaner removed make the idle adjustments in the following sequence:

INITIAL IDLE MIXTURE SETTING

Initially set the idle mixture by turning the idle mixture screws (needles) inward (clockwise) until lightly seated; then, turn the screws outward (counterclockwise) the specified turns (Part 10-6) (Fig. 10). **Do not turn the needles tightly against their seats as this may**

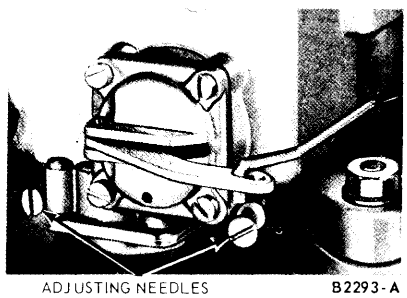


FIG. 10—Idle Fuel Mixture Adjustment

groove the ends. If the needle is damaged, it must be replaced before a satisfactory fuel mixture can be obtained.

ENGINE IDLE SPEED AND MIXTURE (HOT)

1. Operate the engine for 30 minutes at approximately 1200 rpm to stabilize engine temperatures. **On a car with an air conditioner, operate the air conditioner for 20 minutes before setting the engine idle speed. The engine idle speed is adjusted with the air conditioner operating.**

2. Allow the throttle to drop back to the normal idle speed position. Attach a tachometer to the engine. Remove the vacuum line from the vacuum power unit of the automatic vacuum release parking brake assembly, and plug the vacuum line. Set the parking brake. **It is necessary to inactivate the vacuum power unit to keep the parking brake engaged when the engine is running during the adjustment procedures.**

3. Turn on the headlamps. **It is necessary to place the alternator under a load condition in this manner in order to obtain the specified engine idle speed during the adjustment procedure.** Place the transmission selector lever in drive range. Check the engine idle speed. **Be sure the dashpot is not interfering with the throttle lever or the fast idle screw is not contacting the fast idle cam. Also, be sure the hot idle compensator is seated to allow for proper adjustment.**

4. Adjust the engine idle speed to specifications (Part 10-6) by turning the engine idle speed screw inward to increase the speed or outward to decrease the speed (Fig. 11).

5. Turn each idle mixture needle inward until engine rpm begins to drop, due to the lean mixture (Fig. 11); then turn each needle outward until the rpm increases and then begins to drop, due to the rich mixture, then turn the needles inward for maximum engine rpm and smoothness. **The needles should be turned approximately the same amount. The final setting may vary about ½ turn difference between needles.**

6. After the correct engine idle

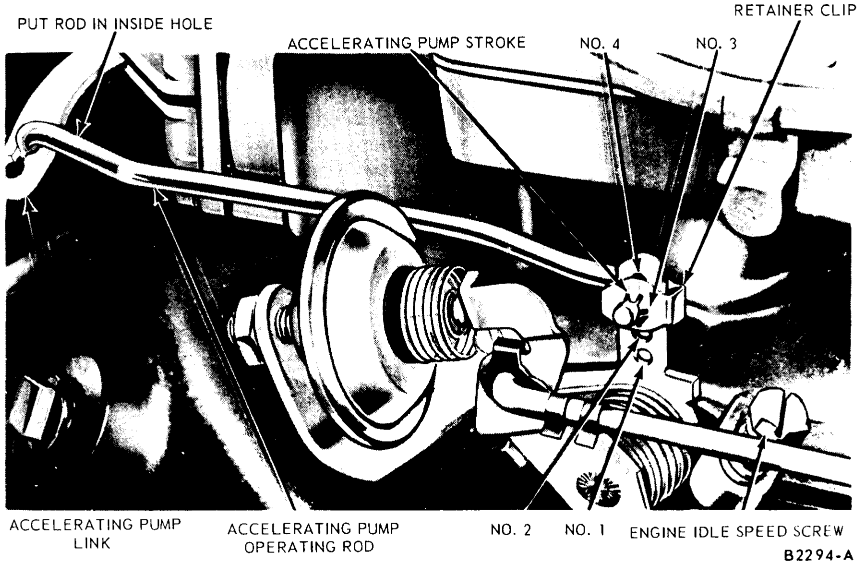


FIG. 11—Accelerating Pump Stroke and Engine Idle Speed Adjustment Points

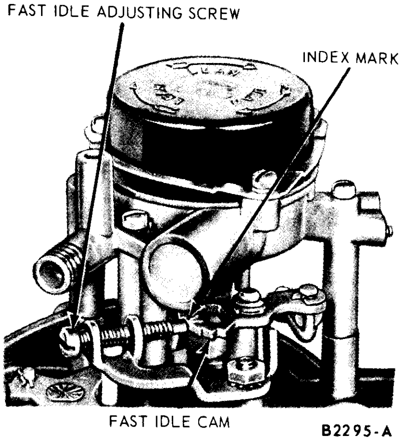


FIG. 12—Engine Fast (Cold Engine) Idle Speed Adjustment

mixture has been obtained, check the idle speed by placing **the transmission selector lever in neutral and manually opening and closing the throttle.** Position the selector lever in drive range, then check and adjust the idle speed to specification (Part 10-6), if necessary. Shut off the engine.

The final engine idle speed may be varied to suit the conditions under which the car is to be operated.

ENGINE FAST (COLD ENGINE) IDLE SPEED

The adjusting screw on the right side of the carburetor (Fig. 12) contacts one edge of the fast idle cam. The cam permits a faster engine idle speed for smoother running when the engine is cold during choke operation. As the choke plate is moved through its range of travel from the closed to the open position, the fast idle cam pick-up lever rotates the fast idle cam. Each position on the fast idle cam permits a slower idle rpm as engine temperature rises and choking is reduced.

1. Manually rotate the fast idle cam (Fig. 12) until the fast idle adjusting screw rests adjacent to the shoulder of the highest stop (screw aligned with arrow mark) on the cam.
2. Start the engine, and turn the fast idle adjusting screw inward or outward as required to obtain the specified fast idle rpm (Part 10-6).
3. Remove the tachometer if the idle fuel mixture does not require adjustment. If the idle fuel mixture requires adjustment, leave the tachometer installed so that the idle speed can be checked after the idle fuel mixture has been adjusted.

ACCELERATING PUMP STROKE

The primary throttle shaft lever (overtravel lever) has 4 holes and the accelerating pump link has 2 holes (Fig. 11) to control the accelerating pump stroke for various ambient temperatures and operating conditions of the engine.

The accelerating pump stroke adjustment is made with the carburetor air cleaner assembly removed from the carburetor.

The accelerating pump operating rod should be in the specified (Part 10-6) hole in the overtravel lever and the inboard hole (hole closest to the pump plunger) in the accelerating pump link (Fig. 11). To release the rod from the retainer clip, press the tab end of the clip toward the rod; then, at the same time, press the rod away from the clip until it is disengaged.

ANTI-STALL DASHPOT

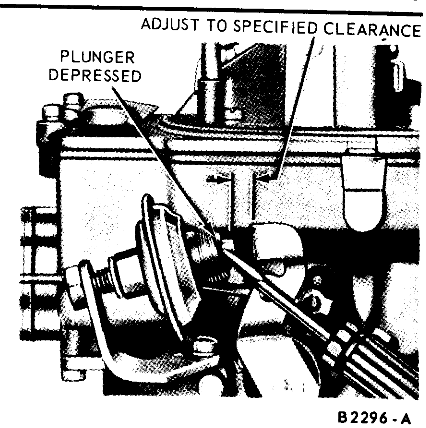


FIG. 13—Anti-Stall Dashpot Adjustment

1. The anti-stall dashpot adjustment is made with the carburetor air cleaner assembly removed from the carburetor. With the engine idle speed and idle mixture properly adjusted, and the engine at normal operating temperature, loosen the anti-stall dashpot lock nut (Fig. 13).
2. Hold the throttle in the closed position and depress the plunger with a screwdriver blade. Check the clearance between the throttle lever and the plunger tip with a feeler gauge of the specified clearance (Part 10-6) dimension. Turn the anti-stall dashpot, in its bracket, in a direction to provide the specified clearance between the tip of the plunger and the throttle lever. Tighten the lock nut to secure the adjustment.
3. Place the tıansmission in neutral, and turn off the engine. Connect the vacuum line to the vacuum power unit of the automatic vacuum release parking brake assembly.

THROTTLE LINKAGE ADJUSTMENTS

The throttle linkage adjustments are covered in Group 7.

3 CLEANING AND INSPECTION

CARBURETOR

The cleaning and inspection procedures in this section are for a complete carburetor overhaul; therefore, for partial carburetor overhaul or parts replacement, follow the pertinent cleaning or inspection procedure.

Dirt, gum, water or carbon contamination in the carburetor or the exterior moving parts of the carburetor are often responsible for unsatisfactory performance. For this reason, efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection of only those parts not included in the carburetor overhaul repair kit are covered here. 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, the power valve, the secondary operating 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, then dry them with compressed air. Wipe all parts that can not be immersed in solvent with a clean, soft, dry cloth. Be sure all dirt, gum, carbon, and other foreign matter are removed from all parts.

Force compressed air through all passages of the carburetor. **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 for ease of operation and free it if necessary.

Check the throttle shafts in their bores for excessive looseness or binding and check the throttle plates for burrs which prevent proper closure.

Inspect the main body, air horn, nozzle bars and booster venturi assemblies, choke housing and thermostatic spring housing, power valve cover, accelerating pump cover, and the secondary operating diaphragm cover for cracks.

Check the floats for leaks by holding them under water that has been heated to just below the boiling point. Bubbles will appear if there is a leak. If a 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 with crocus cloth or steel wool. Replace the float shafts if they are 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 idle tubes in each nozzle bar assembly. If they are plugged, bent, or broken, replace the booster venturi and nozzle bar assembly.

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.

FUEL PUMP

MAINTENANCE

Refer to Group 19 for the recommended maintenance mileage interval.

Clean the fuel pump body with a cloth. Clean the filter housing in solvent. Inspect the fuel pump for cracks or damage. Inspect the mounting flange for distortion. Lap the distorted flange, if necessary. Inspect the rocker arm spring, pin, and the rocker arm for wear, cracks or damage. **The rocker arm spring, pin and the rocker arm are the only fuel pump components that are replaceable. If any other fuel pump components are damaged beyond repair, replace the fuel pump.**

AIR CLEANER

MAINTENANCE

Refer to Group 19 for the recommended air cleaner assembly maintenance mileage interval.

REMOVAL AND INSTALLATION

Refer to Part 10-3, Section 2 for the air cleaner assembly removal and installation procedures.

FILTER ELEMENT

The filter element must never be cleaned with a solvent or cleaning solution. Also, oil must not be added to the surfaces of the filter element or air cleaner body.

There are two procedures that can be used to clean the air filter element. One method is performed with the use of compressed air. The other is performed by tapping the element on a smooth, horizontal surface.

Compressed Air Method. Direct a stream of compressed air through the element in the direction opposite that of the intake air flow, that is from the inside outward. **Extreme care must be exercised to prevent rupture of the element material.**

Tapping Method. Hold the element in a vertical position and tap it lightly against a smooth, horizontal surface to shake the dust and dirt out. **Do not deform the element or damage the gasket surfaces by tapping too hard.** Rotate the filter after each tap until the entire outer surface has been cleaned.

Inspection. Hold the filter in front of a back-up light and carefully inspect it for any splits or cracks. If the filter is split or cracked, replace it.

BODY AND COVER

Clean the air cleaner body and the cover with a solvent or compressed air. **Probe the air cleaner body at the positive crankcase ventilation system inlet connection to assure removal of deposits.** Wipe the air cleaner dry if a solvent is used. Inspect the air cleaner body and cover for distortion or damage at the gasket mating surfaces. Replace the cover or body if they are damaged beyond repair.

PART 10-2 FORD 4-V CARBURETOR

1 DESCRIPTION AND OPERATION

DESCRIPTION

The Ford 4-V carburetor (Figs. 1, 2, and 3) has two main assemblies; the air horn, and the main body.

The air horn assembly, which serves as the main body cover, contains the choke plate, the hot idle compensator, the vents for the fuel bowls, the secondary throttle control vacuum tube, and the automatic choke clean air pick-up tube. A rubber hose and steel tube connects the clean air pick-up tube to the automatic choke heat chamber in the right exhaust manifold.

The primary and secondary throttle plates, the accelerating pump assembly, the power valve assembly, the secondary operating diaphragm assembly, and the fuel bowls are in the main body. The automatic choke housing is attached to the main body.

The two primary (front) barrels each contain a main and booster venturi, main fuel discharge, accelerating pump discharge, idle fuel discharge, and a primary throttle plate.

The two secondary (rear) barrels each have a main fuel discharge, and a vacuum operated throttle plate.

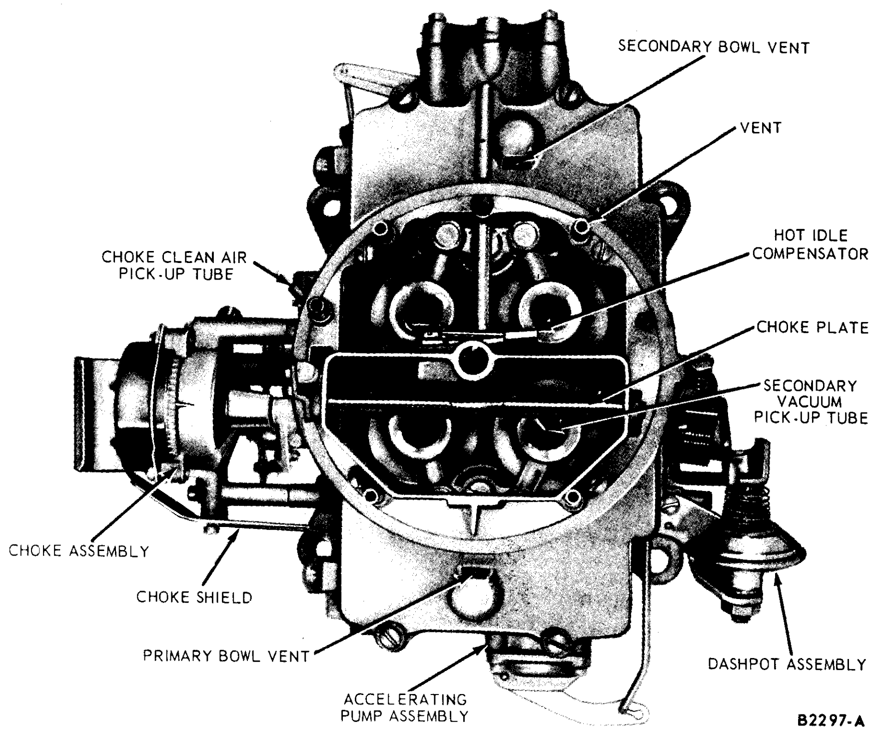


FIG. 1—Top View—Air Horn Installed

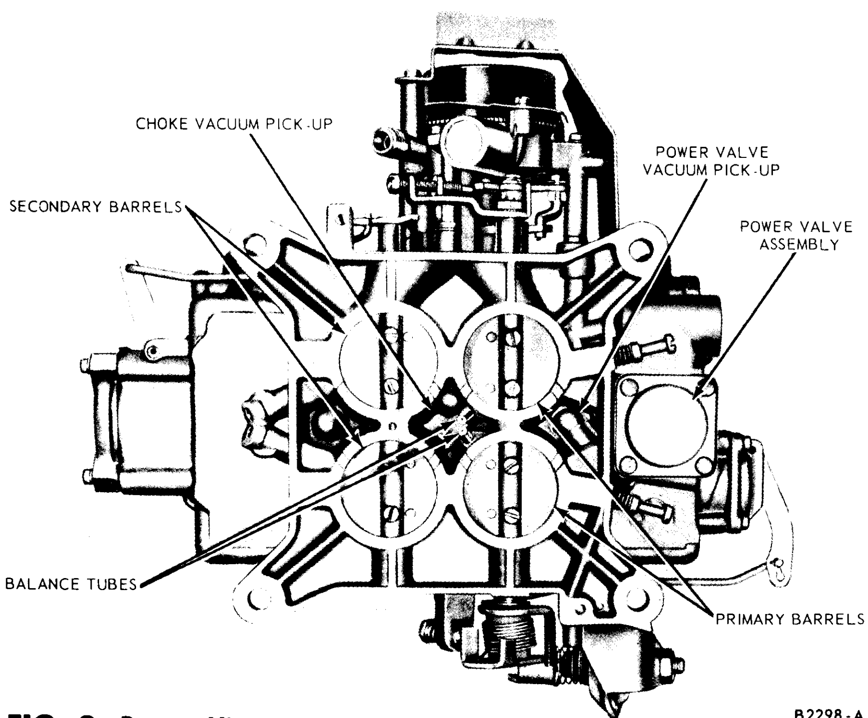


FIG. 2—Bottom View

OPERATION

FUEL INLET SYSTEM

A separate fuel bowl is provided for the primary and secondary stages (Fig. 4). The fuel first enters the primary fuel bowl through the fuel inlet. A drilled passage through the right side of the main body connects the fuel bowls. The pressure in the two fuel bowls is balanced by means of a pressure equalizing chamber built into the left side of the main body. Two baffles in the internal fuel equalizer passage between the primary and secondary fuel bowls permit proper control and balance of the metering forces within each fuel bowl.

The amount of fuel entering a fuel bowl is regulated by the distance the fuel inlet needle is raised off its

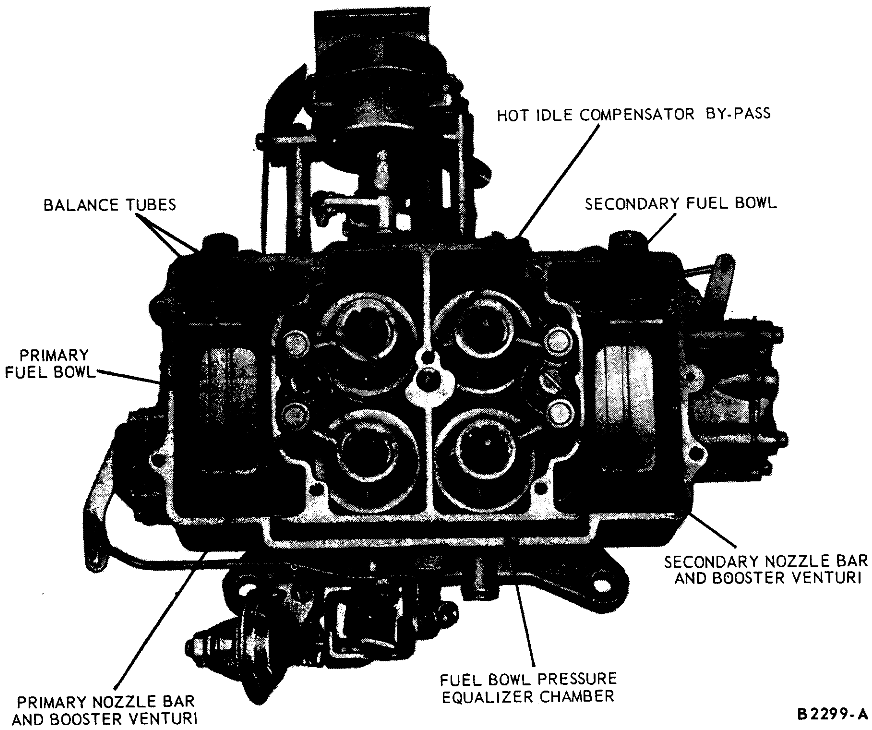


FIG. 3—Top View—Air Horn Removed

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 lowers the fuel inlet needle to a position where it restricts the flow of fuel, admitting only enough fuel thru

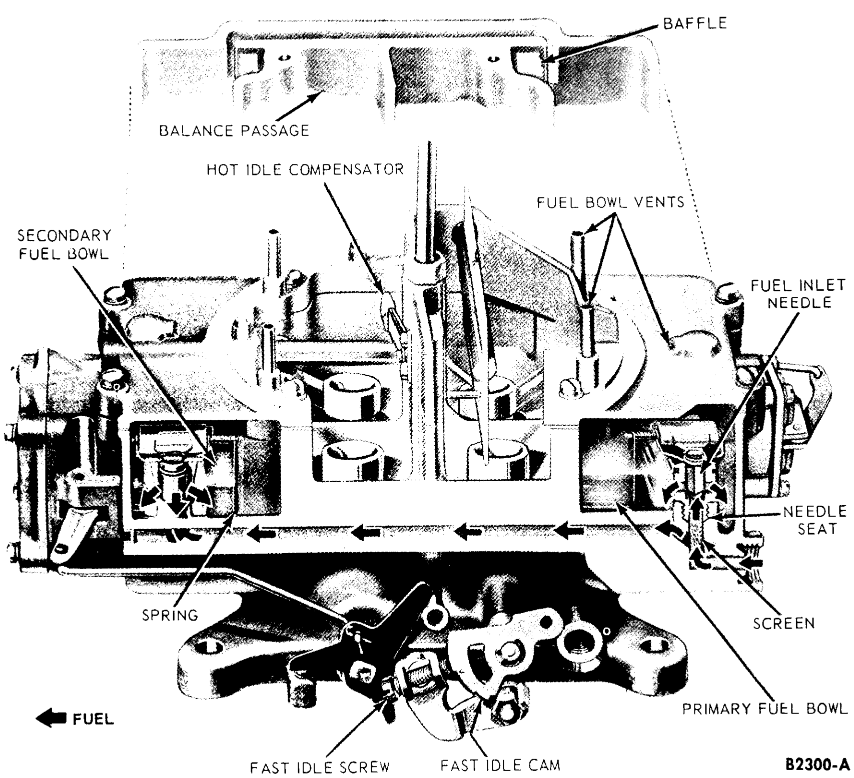


FIG. 4—Fuel Inlet System

the filter screen to replace that being used.

A retracting clip is attached to the fuel inlet needle and hooks over the tab of the float assembly. This clip assures reaction of the fuel inlet needle to any movement of the float.

A wire-type retainer prevents movement of the float shaft within the guides on each side of the fuel bowl. The retainer fits into a groove on the inlet needle seat. The ends of the retainer are hooked over grooves on opposite ends of the float shaft.

A torsion (damper) spring is located on the float shaft, between the inboard end of the float retainer and the float shaft guide in the fuel bowl. The short end of the spring rests under the float lever, and the long end of the spring rests against the inner face of the fuel bowl.

The torsion spring tension resists and absorbs fuel pump pressure pulsations and movement of the fuel in the bowl due to driving conditions. This assures proper regulation of the fuel inlet needle which rises and falls with the fuel level in the bowl.

The fuel filter screen, located below the inlet needle seat, prevents the entrance of foreign matter.

The primary and secondary fuel bowls are vented externally at all times. In addition, both the primary and secondary fuel bowls are internally vented into the air cleaner. The standpipe pitot tubes in the primary and secondary internal vent tube openings raise the level of the internal vent openings above the external vent openings. This provides the necessary pressure differential for proper evacuation of the gaseous vapors through the external vent during a hot soak period.

An integral anti-splash washer is located on top of each fuel inlet needle.

AUTOMATIC CHOKE SYSTEM

The choke plate, located in the air horn above the primary barrels, when closed, provides a high vacuum above as well as below the throttle plates. With a vacuum above the throttle plates, fuel will flow from the main fuel system as well as from the idle fuel system. This provides the extremely rich fuel mixture necessary for cold engine operation.

The carburetor choke shaft is

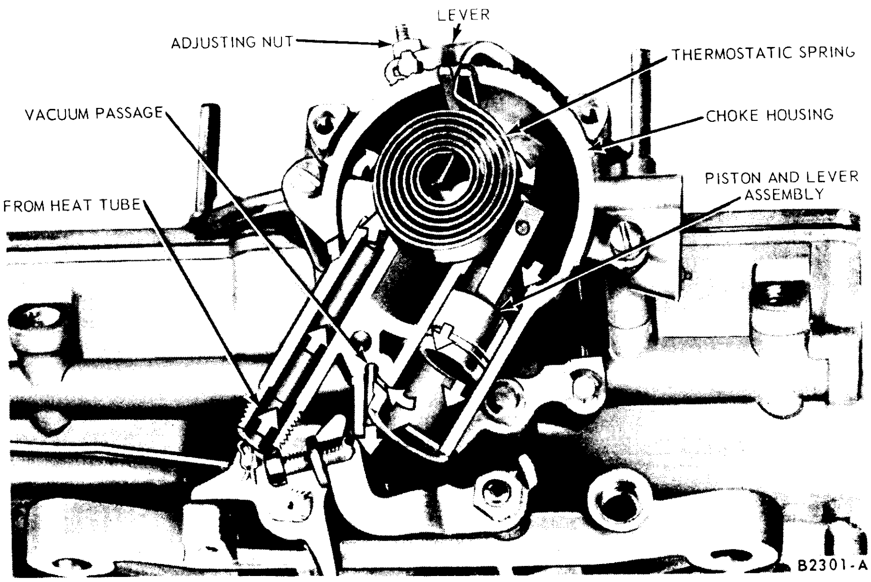


FIG. 5—Automatic Choke System

linked to a thermostatic choke control mechanism mounted on the main body (Fig. 5).

The linkage between the choke lever and the throttle shaft is designed so that the choke plate will partially open when the accelerator is fully depressed. This permits unloading of a flooded engine.

The automatic choke is equipped with a bi-metal thermostatic spring and a vacuum piston (Fig. 5). The bi-metal thermostatic spring mechanism winds up when cold and unwinds when warm. When the engine is cold, the thermostatic spring, through attaching linkage, holds the choke piston upward and the choke plate in a closed position prior to engine start. Manifold vacuum channeled through a passage in the choke control housing, draws the choke vacuum piston downward, exerting an opening force on the choke plate.

When the engine is started, manifold vacuum, acting directly on the piston located in the choke housing, immediately moves the plate against the tension of the thermostatic spring to a partially open position to prevent stalling.

As the engine continues to operate, manifold vacuum draws heated air from the exhaust manifold heat chamber. The amount of air entering the choke housing is controlled by restrictions in the air passages in the carburetor.

The warmed air enters the choke housing and heats the thermostatic spring, causing it to unwind. The tension of the thermostatic spring gradually decreases as the temperature of the air from the heat chamber rises, allowing the choke plate to open. The air is exhausted into the intake manifold.

When the engine reaches its normal operating temperature, the thermostatic spring exerts tension on the choke plate forcing it to the full open position. In this position, the choke piston it at its lowest point in the cylinder. Slots in the piston chamber wall allow sufficient air to bleed past the piston and into the intake manifold, causing a continual flow of warm air to pass through the thermostatic spring housing. The spring thus remains heated and the choke plate remains fully open until the engine is stopped and allowed to cool.

The choke rod actuates the fast idle cam during choking. Steps on the edge of the fast idle cam contact the fast idle adjusting screw which permits a faster engine idle speed for smoother running when the engine is cold. As the choke plate is moved through its range of travel from the closed to the open position, the choke rod rotates the fast idle cam. Each step on the fast idle cam permits a slower idle rpm as engine temperature rises and choking is reduced.

During the warm-up period, if the engine should reach the stall point due to a lean mixture, manifold vacuum will drop considerably. The tension of the thermostatic spring then overcomes the lowered vacuum acting on the choke piston, and the choke plate will be moved toward the closed position, providing a richer mixture to help prevent stalling.

The linkage between the choke lever and the throttle shaft is designed so that the choke plate will partially open when the accelerator pedal is fully depressed. This permits unloading of a flooded engine.

IDLE FUEL SYSTEM

The difference in pressure between the fuel bowls and the idle discharge ports forces fuel through the primary and secondary stage idle fuel systems.

Primary Stage. Fuel flows from the primary stage fuel bowl through the main jet and into the bottom of the main well (Fig. 6).

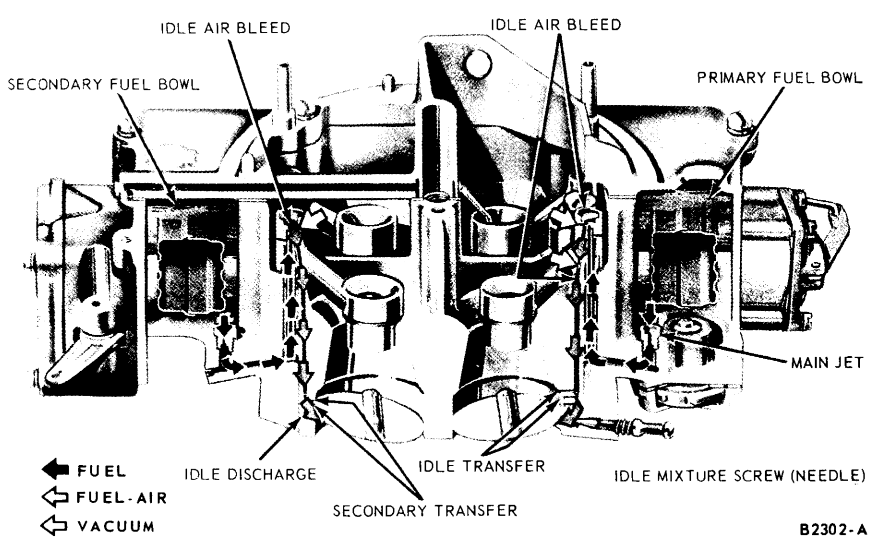


FIG. 6—Idle Fuel System

From the main well, the fuel flows up through the idle tube and through a short diagonal passage in the booster venturi assembly into the idle passage in the main body. A calibrated restriction, at the upper tip of the idle tube, meters the flow of fuel.

Air enters the idle system from the air bleed which is located directly above the idle tube. The air bleed also acts as a vent to prevent siphoning at off-idle or high speeds and when the engine is stopped. The fuel and air pass down a diagonal passage in the booster venturi and through a calibrated restrictor. Additional air is bled into the system through an air bleed located at the bottom of the diagonal passage where the fuel enters the idle passage in the main body.

Fuel flows down the idle passage in the main body past two idle transfer holes. The idle transfer holes act as additional air bleeds at curb idle. The fuel then flows past the pointed tip of the adjusting needle which controls the idle fuel discharge in the primary stage. From the adjusting needle chamber, the fuel flows through a short horizontal passage and is discharged below the primary throttle plates.

During off-idle when the primary throttle plate is moved slightly past the idle transfer holes, each hole begins discharging fuel as it is exposed to manifold vacuum. As the primary throttle plate is opened still wider and engine speed increases, the air flow through the carburetor is also increased. This creates a vacuum in

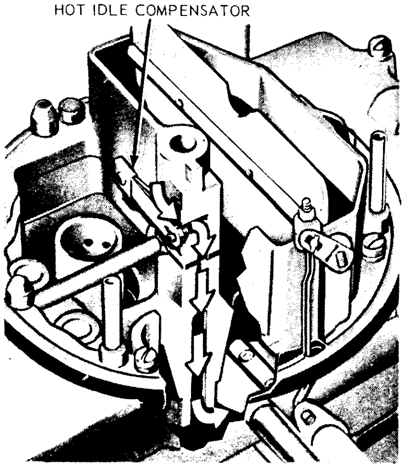


FIG. 7—Hot Idle Compensator System

the booster venturi strong enough to bring the primary stage main fuel system into operation. Fuel flow from the primary idle fuel system begins tapering off as the main fuel system begins discharging fuel.

Hot Idle Compensator System. A thermostatically controlled hot idle compensator is located on the air horn above the secondary booster venturis (Fig. 7). At carburetor high inlet air temperatures, the hot idle compensator will open and allow air to bypass the throttle plates through a passage in the air horn and main body and enter the intake manifold. This improves idle stability and minimizes the effect of fuel vaporization which results in excessively rich idle mixtures.

Secondary Stage. Fuel flows from the secondary stage fuel bowl through the main jet and into the bottom of the main well (Fig. 6).

From the main well, the fuel flows up through the idle tube and through a short diagonal passage in the booster venturi assembly and then into the idle passage in the main body. A calibrated restriction, at the upper tip of the tube, meters the flow of fuel.

Fuel flows down the idle passage in the main body, past two transfer holes above the closed throttle plate, and flows through a metered restriction into a short horizontal passage where it is discharged into the secondary barrel below the closed throttle plate. The transfer holes act as air bleeds at idle. The secondary idle fuel system continues discharging fuel until the secondary main fuel system comes into operation.

Air is introduced into the secondary stage idle fuel system from the idle air bleed, located directly above the idle tube. The air bleed also acts as a vent to prevent siphoning in the idle fuel system at high speeds and when the engine is stopped.

ACCELERATING SYSTEM

Upon accelerating, the air flow through the carburetor responds almost immediately to the increased throttle opening. There is, however, a brief interval before the fuel, which is heavier than air, can gain speed and maintain the desired balance of fuel and air. During this interval, the accelerating system (Fig. 8) supplies fuel until the other systems can once again provide the proper mixture.

When the throttle is closed, the diaphragm return spring forces the diaphragm toward the cover, drawing fuel into the chamber through the inlet. The inlet has an Elastomer valve which uncovers the inlet hole to admit fuel from the fuel bowl and covers the inlet hole when the accelerating pump is operated to prevent the fuel from returning to the bowl. A discharge weight and ball check prevents air from entering from the discharge nozzle when fuel is drawn into the diaphragm chamber.

When the throttle is opened, the diaphragm rod is forced inward, forcing fuel from the chamber into the discharge passage. Fuel under pressure forces the pump discharge weight and ball off their seat and fuel passes through the accelerating pump discharge screw and is sprayed into each main venturi through discharge ports.

An air bleed in the wall of the accelerating pump fuel chamber pre-

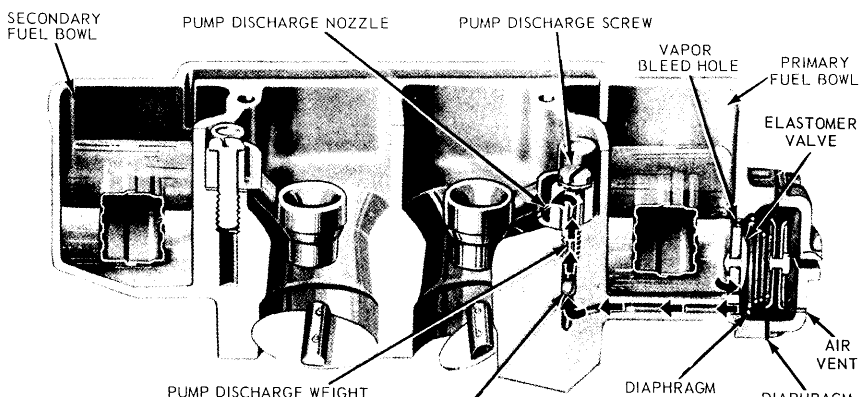


FIG. 8—Accelerating System

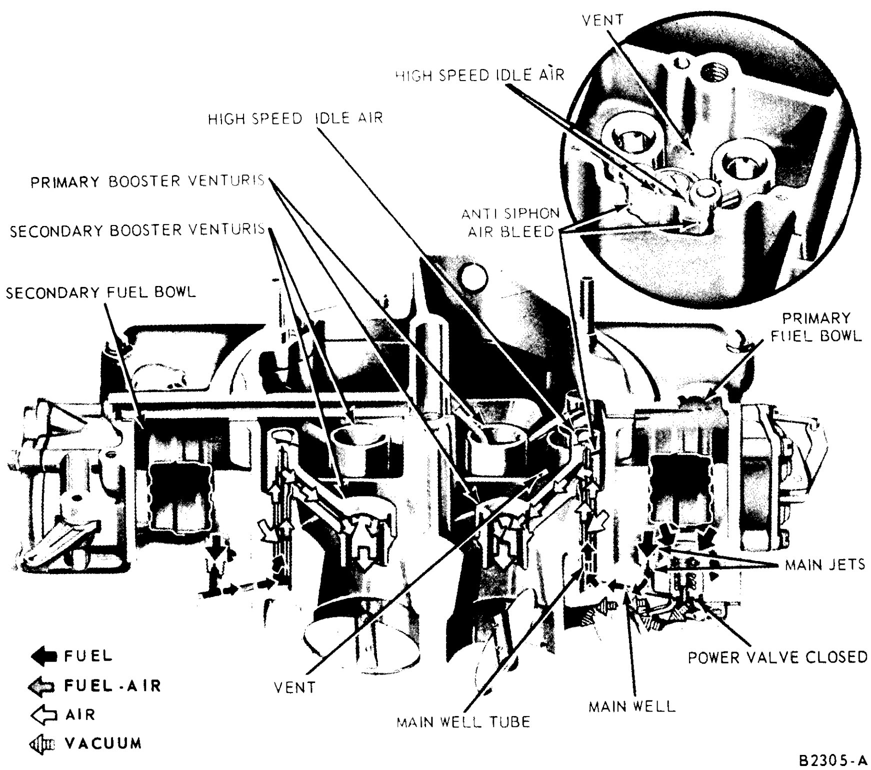


FIG. 9–Primary Stage Main Fuel System

vents vapor entrapment and pressure build-up in the diaphragm chamber.

PRIMARY STAGE MAIN FUEL SYSTEM

As engine speed increases, the air passing through the booster venturi creates a vacuum. The amount of vacuum is determined by the air flow through the venturi, which in turn is regulated by the speed of the engine. The difference in pressure between the main discharge port and the fuel bowl causes fuel to flow through the main fuel system (Fig. 9).

At a predetermined venturi vacuum, fuel flows from the primary fuel bowl, through the main jets, and into the bottom of the main well. The fuel moves up the main well tube past air bleed holes. Filtered air from the high speed air bleed enters the fuel flow in the main well tube through holes in the side of the tube. The high speed air bleed meters an increasing amount of air to the fuel as venturi vacuum increases, maintaining the required fuel-air ratio. The mixture of fuel and air is lighter than raw fuel and responds faster to changes in venturi vacuum. It also atomizes more readily than raw fuel. The fuel and air continue up the main well tube past another air bleed which also acts as a vent to prevent siphoning when the engine is shut down. The fuel is discharged into the booster venturi where it is atomized and mixed with the air flowing through the carburetor.

The throttle plate controls the amount of the fuel-air mixture admitted to the intake manifold, regulating the speed and power output of the engine.

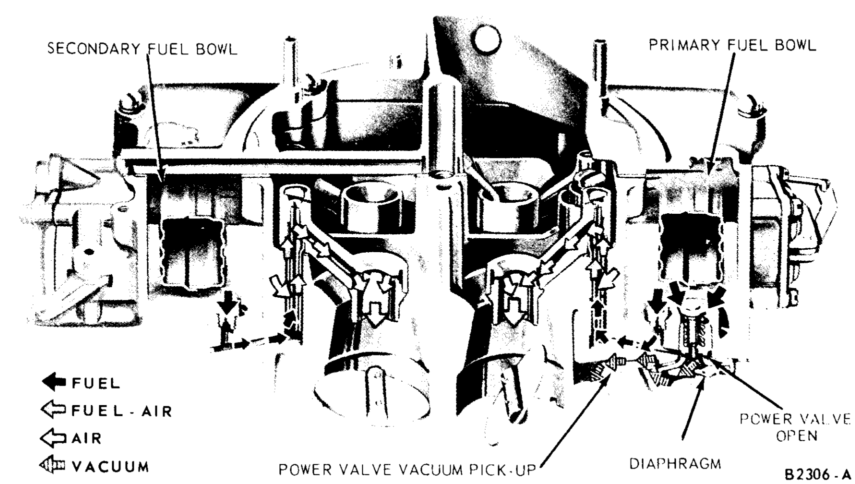


FIG. 10–Power Fuel System

A balance tube is located in each primary barrel directly below the booster venturi. When decelerating, the balance tube siphons off any excess fuel droplets remaining around the edge of the booster venturi and discharges the droplets into the equalizing slots in the base of the carburetor where they are mixed with the idle fuel. The balance tube also acts as an additional air bleed during the idle fuel system operation.

POWER FUEL SYSTEM

During periods of increased road loads or high speed operation, the fuel-air ratio must be increased for added power. The added fuel required during this period is supplied by the power fuel system (Fig. 10).

The power fuel system is controlled by manifold vacuum.

Manifold vacuum is transmitted from an opening in the base of the main body, through a passage in the main body and power valve chamber to the power valve diaphragm. The manifold vacuum, acting on the power valve at idle speed or normal road load conditions, is great enough to hold the power valve diaphragm down, overcoming the tension of the spring on the valve stem and holding the valve closed. When high power operation places a greater load on the engine and manifold vacuum drops below a predetermined value, the spring opens the power valve. Fuel from the primary fuel bowl flows through the power valve and into passages leading to both primary stage main fuel wells. Here the fuel is added to the fuel from the primary stage main fuel system, enriching the mixture.

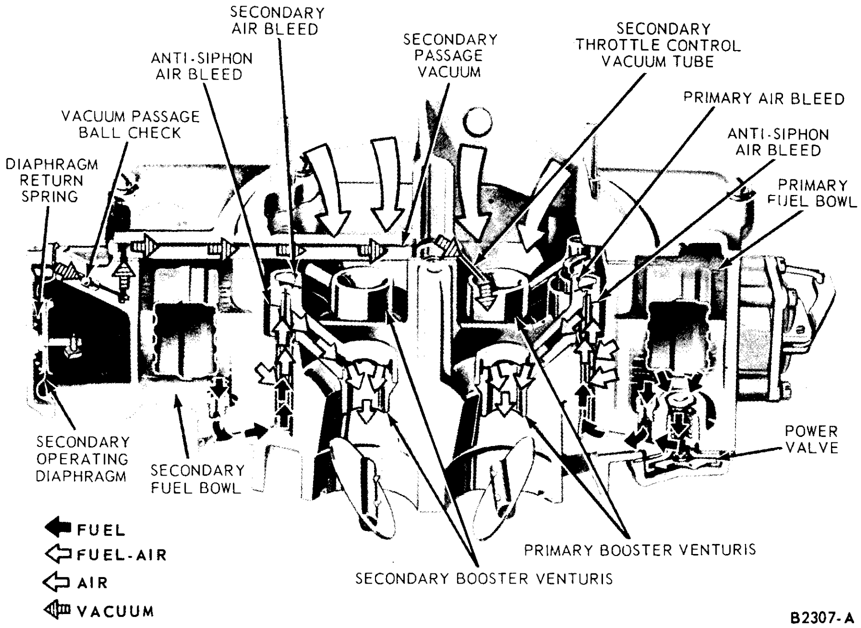


FIG. 11—Secondary Stage Main Fuel System

As engine power demands are reduced, manifold vacuum increases. The increased vacuum overcomes the tension of the valve stem spring and closes the power valve.

SECONDARY THROTTLE OPERATION AND MAIN FUEL SYSTEM

To provide sufficient fuel-air mixture to operate the engine at maximum power, the mixture supplied by the primary stage is supplemented by an additional quantity of fuel-air mixture from the secondary stage (Fig. 11).

This additional supply of fuel-air mixture is delivered through the two secondary (rear) barrels of the carburetor. The secondary stage throttle plates are operated by a spring-loaded vacuum diaphragm assembly attached to the main body and linked to the secondary throttle shaft.

Opening of the secondary throttle plates is controlled by vacuum from the left primary booster venturi. The vacuum is transmitted from the secondary throttle control vacuum tube through passages in the air horn, main body, and behind the secondary operating diaphragm.

As the primary throttle plates are opened, primary venturi vacuum increases. When the vacuum reaches a predetermined amount, it starts to act on the secondary stage operating diaphragm, which in turn starts to open the secondary throttle plates.

A ball check, located in the vacuum passage in the diaphragm housing, controls the rate at which the secondary throttle plates are allowed to open. Any rapid increase in vacuum which would tend to open the secondary throttle plates too suddenly holds the ball check against its seat. The opening of the secondary throttle plates is slowed to a rate governed by the amount of vacuum passing through a bleed in the ball seat.

As the secondary throttle plates begin to open, fuel flows from the secondary fuel bowl through the secondary main jets into the bottom of the main well and up the main well tube past air bleed holes. Air is introduced through an air bleed at the top of the tube. When the secondary throttle plates are moved slightly past the secondary transfer holes, each hole begins discharging fuel as it is exposed to manifold vacuum. As secondary venturi vacuum is increased, the fuel is discharged into the secondary booster venturi. Fuel from the transfer holes tapers off and the holes act as additional air bleeds.

When decelerating, vacuum in the primary venturi decreases, and the secondary throttle plates begin to close. The ball check in the diaphragm housing passage will unseat when the throttle is closed quickly, allowing the low pressure on the vacuum side of the diaphragm to rapidly return to atmospheric pressure. As the vacuum acting on the diaphragm is lessened, the load on the diaphragm spring will start closing the secondary plates.

2 IN-CAR ADJUSTMENT AND REPAIR

CARBURETOR ADJUSTMENTS

All carburetor adjustments are covered in Part 10-1, Section 2, "Common Adjustments and Repairs."

The fuel level float adjustment (dry) and the secondary throttle plate adjustment are performed only as bench adjustments.

The choke plate clearance (pulldown) and fast idle cam linkage adjustment, the automatic choke thermostatic spring housing adjustment, the accelerating pump stroke adjustment, and the initial idle mixture setting can be performed with the carburetor on the bench or installed in the car.

The fuel level float adjustment (wet), the idle fuel mixture and idle speed adjustments, and the anti-stall dashpot adjustment are performed only with the carburetor installed in the car.

THROTTLE LINKAGE ADJUSTMENTS

The throttle linkage adjustments are covered in Group 7.

REPAIRS

AIR HORN TO MAIN BODY GASKET REPLACEMENT

1. Remove the air cleaner assembly (Part 10-3, Section 2). Remove the air cleaner anchor screw.

2. Disconnect the automatic choke clean air tube at the carburetor.

3. Remove the automatic choke plate operating rod to choke lever retainer.

4. Remove the air horn retaining screws and lockwashers, and the carburetor identification tag. Remove

the air horn and air horn gasket.

5. Install a new air horn to main body gasket. **Make sure all holes in the new gasket have been properly punched and that no foreign material has adhered to the gasket.**

6. Position the air horn on the main body and gasket so that the choke plate operating rod fits into the opening in the choke housing lever. Install the choke plate rod retainer. **Use care to prevent damage to the secondary throttle control vacuum tube during the air horn installation.**

7. Install the air horn retaining screws and lockwashers and the identification tag. Install the air cleaner anchor screw.

8. Connect the automatic choke clean air tube to the carburetor.

9. Adjust the idle fuel mixture and idle speed and the dashpot (Part 10-1, Section 2).

10. Install the carburetor air cleaner assembly (Part 10-3, Section 2).

FLOAT, NEEDLE VALVE AND SEAT, OR INLET SCREEN REMOVAL OR REPLACEMENT

1. Remove the carburetor air horn to main body gasket by following steps 1 thru 4 under "Air Horn to Main Body Gasket Replacement" in this section.

2. Remove the carburetor float(s) and the fuel inlet needle assembly(ies) by following step 1 under "Main Body Disassembly" (Part 10-2, Section 4).

3. If required, remove the fuel inlet needle seat(s), gasket(s) and filter screen(s) by following step 2 under "Main Body Disassembly" (Part 10-2, Section 4).

4. Install the fuel inlet filter(s), needle valve seat(s) and gasket(s) by following step 13 under "Main Body Assembly" (Part 10-2, Section 4).

5. Install the carburetor float(s) and fuel inlet needle(s) by following steps 14 thru 16 under "Main Body Assembly" (Part 10-2, Section 4).

6. Install the carburetor air horn and gasket by following steps 5 thru 7 under "Air Horn to Main Body Gasket Replacement" in this section.

7. Perform a fuel level float adjustment (wet) by following steps 1 thru 8 under "Fuel Level Float Adjustment—Wet" (Part 10-1, Section 2).

MAIN JET REPLACEMENT

1. Remove the carburetor float(s), needle valve(s), seat(s) and inlet screen(s) by following steps 1 thru 3 of "Float, Needle Valve and Seat, or Inlet Screen Removal or Replacement" in this section.

2. Remove the carburetor main jet(s) with a jet wrench.

3. Install the carburetor main jet(s) with a jet wrench.

4. Install the carburetor inlet screen(s), needle valve(s), and seat(s), and the carburetor floats by following steps 4 thru 7 under "Float Needle Valve and Seat, or Inlet Screen Removal or Replacement" in this section.

ACCELERATOR PUMP DIAPHRAGM AND ELASTOMER VALVE REPLACEMENT

1. Remove the carburetor air horn to main body gasket by following steps 1 thru 4 under "Air Horn to Main Body Gasket Replacement" in this section.

2. Remove the accelerating pump diaphragm and the Elastomer valve by following step 6 under "Main Body Disassembly" (Part 10-2, Section 4).

3. Install the Elastomer valve and the diaphragm by following steps 5 thru 7 under "Main Body Assembly" (Part 10-2, Section 4).

4. Install the carburetor air horn and gasket by following steps 5 thru 7 under "Air Horn to Main Body Gasket Replacement" in this section.

SECONDARY DIAPHRAGM REPLACEMENT

1. Remove the carburetor air horn to main body gasket by following steps 1 thru 4 under "Air Horn to Main Body Gasket Replacement" in this section.

2. Remove the secondary diaphragm assembly, except the ball check, by following step 7 under "Main Body Disassembly" (Part 10-2, Section 4).

3. Install the secondary diaphragm assembly by following step 11 under "Main Body Assembly" (Part 10-2, Section 4).

4. Install the carburetor air horn and gasket by following steps 5 thru 7 under "Air Horn to Main Body Gasket Replacement" in this section.

POWER VALVE OR GASKETS REPLACEMENT

1. Remove the carburetor from the engine; refer to steps 1 and 2 under "Removal" (Part 10-2, Section 3).

2. Test the power valve; refer to steps 1 thru 4 under "Power Valve" (Part 10-1, Section 1).

3. Remove the power valve and/or gaskets by following step 8 under "Main Body Disassembly" (Part 10-2, Section 4).

4. Replace the power valve and/or gaskets by following step 6 and 7 under "Main Body Assembly" (Part 10-2, Section 4).

5. Install the carburetor assembly; refer to steps 1 and 2 under "Installation" (Part 10-2, Section 3).

ANTI-STALL DASHPOT REPLACEMENT

1. Remove the air cleaner (Part 10-3, Section 2).

2. Remove the retaining nut and the dashpot from the mounting bracket.

3. Install the dashpot and retaining nut on the mounting bracket.

4. Adjust the anti-stall dashpot; refer to "Anti-Stall Dashpot" (Part 10-1, Section 2).

5. Install the air cleaner (Part 10-3, Section 2).

THERMOSTATIC CHOKE SPRING HOUSING AND GASKET REPLACEMENT

1. Remove the carburetor air cleaner assembly (Part 10-3, Section 2).

2. Remove the heater hose and mounting bracket from the carburetor.

3. Remove the thermostatic spring housing clamp retaining screws and remove the spring housing and gasket.

4. Replace the gasket and/or spring housing. Position the thermostatic choke spring housing gasket on the choke housing.

5. Install the spring housing on the choke housing, with the slot in the arm of the thermostatic spring lever inserted into the loop of the thermostatic spring. Position the retainer over the thermostatic spring housing and loosely install the retaining screws.

6. Set the thermostatic spring housing to the specified index mark (Part 10-6) and tighten the retaining screws.

7. Install the heater hose mounting bracket, heater hose, and the air cleaner assembly (Part 10-3, Section 2) on the carburetor.

THERMOSTATIC CHOKE REMOVAL AND INSTALLATION —CLEAN OR OVERHAUL

1. Remove the carburetor air cleaner assembly (Part 10-3, Section 2).

2. Remove the heater hose and mounting bracket from the carburetor. Disconnect the choke heat tube from the choke housing.

3. Remove and disassemble the thermostatic choke assembly by following steps 1 thru 4 under "Vacuum Piston Choke Disassembly" (Part 10-2, Section 4).

4. Assemble and install the thermostatic choke assembly by following steps 1 thru 4 under "Vacuum Piston Choke Assembly" (Part 10-2, Section 4). Connect the choke heat tube to the choke housing.

5. Perform an "Automatic Choke Plate Clearance (Pull-Down) and Fast Idle Cam Linkage Adjustment" (Part 10-1, Section 2).

ACCELERATOR PEDAL

1. Remove the retaining screws securing the accelerator pedal to the floor panel. Remove the accelerator pedal.

2. Position the accelerator pedal on the accelerator pedal shaft. Align the pedal to floor pan mounting holes and install the retaining screws.

SPACER AND GASKETS REPLACEMENT

Perform the carburetor "Removal and Installation" procedure steps (Part 10-2, Section 3) to replace the carburetor spacer and/or gaskets.

3 REMOVAL AND INSTALLATION

REMOVAL

Flooding, stumble on acceleration, and other performance complaints are, in many instances, caused by the presence of dirt, water, or other foreign matter in the carburetor. To aid in diagnosing the cause of a complaint, the carburetor should be carefully removed from the engine without removing the fuel from the bowls. The contents of the bowls may then be examined for contamination as the carburetor is disassembled.

1. Partially drain the cooling system coolant into a clean container. Remove the air cleaner (Part 10-3, Section 2). Remove the bracket that secures the heater hose to the automatic choke. Remove the throttle rod from the throttle lever. Disconnect the distributor vacuum line, the fuel inlet line, the choke clean air tube, and the choke heat tube at the carburetor.

2. Remove the carburetor retaining nuts and lock washers; then remove the carburetor. Remove the spacer gasket from the spacer and discard the gasket. **Whenever the carburetor is removed from the engine, care must be exercised to prevent damage to the throttle plates. The lower edges of the throttle plates project below the carburetor body whenever they are open.**

3. Disconnect the coolant inlet and outlet hoses, and the crankcase ventilation system hose from the carburetor spacer. Remove the spacer and gaskets. Discard the gaskets.

INSTALLATION

1. Clean the gasket surface of the intake manifold, spacer and carburetor. Place a new gasket above and below the spacer and install the spacer. Connect the coolant hoses, and the crankcase ventilation system hose to the spacer. Position the carburetor on the spacer. To prevent leakage, distortion or damage to the carburetor body flange, snug the nuts; then, alternately tighten each nut in a criss-cross pattern to the specified torque.

2. Connect the throttle rod, the choke heat tube, the fuel inlet line, the choke clean air tube, and the distributor vacuum line. Fill the radiator to the required level with the previously removed coolant. Refer to "Common Adjustments and Repairs" (Part 10-1, Section 2) and adjust the accelerating pump stroke (if necessary), the idle fuel mixture and idle speed, and the anti-stall dashpot. Install the air cleaner (Part 10-3, Section 2).

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

To facilitate working on the carburetor and to prevent damage to the throttle plates, install carburetor legs on the base. If legs are unavailable, install 4 bolts (about 2¼ inches long of the correct diameter) and 8 nuts on the carburetor base.

Use a separate container for the component parts of the various assemblies to facilitate cleaning, inspection and assembly.

For a complete carburetor overhaul, follow all the steps. To partially overhaul the carburetor or to install a new gasket kit, follow only the applicable steps.

Refer to Fig. 25 for parts identification.

AIR HORN

1. Remove the air cleaner anchor screw.

2. Remove the automatic choke plate operating rod to choke lever retainer (Fig. 12).

3. Remove the air horn retaining screws and lock washers and the identification tag. Remove the air horn and air horn gasket.

4. If it is necessary to remove the choke plate rod, seal and washers, remove the choke plate rod by loosening and turning the choke shaft lever clevis nut counterclockwise. Remove the rod from the air horn. Slide the felt seal and two washers out of the choke rod seal retainer.

5. If it is necessary to remove the choke plate or choke shaft, remove the staking marks on the choke plate retaining screws and remove the screws. **If the tips of the screws are flared excessively, file off the flared portion to prevent damage to the**

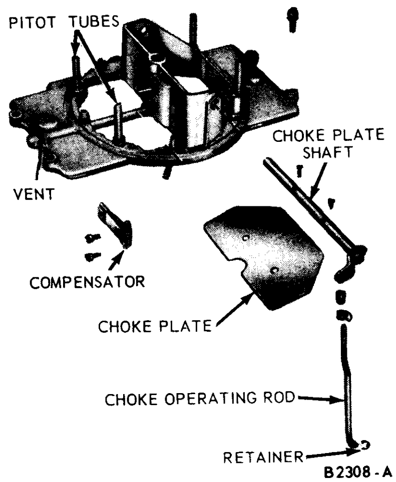


FIG. 12—Air Horn Assembly

threads of the shaft. Remove the choke plate by sliding it out of the shaft, from the top of the air horn. Slide the choke shaft out of the air horn.

6. If it is necessary to remove the secondary throttle control vacuum tube, pry it out with needle nose pliers. Discard the tube after removal.

7. If it is necessary to replace the hot idle compensator, remove the staking marks on the retaining screws and remove the hot idle compensator.

VACUUM PISTON CHOKE

1. Remove the fast idle cam retainer (Fig. 13).

2. Remove the thermostatic choke spring housing retaining screws, and remove the clamp, housing and gasket (Fig. 13).

3. Remove the choke housing assembly retaining screws. If the air horn was not previously removed, remove the choke control rod retainer. Remove the choke housing assembly, gasket and the fast idle cam. Remove the fast idle cam and rod from the fast idle cam lever.

4. Remove the automatic choke shaft retaining screw and washer (Fig. 14). Remove the choke thermostat lever, link and piston from the housing. If necessary, remove the pin securing the choke piston to the choke thermostat lever link. Remove the choke shaft and lever assembly and the fast idle cam lever from the choke housing.

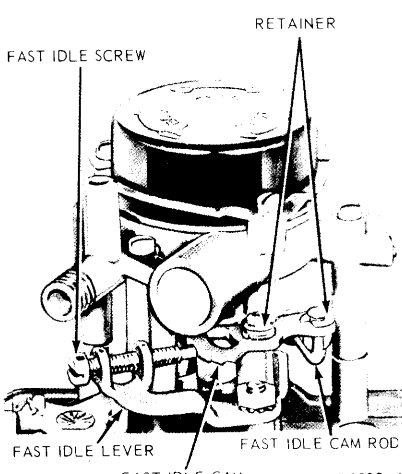


FIG. 13—Fast Idle Cam and Fast Idle Lever

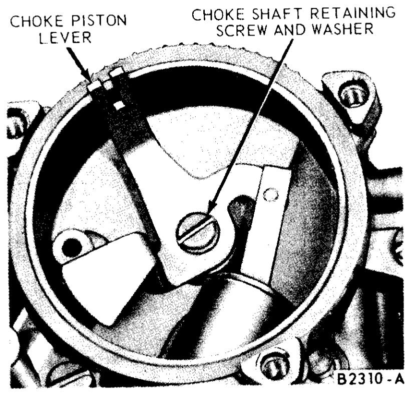


FIG. 14—Choke Shaft and Piston Lever

MAIN BODY

1. Using a hook, disconnect the float shaft retainer from each float (Figs. 15 and 16). Remove the float and shaft and the fuel inlet needle assembly from each fuel bowl. Remove the torsion (damper) spring from the shafts.

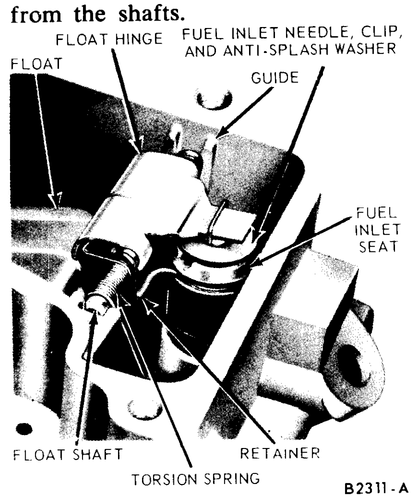


FIG. 15—Float Assembly

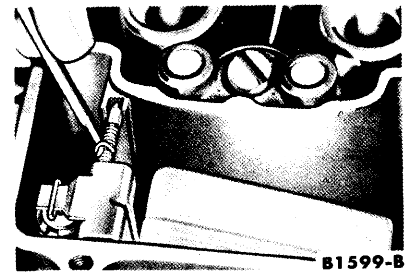


FIG. 16—Float Shaft Retainer Removal or Installation

2. Using a jet wrench, remove the fuel inlet needle seat, gasket and filter screen from each fuel bowl (Fig. 17).

3. Remove the primary stage and secondary stage main jets (Fig. 18).

4. Remove the primary stage booster venturi assembly and gasket (Fig. 19). Invert the main body and let the accelerating pump discharge weight and the ball fall into the hand.

5. Remove the secondary stage booster venturi assembly and gasket.

6. Remove the accelerating pump operating rod retainer. To release the rod from the retainer clip, press the tab ends of the clip together; then, at the same time, press the rod away from the clip until it is disengaged. Remove the rod. Remove the accelerating pump cover, diaphragm assembly and spring (Fig. 20).

If it is necessary to remove the Elastomer valve, grasp it firmly and pull it out. If the Elastomer valve tip broke off during removal, be sure to remove the tip from the fuel bowl. **An Elastomer valve must be replaced whenever it is removed from the main body.**

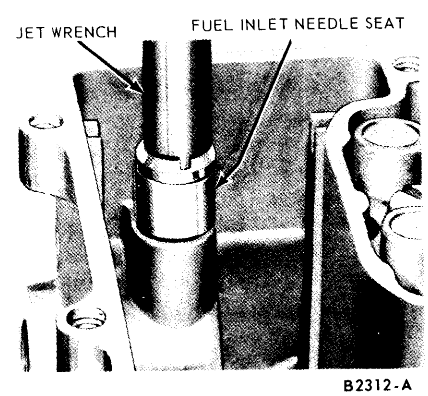


FIG. 17—Fuel Inlet Needle Seat Removal or Installation

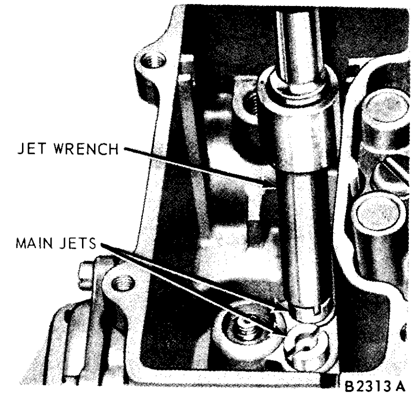


FIG. 18—Main Jet Removal or Installation

7. Remove the secondary diaphragm operating rod retainer and remove the rod. Remove the diaphragm cover, return spring, and diaphragm (Fig. 21). Invert the main body and let the secondary ball check fall into the hand.

8. Invert the main body and remove the power valve cover and gasket. Using a box wrench, remove the power valve and gasket (Fig. 22).

9. Remove the idle fuel mixture adjusting screws (needles) and springs.

10. Remove the anti-stall dashpot.

11. If necessary, remove the idle (hot engine) adjusting screw and spring, and the nut and washer securing the fast idle cam adjusting lever assembly to the primary throttle shaft (Fig. 13). Remove the lever assembly.

12. If it is necessary to remove the throttle plates, lightly scribe the primary and secondary throttle plates along the throttle shafts, and mark each plate and its corresponding bore with a number or letter for proper installation (Fig. 23).

Remove the staking marks on the throttle plate retaining screws and

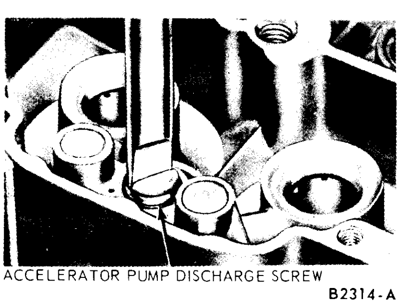


FIG. 19—Booster Venturi Removal or Installation

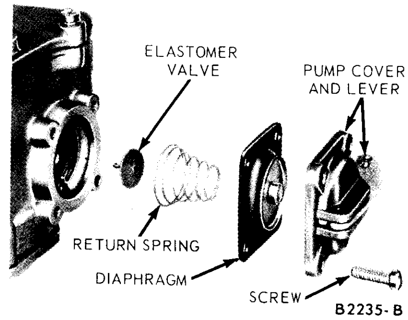


FIG. 20—Accelerating Pump Assembly

remove the screws. **If the tips of the screws are flared excessively, file off the flared portion to prevent damage to the threads of the shaft(s). Do not scratch the edge of the plates or walls of the barrels.** Remove the screws and the throttle plates.

Slide the primary and secondary throttle shafts out of the main body.

Remove the accelerating pump over-travel lever retainer (Fig. 24) and slide the anti-friction bearing, spring and lever off the primary throttle shaft.

PARTS REPAIR OR REPLACEMENT

Clean and inspect the carburetor component parts. Refer to "Cleaning and Inspection" (Part 10-1) for the proper procedure. Replace all worn or damaged parts.

ASSEMBLY

Make sure all holes in the new gaskets have been properly punched and that no foreign material has adhered to the gaskets. Make sure the accelerating pump diaphragm and secondary operating diaphragm are not torn or cut. The carburetor assembly is shown in Fig. 25.

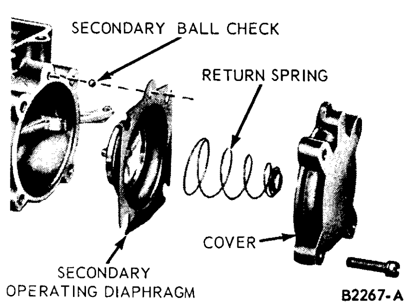


FIG. 21—Secondary Diaphragm Assembly

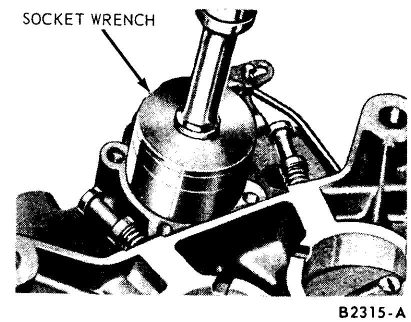


FIG. 22—Power Valve Removal or Installation

MAIN BODY

1. If the throttle plates were removed, install the accelerator over-travel spring anti-friction bearing on the accelerator over-travel lever boss. Place the accelerator over-travel spring, with the shortest tang end first, over the bearing on the over-travel lever (Figs. 24 and 26). Place the short tang of the spring under the lug on the over-travel lever. Slide the over-travel lever spring and bearing assembly on the primary throttle shaft. Hook the longest tang

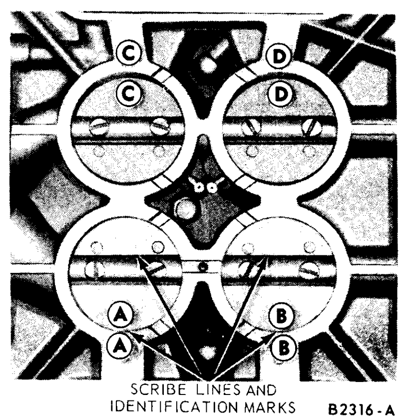


FIG. 23—Throttle Plate Removal

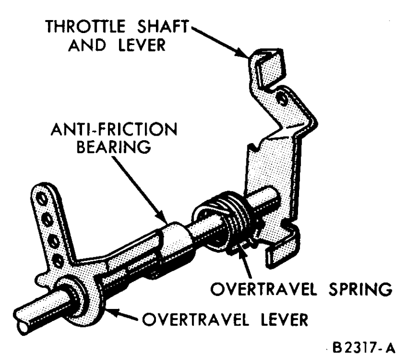


FIG. 24—Throttle Shaft Assembly

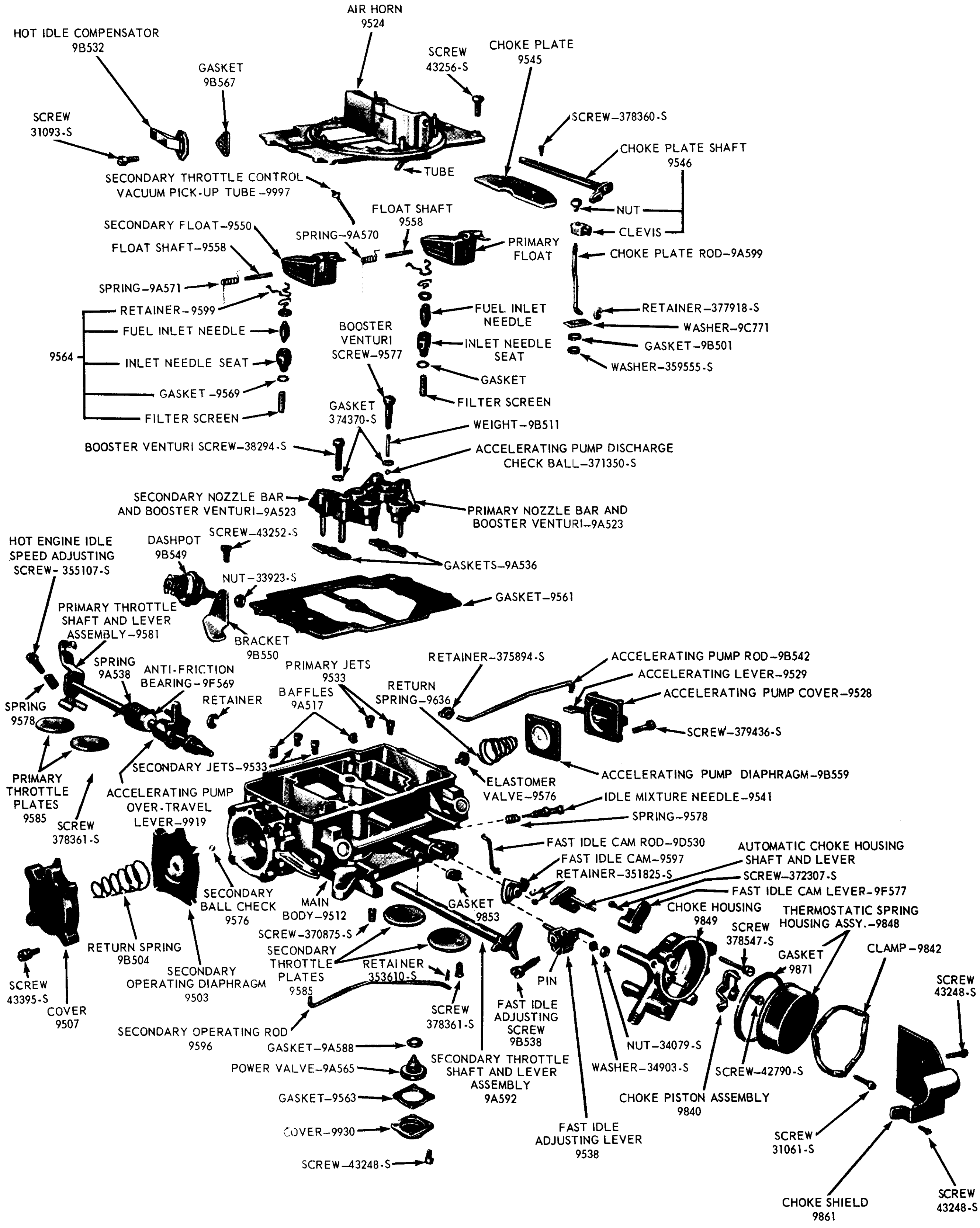


FIG. 25—Carburetor Assembly

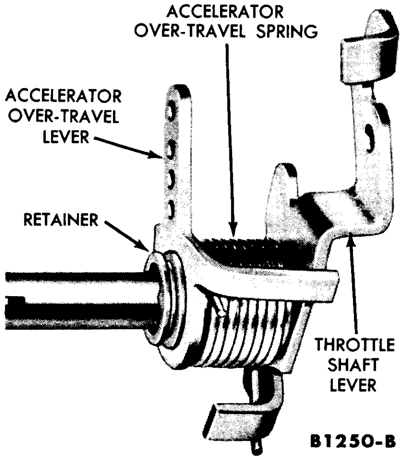


FIG. 26—Accelerator Over-Travel Spring and Lever Installation

of the spring under the closed throttle lug of the throttle lever. Install the over-travel lever retainer. Slide the primary throttle shaft assembly into the main body.

Refer to the lines and identification marks scribed on the throttle plates (Fig. 23), and install the primary throttle plates in their proper location with the screws snug, but not tight. Invert the main body and hold it up to the light. Little or no light should show between the throttle plates and the throttle bores. Tap the plates lightly with a screwdriver handle to seat them. Tighten and stake the screws.

Slide the secondary throttle shaft into the main body. Refer to the lines scribed on the secondary throttle plates and install the throttle plates in their proper location. To install the plates, follow the procedure given for the primary throttle plates.

Adjust the secondary throttle plates. Refer to Part 10-1, Section 2 for the proper procedure.

2. Install the idle (hot engine) adjusting screw and spring.

3. If the fast idle lever was removed, place the fast idle lever assembly on the primary throttle shaft, and install the retaining washer and nut (Fig. 13). Do not install the fast idle cam or retainer at this time.

4. Install the anti-stall dashpot.

5. If the Elastomer valve was removed, lubricate the tip of a new Elastomer valve and insert the tip into the accelerator pump cavity center hole (Fig. 20). Using a pair of needle nosed pliers, reach into the fuel bowl and grasp the valve tip. Pull the valve in until it seats and cut off the tip at the retaining shoulder. Position the diaphragm return spring on the boss in the chamber.

6. Position the accelerator pump diaphragm assembly to the cover and place the cover and diaphragm assembly in position on the return spring and main body. Install the cover screws finger tight. Push the accelerating pump plunger the full distance of its travel and tighten the cover screws.

7. Install the accelerating pump operating rod. Refer to Part 10-1, Section 2 and adjust the accelerating pump stroke.

8. Invert the main body. Using a socket wrench, install the power valve and gasket (Fig. 22). **Tighten the power valve securely.** Install the cover and gasket.

9. Install the idle adjusting needles and springs. Turn the needles in gently with the fingers until they just touch the seat; then back them off the specified number of turns (Part 10-6) for a preliminary idle adjustment.

10. Drop the secondary discharge ball check into the passage in the main body (Fig. 21).

11. Install the secondary operating diaphragm on the secondary operating lever. Install the diaphragm return spring on the cover. Install the cover with the screws finger tight. With the diaphragm in the extended position, tighten the cover screws. Install the secondary operating rod in the operating lever, and secure the rod to the secondary throttle shaft with the retaining clip.

Check the operation and seal of the secondary vacuum system by opening the primary and secondary throttle plates. Hold the secondary throttle plates open. Place a finger over the secondary vacuum inlet hole in the main body and release the secondary throttle plates. This is a check for vacuum leakage at the diaphragm. The throttle plates should not close fully. They will move slightly when released, but they must stop and should not move toward the closed position after the initial movement. Replace the diaphragm or tighten the cover screws as necessary to correct the vacuum leakage.

12. Using a jet wrench, install the primary and secondary main jets (Fig. 18). **Be sure the correct jets are installed for the primary and secondary systems (Part 10-6).**

13. Install the primary and secondary fuel inlet filters, below the fuel inlet valve seats. Install the valve seats and gaskets (Fig. 17).

14. Position the primary float shaft retainer in the groove on the fuel inlet needle seat (Figs. 15 and 16). Install the fuel needle assembly in the fuel inlet seat. Slide the float shaft into the float lever hinge. Install the damper spring on the float shaft and insert the short end of the spring under the flange of the float lever.

Insert the float assembly into the fuel bowl and hook the float tab under the clip on the fuel inlet needle assembly. Insert the float shaft into its guides at the sides of the fuel bowl. Allow the long end of the damper spring to rest against the wall of the fuel bowl. Using a hook (Fig. 16) position the shaft retainer in the grooves on the shaft.

15. Repeat step 14 on the secondary stage fuel bowl.

16. Refer to Part 10-1, Section 2, "Float Adjustment (Dry)" and perform a dry float fuel level adjustment on the primary and secondary floats.

17. Drop the accelerating pump discharge ball into its passage in the primary side of the main body. Seat the ball with a brass drift and a light hammer. **Make sure the ball is free.** Drop the accelerating pump discharge weight on top of the ball. Position the primary booster venturi assembly and gasket in the main body. Install the retaining screw securely (Fig. 19). **The primary booster screw is hollow.**

18. Position the secondary booster venturi assembly and gasket in the main body, and install the gasket and retaining screw.

VACUUM PISTON CHOKE

1. If the choke piston and link was disassembled, install the choke piston on the choke thermostatic spring lever link and install the retaining pin (Fig. 27).

2. Position the fast idle cam lever on the thermostatic choke shaft and lever assembly (Figs. 27 and 28). **The bottom of the fast idle lever adjusting screw must rest against the tang on the choke shaft lever.** Insert the choke shaft assembly into the rear of the choke housing. Position the choke shaft lever so that the hole in the lever is to the left side of the choke housing (Fig. 28).

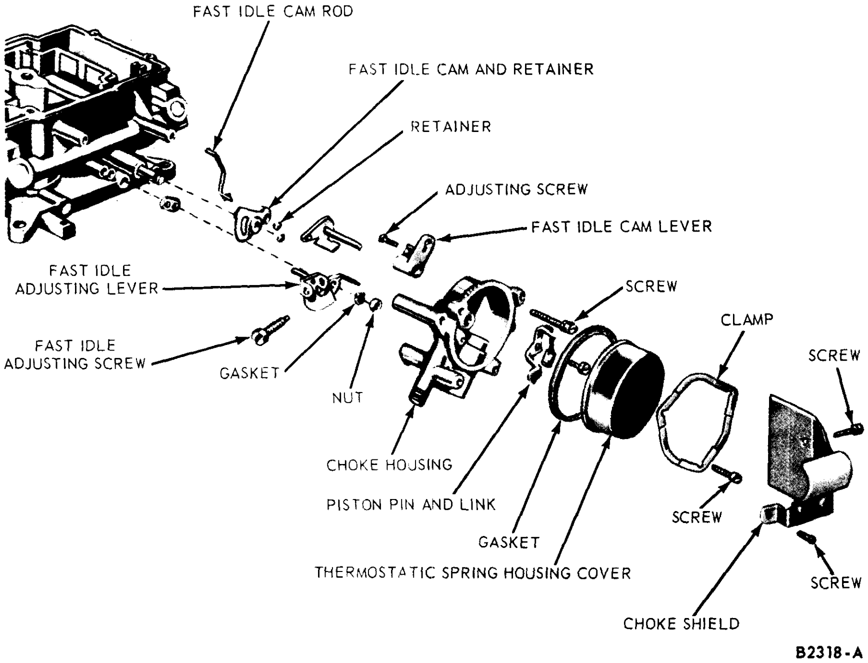


FIG. 27—Choke Housing Assembly

3. Insert the choke piston into the choke housing. Position the choke thermostatic spring lever on the flange of the choke shaft, and install the retaining screw and washer (Fig. 14).

4. Install the fast idle cam rod on the fast idle cam lever (Fig. 28). Place the fast idle cam on the fast idle cam rod and install the retainer. Place the choke housing vacuum pick-up port to main body gasket on the choke housing flange. Position the choke housing on the main body, and at the same time, install the fast idle cam on the hub of the main body. Position the gasket

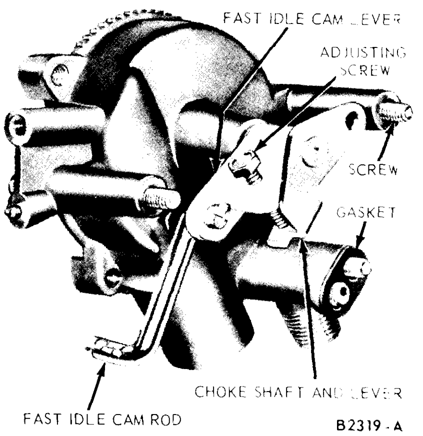


FIG. 28—Choke Linkage Installation

and install the choke housing retaining screws. Install the fast idle cam retainer. **The thermostatic spring housing is installed after the choke plate clearance (pull-down) has been adjusted to specification.**

AIR HORN

Refer to Fig. 12 for the correct location of the parts.

1. If the choke plate shaft was removed, position the choke plate shaft in the air horn. Insert the plastic choke pulldown adjusting nut and swivel into the keyed hole in the choke shaft lever. Position the felt washer between the two brass washers and slide them into place on the choke control rod seal retainer.

Insert the choke control rod through the control rod seal and the air horn. Insert the choke control rod into the choke shaft lever clevis nut, and turn the nut clockwise to thread the rod onto the nut.

2. If the choke plate was removed, insert the choke plate into the choke plate shaft. Install the choke plate screws snug, but not tight. Check for proper plate fit, binding in the air horn, and free rotation of the shaft by moving the plate from the closed position to the open position. If necessary, remove the choke plate and grind or file the plate edge where it is binding or scraping on the air horn wall. If the choke plate and shaft moves freely, tighten the choke plate screws while holding the choke in the fully closed position. Stake the screws. **When staking the screws, support the shaft and plate on a block of wood or a metal bar to prevent bending of the shaft.**

3. If necessary, start a new secondary throttle control vacuum tube into the air horn. **Make certain the tube is installed in a manner that will insure that the pick-up end will face downward toward the primary booster venturi when the air horn is installed.** Drive the tube into the air horn by grasping it lightly below the shoulder with pliers and striking the pliers with a hammer. Drive the tube in until it stops against its shoulder. **Do not crush or bend the tube.**

4. If the hot idle compensator was removed, install a new compensator and gasket. Stake the retaining screws.

5. Position the main body gasket on the main body (Fig. 29). Position the air horn on the main body and gasket so that the choke plate rod fits into the opening in the choke housing lever. Install the choke plate rod retainer. **Use care to prevent damage to the secondary throttle control vacuum tube during the air horn installation.** Install the air horn retaining screws, lock washers and the carburetor identification tag.

6. Refer to Part 10-1, Section 2, "Common Adjustments and Repairs" and perform the automatic choke plate clearance (pull-down) and fast idle cam linkage adjustment.

7. Position the thermostatic choke

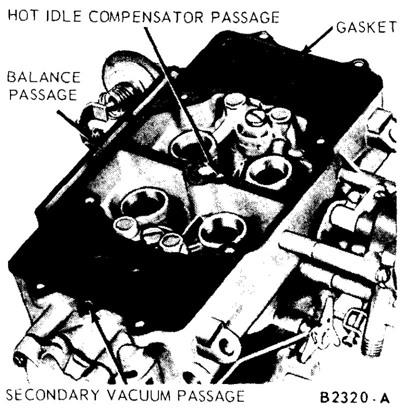


FIG. 29—Main Body Gasket Installation

spring housing gasket on the choke housing. Install the spring housing on the choke housing and gasket, with the slot in the arm of the thermostatic spring lever inserted into the loop of the thermostatic spring. Position the spring housing retainer (clamp) over the spring housing and loosely install the retaining screws.

8. Refer to Part 10-1, Section 2, "Common Adjustments and Repairs" and perform the automatic choke spring housing adjustment.

BENCH ADJUSTMENTS

The fuel level float adjustment (dry) and the secondary throttle plate adjustment are performed only as bench adjustments. Refer to Part 10-1, Section 2 for the procedures.

The automatic choke plate clearance (pull-down) and fast idle cam linkage adjustment, automatic choke housing cover adjustment, and the accelerating pump stroke adjustment can be performed with the carburetor on the bench or in the car. Refer to Part 10-1, Section 2, for the procedures.

PART 10-3 AIR CLEANER

1 DESCRIPTION AND OPERATION

DESCRIPTION

The engine is equipped with a dry-type air cleaner that has a replaceable cellulose fiber filtering element (Fig. 1).

The air cleaner body is mounted on a sealing gasket located on the carburetor air horn. The air cleaner assembly is retained on the engine by a stud in the carburetor body and a wing nut above the filter cover. The replaceable filter element assembly is equipped with integral plastic gaskets, located on the top and bottom of the element. The gaskets prevent entry of dirt and unfiltered air into the engine.

An integral positive crankcase ventilation system tube is located on the lower surface of the air cleaner body. The crankcase ventilation system inlet hose is attached to the air cleaner tube with a clamp.

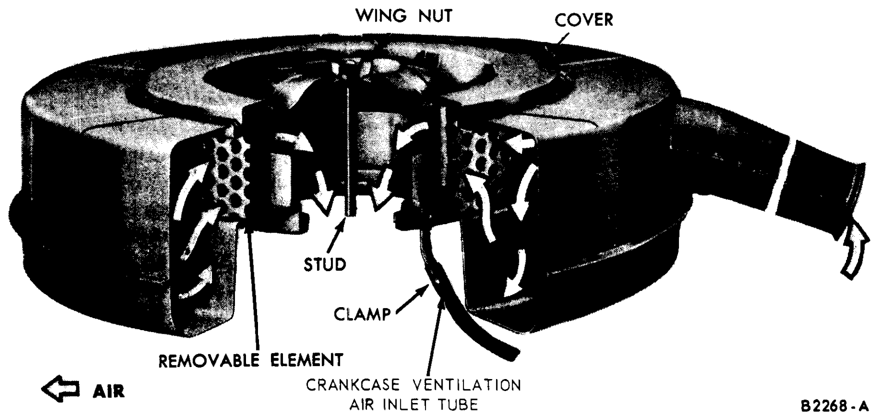


FIG. 1—Air Cleaner Assembly Sectional View

OPERATION

The air from the engine compartment enters the air cleaner assembly through the opening (horn) on the side of the body, passing into a silencing chamber and through the filter element (Fig. 1). Dust particles are trapped in the filter element as the air rushes through it into the positive crankcase ventilation system, carburetor and the automatic choke clean air tube in the carburetor air horn.

The filtered air flows through the choke clean air tube in the carburetor, passing into a connecting hose and tube to the heat chamber in the exhaust manifold. Filtered air also flows through the integral positive crankcase ventilation system tube on the bottom of the air cleaner body, passing into a connecting hose and tube to the intake manifold.

2 REMOVAL AND INSTALLATION

FILTER MAINTENANCE

Refer to Group 19 for the recommended maintenance mileage interval.

REMOVAL

1. Loosen the retaining clamp and disconnect the positive crankcase ventilation inlet hose at the air cleaner.

2. Remove the wing nut retaining the air cleaner on the carburetor; then, lift the air cleaner off the carburetor. **To prevent dirt from entering the carburetor, the filter element must never be removed when the air cleaner body is mounted on the carburetor.**

3. Remove the cover and filter element. Discard the air cleaner mounting gasket on the carburetor if it is excessively worn or damaged.

CLEANING AND INSPECTION

Refer to Group 10-1, Section 3 for the recommended cleaning and inspection procedure.

INSTALLATION

1. Install the air cleaner mounting gasket on the carburetor. Install the air cleaner body on the carburetor so that the word "FRONT" faces the front of the car.

2. Place the element in the air cleaner body. Make sure the element gasket is properly seated. Install the cover and tighten the retaining wing nut.

3. Connect the crankcase ventilation inlet hose to the air cleaner body and tighten the retaining clamp.

PART 10-4 FUEL PUMP

1 DESCRIPTION AND OPERATION

DESCRIPTION

The single-action fuel pump (Fig. 1) is mounted on the left side of the cylinder front cover. The disposable-type fuel filter is integral with the fuel pump.

OPERATION

The fuel pump is mechanically actuated by the fuel pump rocker arm and an eccentric mounted on the front of the camshaft. The fuel pump diaphragm is operated by a combination of rocker arm action and calibrated spring pressure.

On the fuel intake stroke, the camshaft eccentric causes the rocker arm to pull the fuel pump diaphragm against the diaphragm spring pressure. This action draws fuel through the inlet valve into the pump chamber and closes the outlet valve. At the same time, fuel is drawn from the fuel tank through the fuel inlet line to replace the fuel drawn into the chamber.

As the camshaft eccentric continues to rotate, the rocker arm relieves the pressure on the diaphragm spring and allows the spring to move the diaphragm toward the inlet and outlet valves, exerting pressure on the fuel in the fuel inlet chamber. This pressure causes the pump inlet valve to close and the ensuing pressure buildup opens the outlet valve. The fuel is then forced through the valve housing cover outlet to the filter element, where the fuel is cleansed before entering the outlet line leading to the carburetor. **Fuel is delivered to the carburetor only when the fuel inlet valve in the carburetor is open. The fuel inlet valve is closed by fuel pressure on the float when the specified fuel level in the carburetor float chamber is reached.**

When there is no demand for fuel from the carburetor, the diaphragm spring tension is not strong enough to force the diaphragm downward against the fuel pressure built up in the inlet chamber of the pump. Thus, the up and down rocker arm action continues, but the diaphragm remains stationary until pressure against the carburetor float is relieved by a demand for fuel at the carburetor.

Pressure relief orifices are incorporated in the inlet and outlet valve cages to prevent excessive pressure build-up in the line betwen the carburetor during hot soak periods.

An air vent is located in the fuel pump body to relieve air pressure build-up on the spring side of the diaphragm.

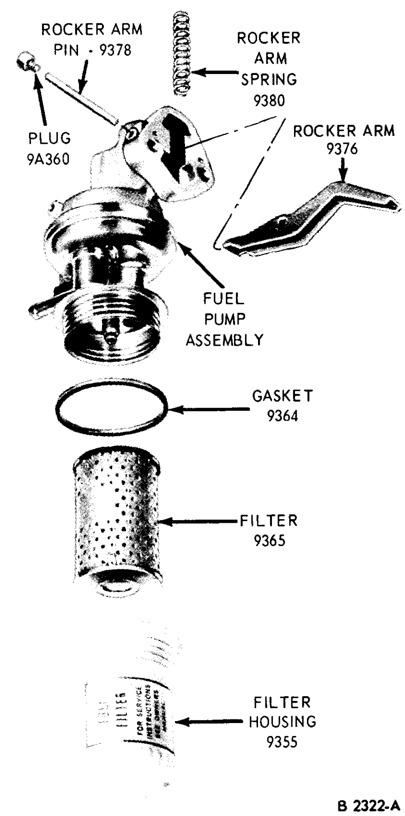


FIG. 1—Fuel Pump and Fuel Filter Assembly

2 IN-CAR ADJUSTMENTS AND REPAIRS

FUEL FILTER REPLACEMENT

The fuel filter is integral with the fuel pump (Fig. 1). The filter housing contains a long-life replaceable element. Replace the element if it becomes clogged, and also at the maintenance mileage interval recommended in Group 19.

1. Unscrew the filter housing from the fuel pump, and remove the filter element and gasket. Discard the element and gasket. Clean the filter housing in cleaning solvent.

2. Place a new filter element over the spout in the fuel pump valve housing cover (Fig. 1). Coat a new gasket with light engine oil and position the gasket on the filter housing. Screw the filter housing on the pump. Hand-tighten the filter housing until the gasket contacts the pump, then advance it 1/8 turn.

3. Start the engine and check for leaks.

3 REMOVAL AND INSTALLATION

TESTS

Fuel pump tests are covered in Part 10-1, Section 1.

REMOVAL

1. Disconnect the fuel lines at the pump.

2. Remove the pump retaining bolts, then remove the pump and gasket. Discard the gasket.

CLEANING AND INSPECTION

Clean and inspect the fuel pump. Refer to "Cleaning and Inspection" in Part 10-1 for the proper procedure.

INSTALLATION

1. Remove all the gasket material from the pump mounting pad and pump flange. Apply sealer to both sides of a new gasket.

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 screws, and alternately torque them to specifications. Connect the fuel lines.

4. Operate the engine and check for leaks.

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

The fuel pump assembly is shown in Fig. 1.

1. Remove the filter housing, gasket and filter element. Discard the filter element and gasket.
2. Scrape away the staking mark and remove the rocker arm pin seal plug as shown in Fig. 2.
3. Release the tension on the rocker arm by pressing the arm downward against the diaphragm and rocker arm spring pressure and allow the rocker arm pin to fall out. If the pin does not come out freely, tap the fuel pump assembly lightly on the bench until the pin sticks out of the bore; then, remove the pin with pliers.

CLEANING AND INSPECTION

Clean and inspect the fuel pump component parts. Refer to "Cleaning and Inspection" (Part 10-1, Section 3) for the proper procedure. Replace all worn or damaged parts.

ASSEMBLY

The fuel pump assembly is shown in Fig. 1.

1. Invert the fuel pump so that the filter housing cover faces upward. Insert the rocker arm spring into the spring guide bore in the dome of the fuel pump rocker arm cavity.
2. Insert the rocker arm into the cavity and hook it onto the diaphragm rod, directly below the rod flange. Position the rocker arm spring over the spring locater on the rocker arm. Align the rocker arm pin holes and install the rocker arm pin. **Make certain the rocker arm spring is properly positioned on the spring locater on the rocker arm.**
3. Install a new rocker arm pin plug. Stake the plug into position.
4. Place a new filter element over the spout in the fuel pump. Coat the filter housing gasket with oil. Position the gasket on the filter housing, and screw the housing on the pump. Hand tighten the filter housing until the gasket contacts the pump; then, advance it ⅛ turn.

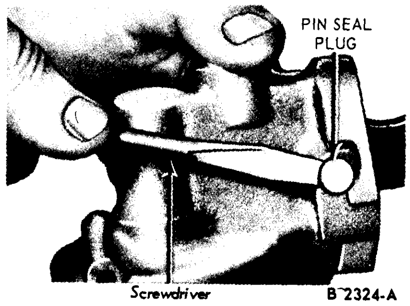


FIG. 2—Rocker Arm Pin Seal Plug Removal

PART 10-5 FUEL TANK AND LINES

1 DESCRIPTION AND OPERATION

The fuel tank (Fig. 1) is held in a vertical position by two steel straps. An insulating pad is positioned between the top of the tank and the underside of the luggage compartment floor pan, and also between the rear vertical wall of the tank and the front wall of the spare tire well.

The fuel gauge sender unit is located on the front side of the tank and is accessible from underneath the car.

The fuel outlet line is fastened to a connecting hose that is attached to the fuel tank sender gauge unit assembly. A filter is located in the tank on the fuel line pick-up tube. **This filter does not require servicing.**

The fuel tank filler pipe opening is located behind a door in the left rear quarter panel, just above and rearward of the wheel house opening. The tank is vented through a vent tube, located on the top of the fuel tank. The filler pipe is attached to the filler pipe housing of the quarter panel. A gasket is positioned between the filler pipe housing and the door housing. The filler pipe is sealed at the tank with an O-ring.

The fuel line is routed from the fuel tank, passing beneath the left side of the underbody; then, under the left fender and through the forward part of the fender apron. The complete fuel line is replaceable as a unit. However, only the damaged segments are usually replaced.

2 REMOVAL AND INSTALLATION

FILLER PIPE

REMOVAL

In some instances, removal of the fuel filler pipe may prove difficult. A fuel tank filler pipe removal tool can be fabricated locally from standard steel shapes that are readily available. Fig. 2 outlines instructions for fabricating the tool.

1. Refer to Fig. 1. Partially drain the fuel tank with a siphon to a level below the filler pipe connection in the tank.
2. Remove the retaining screws securing the filler pipe to the filler pipe housing. Insert the filler pipe removal tool in the filler pipe opening. Rotate the filler pipe with the removal tool and pull it outward to remove it from the fuel tank and housing.
3. Remove and discard the O-ring seal located in the filler pipe opening of the fuel tank.

INSTALLATION

1. Refer to Fig. 1. Install a new O-ring seal in the fuel tank.
2. Position the filler pipe and rotate the pipe into the fuel tank. **Index the filler pipe properly. The word "TOP", inscribed on the filler pipe flange, must face upward. Make certain the O-ring seal is properly seated.** Install and tighten the filler pipe retaining screws.
3. Fill the fuel tank and install the filler cap. Check for fuel leaks.

FUEL TANK

REMOVAL

1. Refer to Fig. 1. Remove the fuel tank filler cap. Drain the fuel from the tank into a suitable container, with the use of a siphon.
2. Disconnect the rear shock absorber upper mounting brackets from the underbody crossmember, from within the luggage compartment.
3. Raise the front of the car and keep the rear wheels lowered. Disconnect the fuel tank gauge sender unit wire, the sender unit ground wire and the fuel line from the sender unit. Also, remove the low fuel level warning device wire, if so equipped.
4. Remove the filler pipe to filler pipe housing retaining screws. Rotate the filler pipe and pull it outward to remove it from the fuel tank and housing.
5. Loosen the nuts and release the tank retaining strap bolts (hooks) from the slotted underbody member of the fuel tank.
6. Remove the tank and discard the filler pipe opening O-ring seal.
7. If the fuel tank is to be replaced, remove the fuel gauge sending unit and discard the gasket. **Note the position of the insulating pad.** Remove the retaining tape and clamps securing the vent tube and hose to the fuel tank. **If the vent tube is damaged beyond repair or leaking fuel at the soldered connection on the fuel tank, the tube must be soldered or replaced. To prevent combustion during soldering operations, completely drain the fuel from the tank; then steam clean the tank and dry it with compressed air.**

INSTALLATION

1. Refer to Fig. 1. If the retaining strap(s) require replacement, install the flanged end(s) of the new strap(s) in the slot(s) of the underbody member. If necessary, properly position the tank insulating pad.
2. If the fuel tank vent pipe was removed from the fuel tank for replacement purposes, solder the new pipe into position. Check the connection for leaks; then, dry the tank. Secure the vent pipe into position on

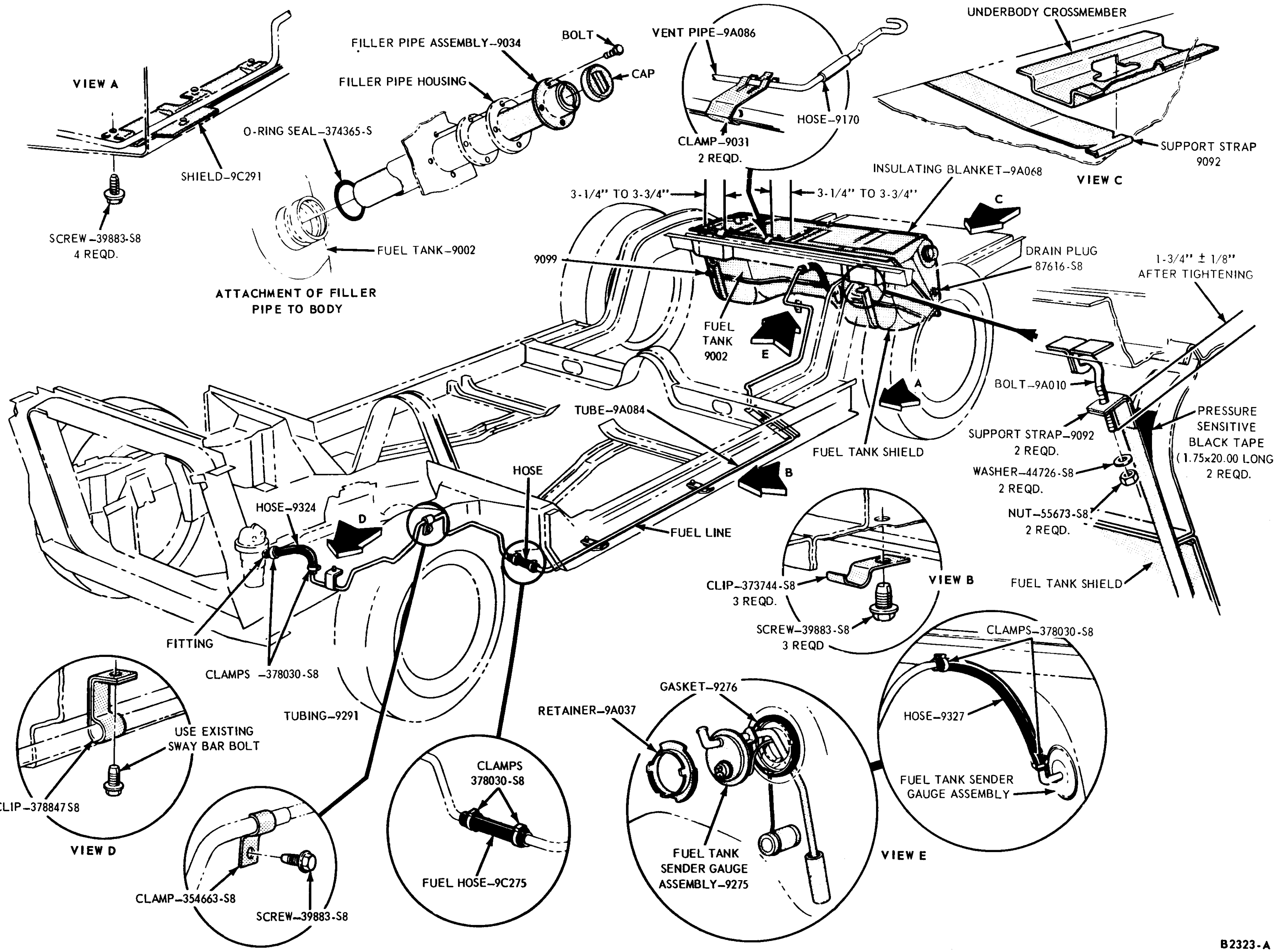


FIG. 1—Fuel System Installation

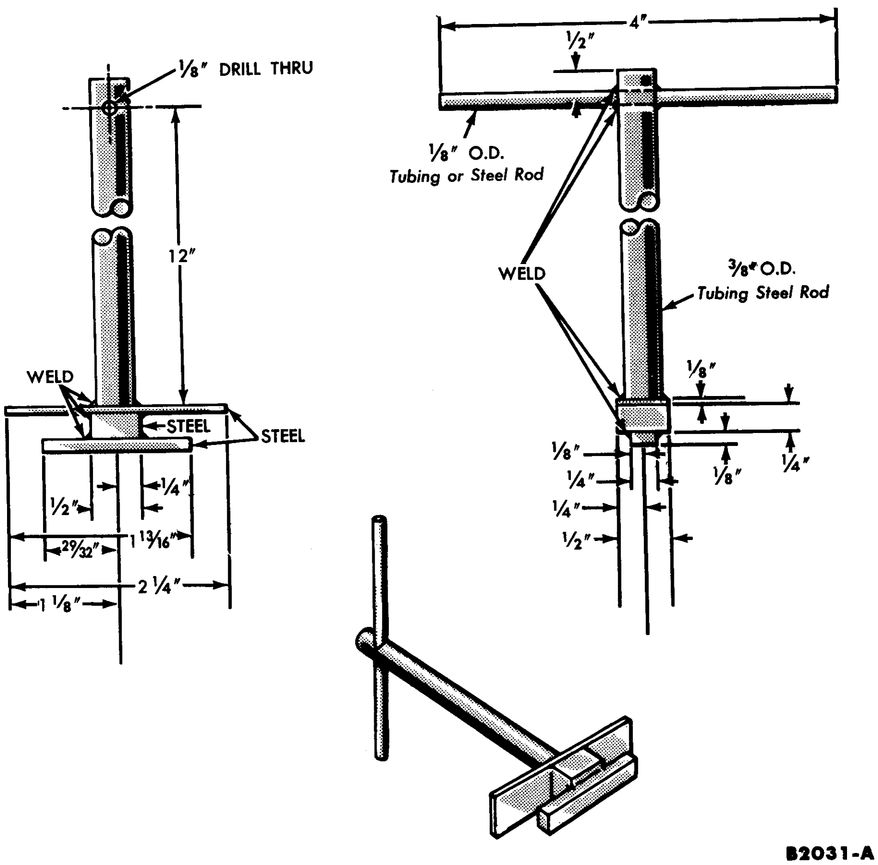


FIG. 2—Fuel Tank Filler Pipe Removal Tool—Fabricated

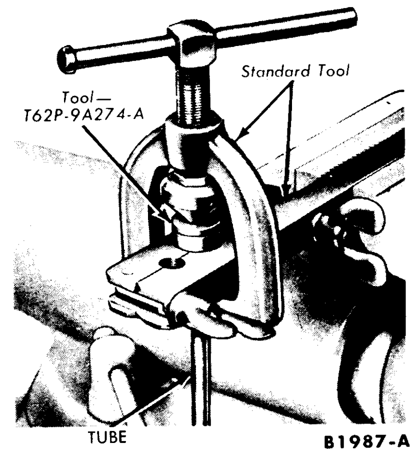


FIG. 3—Fuel Line Tube Die

the tank with new tape and the retaining clamps.

3. If a new tank is to be installed, put new insulating pressure-sensitive black tape on the sides of the fuel tank.

4. Install the fuel gauge sending unit and a new gasket on the tank. Install a new O-ring in the filler pipe opening of the tank. Insert the filler pipe in the filler pipe housing. Carefully position the tank assembly on the retaining straps, and hook the strap bolts in the slots of the underbody member flange. Align the filler pipe opening and the filler pipe, and tighten the tank strap bolt retaining nuts.

5. Position the filler pipe and rotate it into the tank. **Index the filler pipe properly. The word "TOP" inscribed on the filler pipe flange, must face upward. Make certain the O-ring is properly seated in the fuel tank opening.** Install and tighten the filler pipe retaining screws.

6. Connect the sender unit wire, ground wire, and fuel line to the sender unit. Connect the fuel level warning device wire, if so equipped. Install the shock absorbers and torque the retaining nuts to specification.

7. Lower the car. Fill the fuel tank and install the filler cap. Check for fuel leaks.

FUEL LINES

The various fuel lines are not serviced as assemblies. They must be cut, squared and formed out of rolls of fuel system service tubing and hose material of the specified size (Fig. 1), available at dealerships.

A damaged section of **tubing** longer than 12 inches can be cut out of the existing line and replaced by a comparable service **tubing section**, spliced into the line by means of connecting hoses and retaining clamps.

A damaged section of tubing shorter than 12 inches can be cut out of the line and replaced by a length of **service hose** and two retaining clamps. **All replacement hoses must be cut to a length that will insure proper clamp retention beyond the flared ends of the connecting tubing.**

REMOVAL

1. Drain the fuel from the tank.

2. Disconnect the line at the fuel gauge sender unit and the fuel pump. Remove the lines from the holding clips along the underbody. Remove all damaged hose sections and tube sections.

INSTALLATION

1. Cut a new section of tubing to approximately the same length as the section to be replaced. **Allow extra length for flaring the ends of the tubing.** Square the ends of the cut tubing with a file.

2. Ream the inside edges of the cut tubing with the reamer blade on the tube cutter. **Be sure metal chips are removed from inside the tube(s).** Flare the ends of the cut tubing, as required, with a standard tube flaring kit and tool (Fig. 3).

3. Bend the tube section to conform to the contour of the original tube. Cut an ample length of hose to form a coupling between the flared ends of the fuel lines. Connect the hose couplings to the tubing and install the retaining clamps.

4. Position the lines in the underbody clips and tighten the clips. Connect the line to the fuel gauge sender unit and the fuel pump. Fill the tank and check for leaks.

PART 10-6 FUEL SYSTEM SPECIFICATIONS

FUEL PUMP

FUEL PUMP STATIC PRESSURE—Psi @ 500 Engine rpm	
390 (EES)	4.0-6.0
MINIMUM FUEL PUMP VOLUME—Flow @ 500 Engine rpm	
390 (EES)	1 pint in 20 seconds
ECCENTRIC TOTAL LIFT	
390 (EES)	0.690-0.710

FORD 4-BARREL CARBURETOR

The basic part number of the carburetor is 9510. The part number prefix and suffix appears on the identification tag mounted on the air horn.

CARBURETOR PART NO. C5SF-9510-A	
Engine	390 (EES)
Transmission	Automatic
Car Model	All
THROTTLE BORE DIAMETER—Inches	
Primary	$1\frac{9}{16}$
Secondary	$1\frac{9}{16}$
VENTURI DIAMETER—Inches	
Primary	$1\frac{1}{8}$
Secondary	$1\frac{3}{16}$
BOOSTER VENTURI CODE LETTER	
Primary	KD
Secondary	BA
MAIN METERING JET IDENTIFICATION NO.	
Primary	
0-5,000 Feet	49F
5,000-10,000 Feet	47F
Secondary	
0-5,000 Feet	60F
5,000-10,000 Feet	58F
POWER VALVE IDENTIFICATION NO. OR COLOR	
0-5,000 Feet	Plain (#85)
5,000-10,000 Feet	Green (#75)
POWER VALVE TIMING—Opens @ Inches of Mercury	7.5-9.5
CHOKE THERMOSTATIC SPRING IDENTIFICATION	TT
CHOKE PLATE PULL-DOWN CLEARANCE—Inches	$\frac{3}{16}$
CHOKE THERMOSTATIC SPRING HOUSING INITIAL SETTING	
Set at index	

FORD 4-BARREL CARBURETOR (Cont'd)

ACCELERATOR PUMP SETTING
Insert the link in the inboard hole (hole closest to plunger) of the pump lever and the No. 3 hole (third from bottom) in the over-travel lever.

INITIAL FLOAT SETTING—Dry
$\frac{15}{32} \pm \frac{1}{64}$ inch from machined surface of main body to top of free end of float—with float in uppermost position.

FUEL LEVEL SETTING—Wet (Inches)*
Primary and Secondary .... $\frac{7}{8} \pm \frac{1}{32}$
*Distance below the top machined surface of main body.

ANTI-STALL DASHPOT CLEARANCE—Inches .... $\frac{1}{16}$-$\frac{3}{32}$

DECHOKE CLEARANCE
$\frac{1}{16}$ inch minimum between choke plate and air horn with primary throttle plates in the wide open position.

FAST IDLE CAM SETTING
$\frac{1}{8}$ inch clearance between choke plate and air horn with the fast idle screw on the kickdown step (index mark) of the fast idle cam.

INITIAL IDLE MIXTURE ADJUSTMENT—Turns Open* .... $1\frac{1}{2}$
*Turns back from bottomed needle.

FAST (COLD ENGINE) IDLE ADJUSTMENT* .... 1500 rpm
*With fast idle screw on the kickdown step (index mark) of the fast idle cam (hot engine).

CURB (HOT ENGINE) IDLE ADJUSTMENT* .... 475-500 rpm
*Fast idle screw not contacting fast idle cam and the idle compensator seated, with transmission in "Drive" range.

CARBURETOR AIR CLEANER

TYPE	Dry

FUEL TANK CAPACITY

U. S. MEASURE	22 gallons
IMPERIAL MEASURE	$18\frac{1}{2}$ gallons

SPECIAL TOOLS

TOOL	TOOL NO.
FLOAT GAUGE	9550-MFB
POWER VALVE TEST FIXTURE	T57L-9904-A
WIRE GAUGES	
0.010 and 0.012	9545-A
0.065 and 0.080	9545-B
0.076 and 0.085	9581-A
0.015	9597
0.020 and 0.030	9597-B

COOLING SYSTEM — GROUP 11

PART 11-1 GENERAL COOLING SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

DIAGNOSIS

Engine overheating and slow engine warm-up are the two engine troubles most commonly attributed to the cooling system.

Loss of coolant, thermostat stuck in closed position, or the accumulation of rust and scale in the system are the main causes of overheating. Coolant loss may be caused by external leakage at the radiator, radiator supply tank, water pump, hose connections, heater and core plugs. Coolant loss may also be caused by internal leakage due to a defective cylinder head gasket, improper tightening of the cylinder head bolts, or a warped cylinder head or cylinder block gasket surface.

Internal leakage can be detected by operating the engine at fast idle and looking for the formation of bubbles in the radiator supply tank. Oil in the radiator supply tank 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.

Rust and scale that form in the engine coolant passages are carried into the radiator passages by the circulation of the coolant. This clogs the radiator passages and causes overheating. Rust can be detected by the appearance of the coolant. If the coolant has a rusty or muddy appearance,rust is present.

A defective thermostat that remains open will cause slow engine warm-up.

DIAGNOSIS GUIDE

ENGINE OVERHEATS	Insufficient coolant. Belt tension incorrect. Radiator fins obstructed. Thermostat stuck closed. Cooling system passages blocked by rust, scale, or other foreign matter. Water pump inoperative. Faulty fan drive clutch.
ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE	Thermostat stuck open, or of 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 or radiator supply tank. 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 pressure cap defective or wrong type.

TESTING

COOLING SYSTEM PRESSURE TEST

It is recommended that a cooling system pressure test gauge be used to properly test the system for:

1. Blown or leaking cooling system sealing gaskets.
2. Internal or external coolant leakage.
3. Pressure cap malfunction.

Many types of pressure gauges are available for use. Therefore, it is recommended that the gauge manufacturer's instructions be followed when performing the test. **Never exceed the rated pressure indicated on the pressure cap when performing the pressure test.**

THERMOSTAT TEST

Remove the thermostat and immerse it in boiling water. Replace the thermostat if it does not open more than ¼ inch.

If the problem being investigated is insufficient heat, the thermostat should be checked for leakage. This may be done by holding the thermostat up to a lighted background. Light leakage around the thermostat valve (thermostat at room temperature) is unacceptable and the thermostat should be replaced. It is possible, on some thermostats, that a slight leakage of light at one or two locations on the perimeter of the valve may be detected. This should be considered normal.

FAN DRIVE CLUTCH TEST

1. Run the engine at approximately 1000 rpm until normal operating temperature is reached. This process can be speeded up by blocking off the front of the radiator with cardboard.

2. Stop the engine and, using a cloth to protect the hand, immediately check the effort required to turn the fan. If considerable effort is required, it can be assumed that the coupling is operating satisfactorily. If very little effort is required to turn the fan, it is an indication that the coupling is not operating properly, and it should be replaced.

2 MAINTENANCE

COOLANT

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 keeping the radiator fins clean and a periodic inspection of the cooling system for leakage.

Use care when removing the radiator cap to avoid injury from escaping steam or hot water.

In production, the cooling system is filled with a new long-life coolant which prevents corrosion and keeps the cooling system clean for best operation summer and winter. This coolant protects to —35° F. It will not be necessary to provide special anti-freeze protection except in areas where temperatures fall below this level.

In areas where lower temperature protection is necessary, refer to the coolant mixture chart on the Ford Rotunda coolant can for the recommended mixture proportions. **Do not mix permanent-type anti-freeze with the methanol type.**

In areas where protection to —35° F. is not required, but some protection is necessary, refer to the coolant mixture chart on the Ford Rotunda coolant can for the recommended mixture proportions. Whenever the cooling system is completely refilled, add Rotunda Radiator Rust Inhibiter.

A standard ethylene glycol hydrometer can be used to check the protection level of long-life coolant.

Refer to Group 19 for the cooling system drain interval.

DRAINING AND FILLING THE COOLING SYSTEM

To prevent loss of anti-freeze when draining the radiator, attach a hose on the radiator drain cock, and drain the anti-freeze into a clean container.

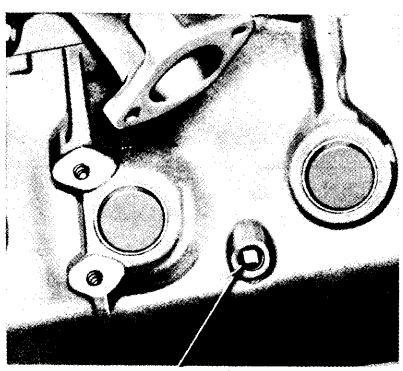


FIG. 1—Typical Cylinder Block Drain Plug

To drain the radiator, open the drain cock located at the bottom corner of the radiator. Drain the cylinder block by removing the drain plugs located on both sides of the block (Fig. 1).

To fill the cooling system, close the radiator drain cock and replace the drain plugs. Disconnect the heater outlet hose at the water pump, to bleed or release trapped air from the system. Fill the system until the coolant begins to flow from the heater outlet hose, then connect the heater outlet hose. Fill the supply tank to a point 1" below the bottom of the filler neck. Operate the engine until normal operating temperature has been reached. **After the initial fill, the coolant level will drop approximately 1 quart after the engine has been operated about 20 minutes at 2000 rpm. This is due to the displacement of entrapped air.** Add more coolant to fill the radiator supply tank.

FAN DRIVE BELTS

If the fan drive belts are noisy, check the tension of the belts to make certain they are within specifications. Also, check for misaligned pulleys. If the drive belts are worn or frayed, replace them following the procedures in Part 11-1, Section 3.

3 COMMON ADJUSTMENTS AND REPAIRS

ADJUSTMENTS

FAN BELT TENSION

The fan belts should be properly adjusted at all times. Loose belts cause improper alternator, fan and water pump operation. A belt that is too tight places a severe strain on the water pump and the alternator bearings.

1. Install the belt tension tool on the drive belt and check the tension, following the instructions furnished by the tool manufacturer (Fig. 2).

2. If adjustment is necessary, loosen the alternator mounting bolts and the alternator adjusting arm bolt. Move the alternator toward or away from the engine until the correct tension is obtained (see specifications). Remove the gauge. Tighten the alternator adjusting arm bolt and the mounting bolts. Install the tension gauge and check the belt tension (Fig. 2).

REPAIRS

FAN REPLACEMENT

On a car with an air conditioner, a fan drive clutch is used. Cars without air conditioning utilize a pulley-to-fan spacer.

1. Remove the fan guard. Remove the capscrews and lock washers retaining the fan and spacer (or drive clutch) to the water pump hub. Remove the fan and spacer (or drive clutch).

2. If equipped with a fan drive clutch, remove the retaining capscrews and lock washers and separate the fan from the drive clutch. Position the replacement fan on the drive clutch and install the lock washers and capscrews.

3. Position the fan and spacer (or drive clutch) on the water pump hub and install the lock washers and capscrews. Torque the capscrews to specification. Then, check the fan drive clutch flange-to-water pump hub for proper mating. Install the fan guard.

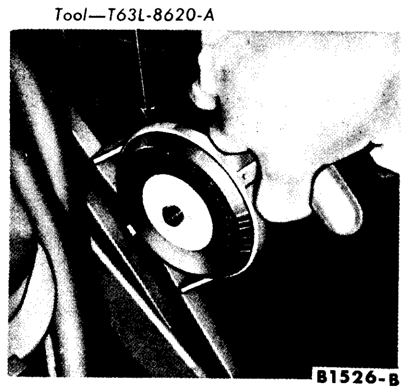


FIG. 2—Checking Drive Belt Tension

FAN BELT REPLACEMENT

1. Loosen the power steering pump bracket at the water pump and remove the drive belt.

On a car with an air conditioner, remove the compressor drive belt.

2. Loosen the alternator mounting bolts and the alternator adjusting arm bolt. Move the alternator toward the engine. Remove the belts from the alternator and crankshaft pulleys, and lift them over the fan.

3. Place the belts over the fan. Insert the belts in the water pump pulley, crankshaft pulley, and alternator pulley grooves. Adjust the belt tension to specifications.

4. On a car with an air conditioner, install and adjust the compressor drive belt to specifications.

5. Install the power steering pump drive belt and tighten the pump bracket to the water pump. Adjust the drive belt tension to specifications.

RADIATOR HOSE REPLACEMENT

Radiator hoses should be replaced whenever they become cracked, rotted or have a tendency to collapse.

1. Drain the radiator, then loosen the clamps at each end of the hose to be removed. Slide the hose off the radiator connection and the radiator supply tank connection (upper hose) or the water pump connection (lower hose).

2. Position the clamps at least 1/8 inch from each end of the hose. Slide the hose on the connections. **Make sure the clamps are beyond the bead and placed in the center of the clamping surface of the connections.** Tighten the clamps. Fill the radiator with coolant. Operate the engine for several minutes, then check the hoses and connections for leaks. Check for proper coolant level after the engine has reached normal operating temperature.

4 CLEANING AND INSPECTION

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.

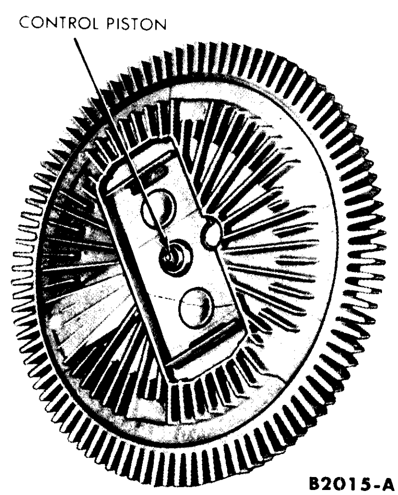


FIG. 3—Control Piston Installed

WATER PUMP

1. Clean the gasket mounting surfaces of the water pump and cylinder block.

2. Clean and inspect the seal seating surface of the water pump.

3. Clean the pump housing and inspect it for cracks, sand holes, improper machining, and damaged surfaces. If the water pump housing is damaged beyond repair, replace the complete water pump.

FAN DRIVE CLUTCH

Check the control piston for free movement in the coupling. If the control piston sticks, remove the piston and clean it with emery cloth.

For fan drive clutch test procedures, refer to Part 11-1, Section 1.

Check the bi-metallic strip, and if it is damaged, replace the complete fan drive clutch assembly. Bi-metallic strips are not interchangeable. Be sure to install the bi-metallic strip with the identification stamp "B-1" facing the fan drive clutch.

After the fan drive clutch is assembled, clean the drive with a clean cloth and solvent. **The fan drive clutch should not be dipped in any liquid.**

PART 11-2 WATER PUMP

1 DESCRIPTION AND OPERATION

A centrifugal-type water pump is mounted on the front of the cylinder block. The water pump inlet port is connected to the bottom of the radiator left header tank to draw coolant from the radiator when the thermostat is open. A by-pass port on the water pump is connected to the intake manifold coolant passage to permit coolant circulation within the engine when the thermostat is closed, bypassing the radiator.

A vane-type, cast-iron impeller supplies coolant through centrifugal action to the water pump outlet ports. Two outlet ports, one for each cylinder bank, provide uniform coolant circulation in the engine cooling passages.

The water pump has 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.**

The cooling fan hub is pressed a specified distance onto the water pump shaft.

2 REMOVAL AND INSTALLATION

REMOVAL

1. Drain the cooling system.

2. Disconnect the power steering pump bracket from the water pump and remove the drive belt. Wire the power steering pump assembly to the left side of the car in a position that will prevent the oil from draining out.

On a car with an air conditioner remove the compressor drive belt.

3. Remove the alternator adjusting arm bolt at the alternator and loosen the adjusting arm bolt at the water pump. Loosen the two alternator mounting bolts at the bracket. Move the alternator inward and remove the fan belt. Remove the fan, spacer and pulley.

On an engine equipped with a fan drive clutch, remove the capscrews retaining the fan drive clutch to the water pump hub. Remove the fan drive clutch and fan as an assembly. Remove the water pump pulley.

4. Disconnect the radiator lower hose and heater hose at the water pump.

5. Remove the alternator bracket retaining bolt at the water pump. Loosen the alternator bracket retaining bolt at the cylinder block, and move the bracket away from the water pump.

6. Loosen and move the water pump bypass hose front clamp to the rear. Remove the bolts retaining the water pump to the block, and remove the water pump assembly and gaskets.

7. Remove the alternator adjusting arm retaining bolt and remove the arm from the pump.

INSTALLATION

Before the water pump is installed, check it for damage. If it is damaged and requires repair, replace it with a new pump or install a rebuilt pump obtained from a Ford-Authorized Reconditioner.

1. Install the alternator adjusting arm, fan, spacer, and pulley on the water pump.

On an engine equipped with a fan drive clutch, position the pulley, fan drive clutch and fan on the water pump hub. Install the retaining capscrews and torque to specifications. After the capscrews have been torqued, check the fan drive clutch flange-to-water pump hub for proper mating.

2. Remove all the gasket material from the mounting surfaces of the water pump and the cylinder block. Position new gaskets, coated on both sides with water-resistant sealer, on the cylinder block, then install the pump. Tighten the retaining bolts evenly and alternately to avoid fracturing the bosses.

3. Position the water pump bypass hose front clamp. Install the alternator mounting bracket to the pump; then tighten the alternator mounting bracket bolt at the cylinder block.

4. Connect the radiator lower hose and heater hose.

5. Position the fan belts over the pulleys and install the alternator adjusting arm bolt at the alternator. Adjust the belt tension to specifications, and tighten the alternator adjusting arm bolts and the mounting bolts at the bracket.

6. On a car with an air conditioner, install and adjust the compressor drive belt to specifications.

Install the power steering pump drive belt and attach the pump bracket to the water pump. Adjust the drive belt tension to specifications.

7. Fill and bleed the cooling system. Operate the engine until normal operating temperature has been reached, then check for leaks.

PART 11-3 RADIATOR, SUPPLY TANK AND THERMOSTAT

1 DESCRIPTION AND OPERATION

RADIATOR

The radiator is of the tube and corrugated-fin-core type with the tubes arranged horizontally for cross-flow of the coolant. Two header tanks, one on each side of the radiator (Fig. 4), provide uniform distribution of the coolant to the cross-flow tubes. The header tank, or chamber, on the left side of the radiator contains a heat exchanger for cooling the transmission fluid. The radiator outlet port (lower left side) is connected to the water pump inlet port.

SUPPLY TANK

A separate radiator supply tank (Fig. 4) is connected to the radiaator inlet port to control coolant surging and provide a pressure chamber for the pressurized cooling system. The inlet port of the supply tank is connected to the intake manifold coolant passage at the thermostat, thereby permitting coolant circulation through the supply tank and radiator when the thermostat is open.

THERMOSTAT

A poppet-type thermostat is mounted in a recess in the coolant outlet passage of the intake manifold. When the thermostat is closed, coolant flows to the water pump through a bypass passage at the front of the intake manifold.

The thermostat used in production is for use with water or permanent-type anti-freeze. A lower temperature thermostat is also available for use with non-permanent-type anti-freeze or water. For operating temperatures, refer to the specifications.

Do not attempt to repair the thermostat. It should be replaced if it is not operating properly.

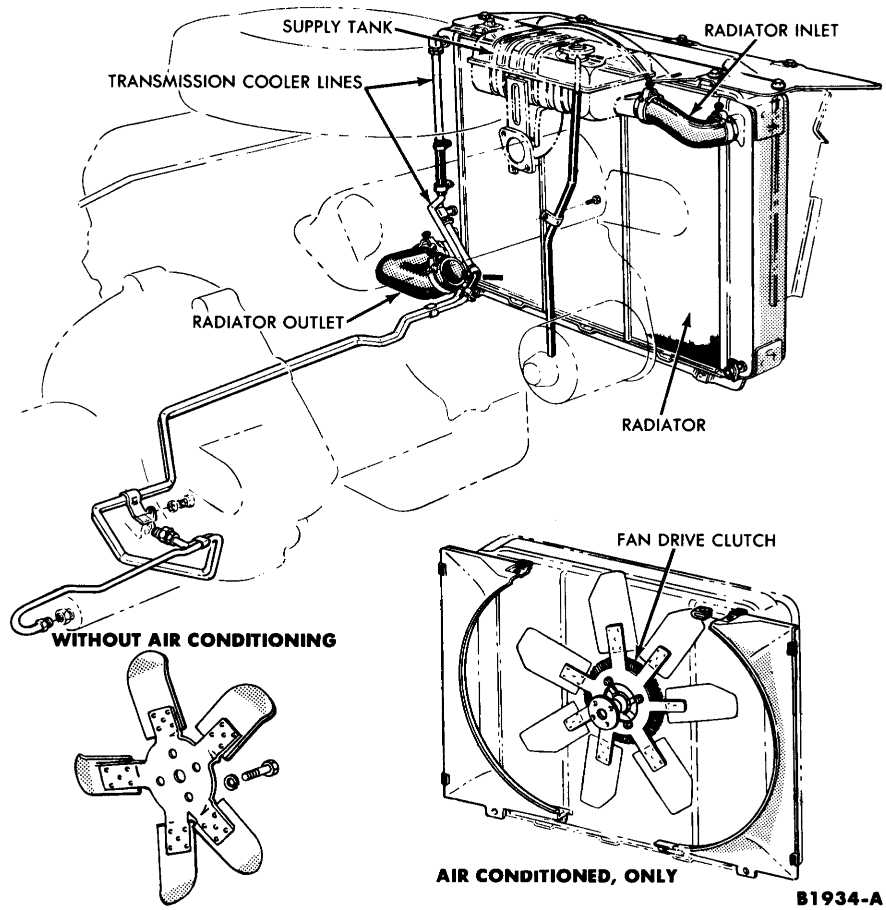


FIG. 4–Radiator and Supply Tank

2 REMOVAL AND INSTALLATION

RADIATOR

REMOVAL

1. Drain the cooling system.
2. Remove the radiator upper support.
3. If equipped with an air conditioner, remove the fan shroud retaining screws and position the shroud out of the way.
4. Disconnect the radiator upper and lower hoses at the radiator.
5. Disconnect the transmission oil cooler inlet and outlet lines at the radiator.
6. Remove the radiator upper and lower support bolts; then remove the radiator. The radiator supply tank need not be removed unless required.

INSTALLATION

1. If a new radiator is to be installed, remove the drain cock from

the old radiator and install it on the new radiator.

2. Position the radiator in the chassis and install and tighten the support bolts.

3. Connect the transmission oil cooler inlet and outlet lines.

4. Connect the radiator upper and lower hoses.

5. If equipped with an air conditioner, install the fan shroud.

6. Install the radiator upper support.

7. Close the drain cock. Fill and bleed the cooling system. Operate the engine and check for coolant leaks. Check the transmission oil cooler lines for leakage. Check the transmission fluid level.

RADIATOR SUPPLY TANK

REMOVAL

1. Drain the cooling system so that the coolant level is below the radiator supply tank. Disconnect the radiator upper hose at the radiator supply tank (Fig. 4).

2. Remove the supply tank retaining screws. Remove the supply tank. Remove the thermostat and gasket from the supply tank.

INSTALLATION

1. Remove all the gasket material from the mounting surfaces of the supply tank and the intake manifold. Coat a new supply tank gasket with sealer, then position the gasket on the intake manifold opening. **The supply tank gasket must be positioned on the manifold before the thermostat is installed.**

2. Install the thermostat in the manifold opening with the copper pellet or element toward the engine. **If the thermostat is improperly installed it will cause the engine to overheat.**

3. Position the supply tank against the manifold; then install and torque the retaining screws to specifications.

If a new tank is installed, remove the overflow hose from the old tank and install it on the new tank.

4. Connect the radiator upper hose. Fill and bleed the cooling system. Check for leaks and proper coolant level after the engine has reached normal operating temperature.

THERMOSTAT REPLACEMENT

To remove or install the thermostat, refer to "Radiator Supply Tank Removal or Installation."

Check the thermostat before installing it, following the procedure under "Thermostat Test."

PART 11-4 FAN DRIVE CLUTCH

1 DESCRIPTION AND OPERATION

The fan drive clutch (Fig. 5) is a fluid coupling containing silicone oil. Fan speed is regulated by the torque-carrying capacity of the silicone oil. The more silicone oil in the coupling the greater the fan speed, and the less silicone oil the slower the fan speed.

A bi-metallic strip and control piston on the front of the fluid coupling regulates the amount of silicone oil entering the coupling. The bimetallic strip bows outward with an increase in surrounding temperature and allows a piston to move outward. The piston opens a valve regulating the flow of silicone oil into the coupling from a reserve chamber. The silicone oil is returned to the reserve chamber through a bleed hole when the valve is closed. Therefore, when the air passing through the radiator becomes hotter, the fan speed increases, and as the temperature decreases, the fan slows down.

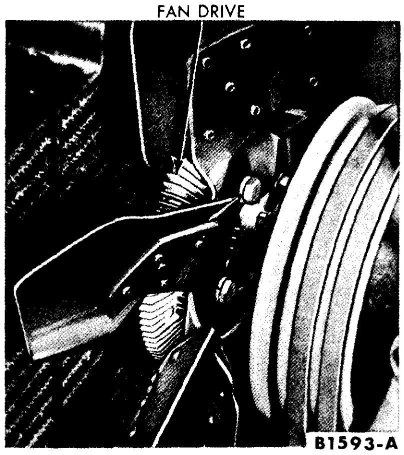


FIG. 5–Fan Drive Clutch

The input side of the coupling is attached to the water pump hub and the fan is attached to the output side. Fins are cast integrally on the exterior of the fluid coupling to dissipate the heat generated by the shearing action of the silicone oil.

2 REMOVAL AND INSTALLATION

REMOVAL

1. Remove the radiator upper support.
2. Remove the capscrews retaining the fan drive clutch to the water pump hub (Fig. 5). Remove the fan drive clutch and fan as an assembly.
3. Remove the retaining capscrews and separate the fan from the fan drive clutch.

INSTALLATION

1. Position the fan on the fan drive clutch and install the retaining capscrews.
2. Position the fan drive clutch and fan assembly to the water pump hub (Fig. 5). Install and tighten the retaining capscrews.
3. Install the radiator upper support.

3 MAJOR REPAIR OPERATION

DISASSEMBLY

1. Remove the bi-metallic strip (Fig. 6) by pushing one end of the strip toward the fan clutch body so that it clears the retaining bracket. Then push the strip to the side so that the opposite end of the strip will spring out of the bracket.
2. Remove the control piston.

CLEANING AND INSPECTION

For cleaning and inspection procedures, refer to Part 11-1.

ASSEMBLY

The fan drive clutch assembly is shown in Fig. 7.

1. Install the control piston (Fig. 3) so that the projection on the end of the piston will contact the bi-metallic strip.

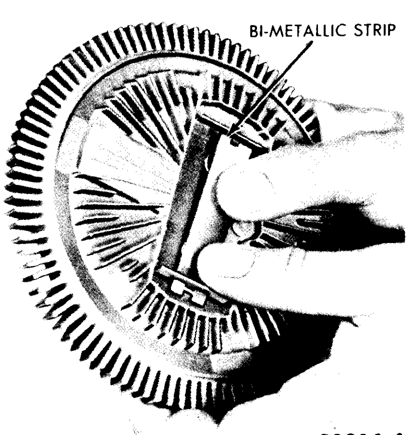


FIG. 6–Fan Drive Clutch Assembly

2. Install the bi-metallic strip with the identification stamp "B-1" facing the fan drive clutch.

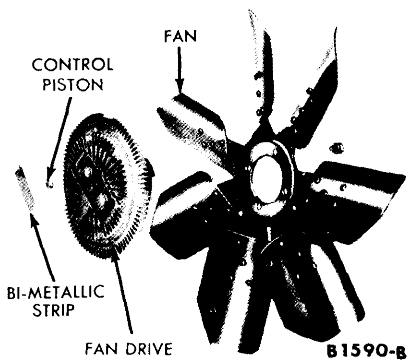


FIG. 7–Fan and Drive Clutch

PART 11-5 SPECIFICATIONS

COOLING FAN

	OUTSIDE DIAMETER	NO. OF BLADES
Standard	18.50 inches	5
Air-Conditioner-Equipped	18.00 inches	7

WATER PUMP

WATER PUMP DRIVE ARRANGEMENT	
Dual belts drive water pump, fan and alternator	
WATER PUMP PULLEY TO ENGINE RATIO	
Standard Cooling and Air-Conditioner-Equipped	0.94:1
WATER PUMP ASSEMBLY DIMENSIONS	
Front Face of Pulley Hub to Pump Housing Face	7.569 inches
Impeller to Housing Cover Mounting Surface Clearance	0.070-0.080 inches

DRIVE BELT TENSION

BETWEEN ALTERNATOR AND WATER PUMP PULLEY (SINGLE BELT)	
New	110-140
*Used	80-110
Minimum Operating Tension	70
BETWEEN ALTERNATOR AND WATER PUMP PULLEY (DUAL BELTS)†	
New—Front	110-140
Rear	105-155
*Used—Front	80-110
Rear	75-120
Minimum Operating Tension	70
BETWEEN WATER PUMP AND AIR COMPRESSOR PULLEY	
New	120-150
*Used	90-120
Minimum Operating Tension	80
BETWEEN CRANKSHAFT AND POWER STEERING PULLEY	
New	120-150
*Used	90-120
Minimum Operating Tension	80

*Belt operated for a minimum of 10 minutes is considered a used belt.
†Dual Belts Used When Equipped With Air Conditioner.

COOLING SYSTEM CAPACITY

	APPROXIMATE CAPACITY* (QUARTS)	
Cooling System	U. S. Measure	Imperial Measure
Standard	19½	16¼

*Add 1 quart extra for heater.

THERMOSTATS

LOW TEMPERATURE	
Opens °F.	157°-164°
Fully Open	184°-188°
HIGH TEMPERATURE	
Opens °F.	192°-199°
Fully Open	219°-221°

TORQUE VALUES

NOTE: **All specifications are given in ft-lbs unless otherwise noted.**

Water Pump to Cylinder Block	20-25
Water Outlet Housing	12-15
Fan and Spacer to Pulley Hub	12-18
Fan to Fan Clutch (with a/c)	10-15
Fan Drive Clutch to Water Pump Hub	12-18
Fan Shroud Assembly	10-15
Radiator to Front End	10-15
Upper Support to Radiator	4-7
Radiator to Engine Hose Clamps	1.0-2.5
Transmission Oil Cooler Tubes to Radiator	18-25
Hose Clamps	15-20 in-lbs.

SPECIAL SERVICE TOOLS

FORD TOOL NO.	FORMER TOOL NO.	DESCRIPTION
T63L-8620-A	8620-A	Belt Tension Gauge

GROUP 12

PART 12-1 EXHAUST SYSTEM

1 DESCRIPTION

A dual exhaust system (Fig. 1) is used on all Thunderbird Models. The production installed exhaust system consists of: a welded, one-piece resonator inlet and crossover pipe assembly; a one-piece assembly on each side of the car that consists of a resonator inlet pipe, resonator, muffler inlet pipe, muffler and muffler outlet pipe.

The service replacement exhaust system consists of: a welded one-piece resonator inlet and crossover pipe assembly (the same as used in production); a one-piece resonator inlet pipe and resonator assembly for each side of the car; a one-piece muffler inlet pipe, muffler and muffler outlet pipe assembly for each side of the car; and a sleeve and two clamps to connect the resonator and pipe assembly to the muffler and pipe assembly on each side of the car.

Hinged-type, rubber-bushed hanger brackets and bracket clamps secure the exhaust system to the car underbody. The flanged ends of the resonator inlet and crossover pipe and exhaust manifolds are sealed by means of gaskets and secured with studs and nuts. A retaining clamp secures each resonator inlet pipe to the crossover inlet pipe assembly.

2 IN-CAR ADJUSTMENTS AND REPAIRS

The exhaust system must be free of leaks, excessive noise, binds, grounding and excessive vibration.

Exhaust system vibration, grounding, or binds are usually caused by: loose, broken or improperly aligned clamps or brackets; and improper installation of the crossover inlet pipe flanges on the exhaust manifolds. Any of the aforementioned conditions may cause changes to the clearances of the exhaust system components (Fig. 2). If any of these conditions exist, the clearance of the exhaust system components must be checked, adjusted and neutralized (strain relieved) or replaced to make certain the specified clearances are maintained.

EXHAUST SYSTEM ALIGNMENT

The exhaust system components and clearance specifications are shown in Figs. 1 and 2. Perform the following procedure to adjust and neutralize the exhaust system:

1. Raise the car. Loosen the upper clamp brackets at the muffler outlet pipe hanger assemblies. Loosen the clamps at the hanger assemblies located at the underbody side member "kick-ups."

2. If the car is equipped with a service replacement one-piece muffler inlet pipe, muffler and muffler outlet pipe assembly(ies), loosen the clamps securing the sleeve(s) to the muffler inlet pipes.

3. Loosen the clamps securing the resonator inlet pipes to the crossover inlet pipe assembly.

4. Loosen the retaining nuts securing the crossover inlet pipe flanges to the exhaust manifolds.

5. Inspect the clamps, brackets, and exhaust manifold studs and nuts, and replace any worn or damaged parts.

6. Torque the crossover inlet pipe flange to exhaust manifold retaining nuts to specification.

If the car is equipped with a service replacement one-piece muffler assembly, adjust the connecting sleeve to position it equally on the front and rear muffler inlet pipes.

7. Adjust the exhaust system components to conform to the clearance specifications shown in Fig. 2. Properly position the respective clamps and brackets. Working from the front of the exhaust system toward the rear, progressively tighten the retaining clamps and brackets.

8. Lower the car. Check the exhaust system for leaks, grounding or excessive vibration.

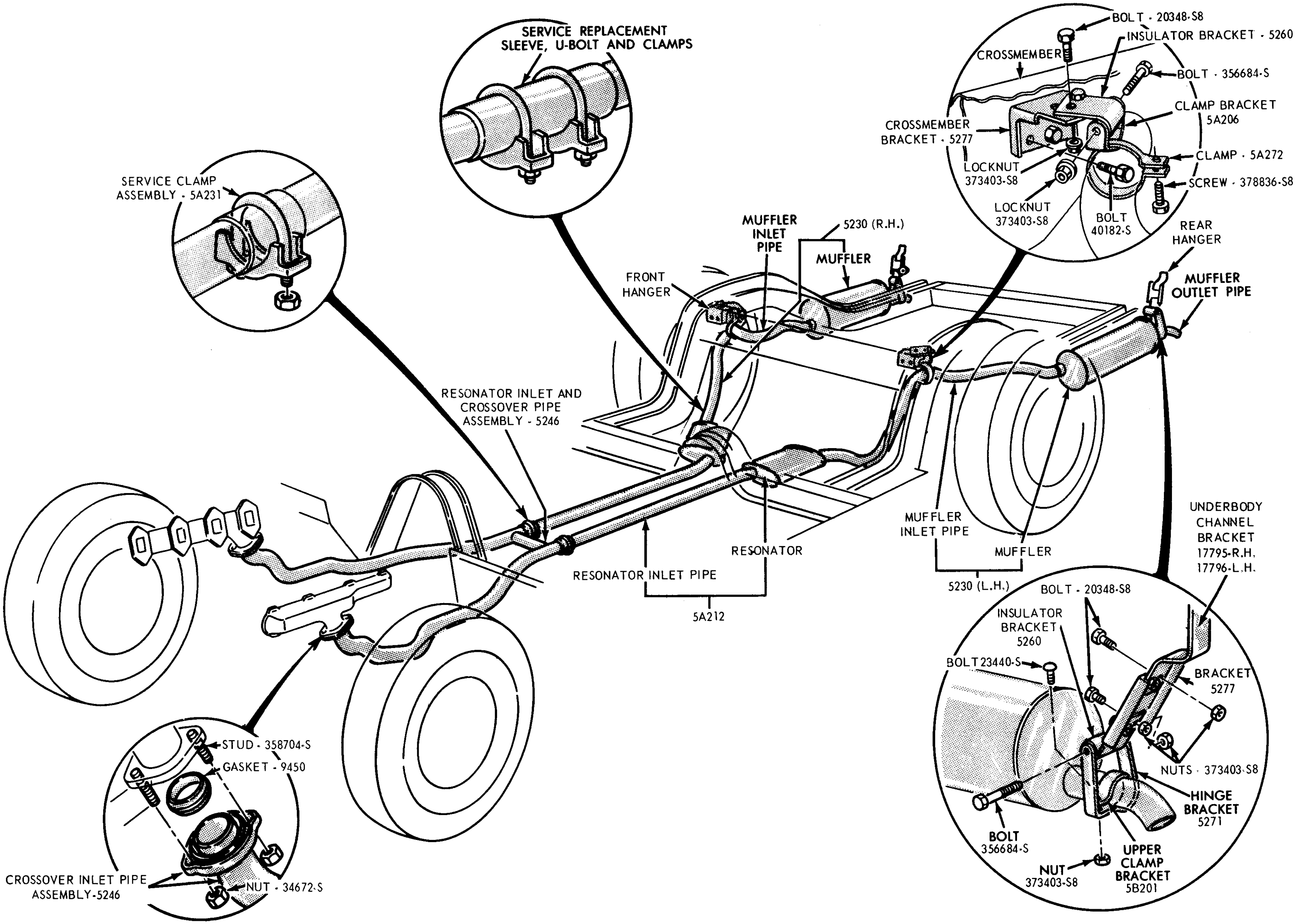


FIG. 1—Thunderbird Exhaust System

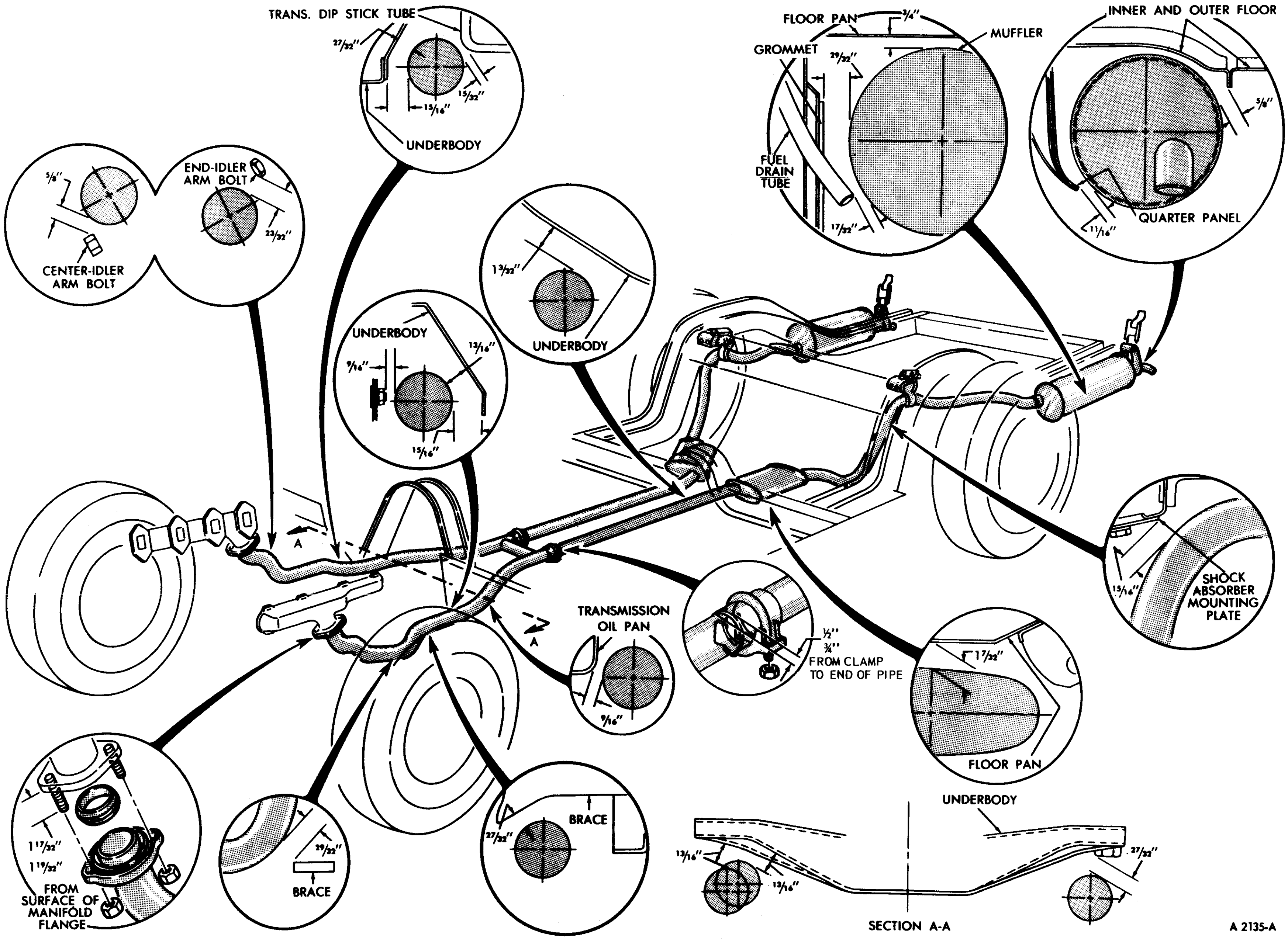


FIG. 2—Thunderbird Exhaust System Clearance Dimensions

3 REMOVAL AND INSTALLATION

The replacement procedures given apply to all Thunderbird Models and to both right and left assemblies of the dual exhaust system. Refer to Figs. 1 and 2 for views of the exhaust system components and their clearance specifications.

RESONATOR INLET AND CROSSOVER PIPE ASSEMBLY

REMOVAL

1. Raise the car. Loosen the clamps securing the resonator inlet pipes to the crossover inlet pipe assembly. Slide the clamps rearward on the resonator inlet pipes.

2. Remove the retaining nuts sesuring the crossover inlet pipes to the exhaust manifolds.

3. Loosen the clamp retaining screws at the right and left muffler inlet pipe hanger assemblies. Loosen the upper clamp bracket retaining nuts at the right and left muffler outlet pipe hanger assemblies.

4. Disconnect the resonator inlet pipes from the crossover inlet pipe assembly, and remove the crossover inlet pipe from the exhaust manifolds. Discard the mounting gaskets.

INSTALLATION

1. Clean the mounting surfaces of the exhaust manifolds and the ends of the resonator inlet pipes.

2. Raise the resonator inlet and crossover pipe assembly into position and connect it to the resonator inlet pipes. Install new right and left exhaust manifold to inlet pipe mounting gaskets; then install the inlet pipe flanges and retaining nuts on the exhaust manifolds. Torque the retaining nuts to specification.

3. Align the exhaust system to conform to the clearance specifications. Torque the right and left resonator inlet pipe to crossover inlet pipe assembly retaining clamps to specification.

4. Torque the right and left front hanger clamp retaining screws to specification. Torque the right and left muffler outlet pipe hanger upper clamp bracket retaining nuts to specification.

5. Lower the car and check the exhaust system for leaks.

RESONATOR INLET PIPE AND RESONATOR ASSEMBLY

REMOVAL

1. Loosen the resonator inlet and crossover assembly to right and left resonator inlet pipe clamps. Slide the clamps forward onto the crossover inlet pipe assembly. Loosen the front hanger clamp and the rear hanger upper bracket clamp.

2. To install an initial service replacement resonator inlet pipe and resonator assembly on a production exhaust system, cut the muffler inlet pipe at a point 2¾ inches from the rear of the resonator (Fig. 1).

On all inlet pipe and resonator assembly replacements required after the initial service replacement on a production exhaust system, loosen the muffler inlet pipe intermediate sleeve clamps.

3. Remove the resonator and pipe assembly. Replace all worn or damaged clamps and brackets.

INSTALLATION

1. Remove any slag or burrs from the cut end of the muffler inlet pipe. Install two clamps on the intermediate sleeve. Position the sleeve and clamps on the resonator outlet.

2. Connect the resonator and pipe assembly to the crossover inlet pipe assembly. Connect the intermediate sleeve to the muffler inlet pipe.

3. Align the exhaust system to conform to the clearance specifications. Torque the crossover inlet pipe assembly to resonator inlet pipe clamp nuts, the intermediate sleeve clamp nuts, the front hanger clamp retaining screw and the rear hanger clamp bracket retaining nut to specifications.

4. Lower the car and check the system for leaks.

MUFFLER INLET PIPE, MUFFLER AND MUFFLER OUTLET PIPE

REMOVAL

1. To install an initial service replacement muffler inlet pipe, muffler and muffler outlet pipe assembly on a production exhaust system, cut the muffler inlet pipe at a point 2¾ inches from the rear of the resonator (Fig. 1).

On muffler inlet pipe, muffler and muffler outlet pipe assembly replacements required after an initial service replacement, loosen the clamp at the muffler inlet end of the intermediate sleeve and slide it forward.

2. Loosen the clamp at the front hanger. Remove the bolt securing the clamp bracket to the insulator bracket. Loosen the upper clamp bracket at the rear hanger. Remove the retaining bolts securing the rear hanger bracket to the underbody channel bracket. Remove the muffler, pipes, front clamp bracket and rear hanger bracket as an assembly.

3. Remove the front clamp bracket from the muffler inlet pipe. Remove the rear hanger assembly from the muffler outlet pipe. Replace all worn or damaged clamps and brackets.

INSTALLATION

1. On an initial service replacement, remove any slag or burrs from the cut end of the resonator outlet. Place two clamps on the intermediate sleeve, and install the sleeve on the resonator outlet.

2. Install the front hanger clamp and clamp bracket on the muffler inlet pipe, and connect the new muffler and pipe assembly to the sleeve. Loosely install the clamp bracket to insulator bracket retaining bolt.

3. Install the rear hanger assembly on the muffler outlet pipe. Install the rear hanger assembly on the underbody channel bracket and torque the retaining bolts to specification.

4. Align the exhaust system to conform to the clearance specifications (Fig. 2). Torque the intermediate sleeve clamp nut(s), front hanger clamp screw, front hanger insulator bracket to clamp bracket retaining bolt and hanger upper bracket retaining nuts to specifications.

5. Lower the car and check the system for leaks.

PART 12-2 SPECIFICATIONS

TORQUE LIMITS	Ft-lbs
Muffler Inlet Pipe to Engine Manifold	25-35
Resonator Inlet and Resonator Inlet and Crossover Pipe Assembly Clamps	13-20
Front Hanger Clamp	13-20
Front Hanger Clamp Bracket to Insulator Bracket	13-20
Front Hanger Insulator Bracket to Crossmember Bracket	13-20
Front Hanger Crossmember Bracket to Crossmember	13-20
Muffler Inlet Pipe Sleeve Clamps	13-20
Rear Hanger Upper Clamp Bracket to Hinge Bracket	13-20
Rear Hanger Hinge Bracket to Insulator Bracket	13-20
Rear Hanger Insulator Bracket to Underbody Flange Bracket	13-20
Rear Hanger Flange Bracket to Underbody Channel Bracket	13-20

GROUP 13

PART 13-1 GENERAL CHARGING SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

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. The alternator belt worn, or loose and slipping over the pulley.
2. The battery in such poor condition that it will not hold or take a charge.
3. The alternator not producing its rated output.
4. Regulator unit out of adjustment, and excessive resistance in the alternator-to-battery circuit or in the battery-to-ground circuit.

First check the alternator belt adjustment and condition.

RECHARGE OR REPLACE BATTERY

Perform a battery Capacity Test (in this part). Replace the battery if the test indicates it is worn out or under capacity. If the battery capacity is normal, proceed as follows:

TEST ALTERNATOR OUTPUT

Test the alternator output(in this part) to determine if the alternator is at fault. If the output is normal or greater than the rating of the alternator, proceed with an alternator regulator test under the heading Test Alternator Regulator. If the output is low, proceed as follows:

ALTERNATOR OUTPUT LOW

Connect a heavy jumper wire from the battery ground post to the alternator ground terminal. Repeat the alternator output test. If the output now reaches or exceeds rated output, either the alternator 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 alternator mounting bolts.

If the alternator output is still less than normal, the alternator output could be low due to an open or short circuit in the field, stator, 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 in the slip rings. Remove the alternator for repair.

TEST CIRCUIT RESISTANCE

If the alternator output is normal, check the external circuit to deter-

CONTINUED ON NEXT PAGE

TROUBLE DIAGNOSIS GUIDE (Continued)

BATTERY LOW IN CHARGE (Continued)	mine the circuit resistance (in this part). **RESISTANCE EXCESSIVE** If the resistance (voltage drop) is greater than that specified for the vehicle, locate the trouble by performing a complete external circuit resistance test (in this part). Repair or replace the defective part. **RESISTANCE NORMAL** If the resistance (voltage drop) is equal to or less than that specified for the vehicle, test the alternator regulator.	**TEST ALTERNATOR REGULATOR** If the circuit resistance is normal, test the regulator to determine if it is properly adjusted. After checking both regulator units, adjust or replace the regulator as necessary. If the regulator is not at fault, the low charge is due to operational factors such as: 1. Excessive use of accessories. 2. Short trips. 3. Accidental discharge of battery. 4. Incorrect engine lubricant for ambient temperature encountered. 5. Regulator calibration set too close to low limit for vehicle operating conditions.
HIGH CHARGING RATE	Indications of a high charging rate are: 1. Lights and fuses burn out repeatedly. 2. Battery requires too frequent refilling. 3. The ignition contacts have a short life. 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 limiter. If the voltage limit 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 (Part 13-3).

ALTERNATOR TESTS

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

Use care when connecting any test equipment to the alternator system as the alternator output terminal is connected to the battery at all times.

ALTERNATOR OUTPUT TEST

When an alternator output test is conducted off the car, a test bench must be used. Follow the procedure given by the test bench equipment manufacturer. **When the alternator is removed from the car for this purpose, always disconnect a battery cable, as the alternator battery terminal is connected to the battery at all times.**

To test the output of the alternator on the car, proceed as follows:

1. Place the transmission in neutral or park and apply the parking brake. Make the connections as shown in Fig. 1. Be sure that the field resistance control is at the OFF position at the start of this test.

2. Close the battery adapter switch. Start the engine, then open the battery adapter switch.

3. Increase the engine speed to approximately 2750 rpm.

4. Adjust the field resistance control until the voltmeter reads exactly 15 volts. Observe the ammeter reading. Add 2 amperes to this reading when the car is equipped with standard ignition or 6 amperes with the transistor ignition system, to obtain total alternator output.

If the battery was fully charged, it might not be possible to obtain maximum current output. If specified current is not obtained, make the following test before condemning the alternator:

5. Turn the field resistance control knob to the OFF position. Rotate the master control knob to the CURRENT REG. position. Maintain the engine speed at 2750 rpm.

6. Turn the field resistance control and the master control clockwise, maintaining a voltmeter reading of 15 volts maximum, until the field resistance control is at its maximum clockwise position.

7. Readjust the master control until the voltmeter reads exactly 15 volts. Observe the ammeter reading. Add 2 amperes to this reading when the car is equipped with standard ignition or 6 amperes with the transistor ignition system, to obtain total alternator output.

8. Stop the engine, return the field resistance control to the OFF position and disconnect the test equipment.

An output of 2 to 5 amperes below specifications usually indicates an open diode rectifier. An output of approximately 10 amperes below specifications usually indicates a shorted diode rectifier. An alternator with a shorted diode will usually whine, which will be most noticeable at idle speed.

DIODE TEST

To test the positive diodes, make the connections shown in Fig. 3. Contact the probe to each stator lead terminal. Make sure that the tip of the probe is sharp and that it penetrates the varnish at the stator terminals.

To test the negative diodes, make the connections shown in Fig. 4. Follow the same procedure as for the positive diodes.

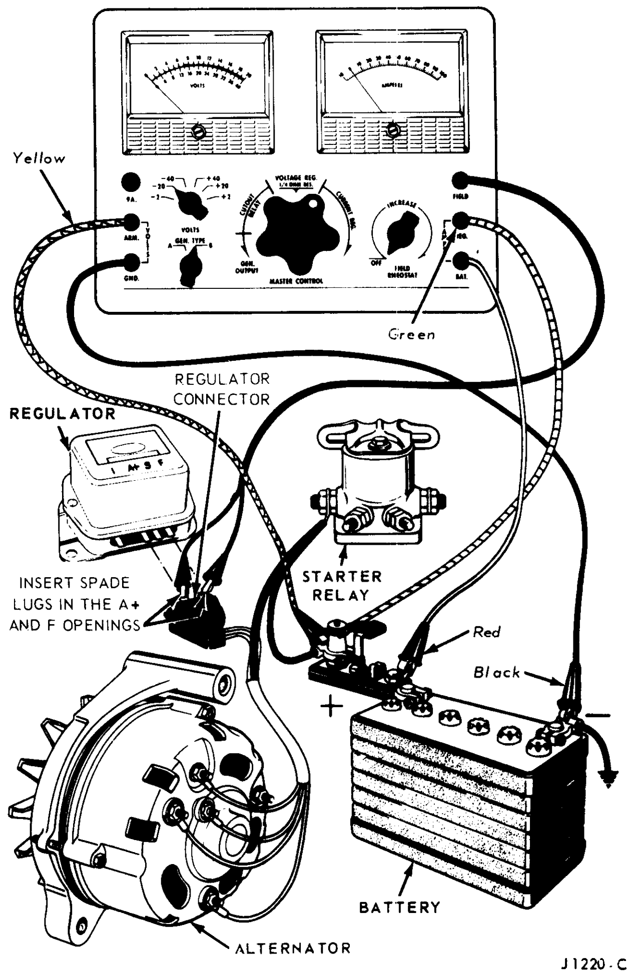


FIG. 1—Alternator Output Test

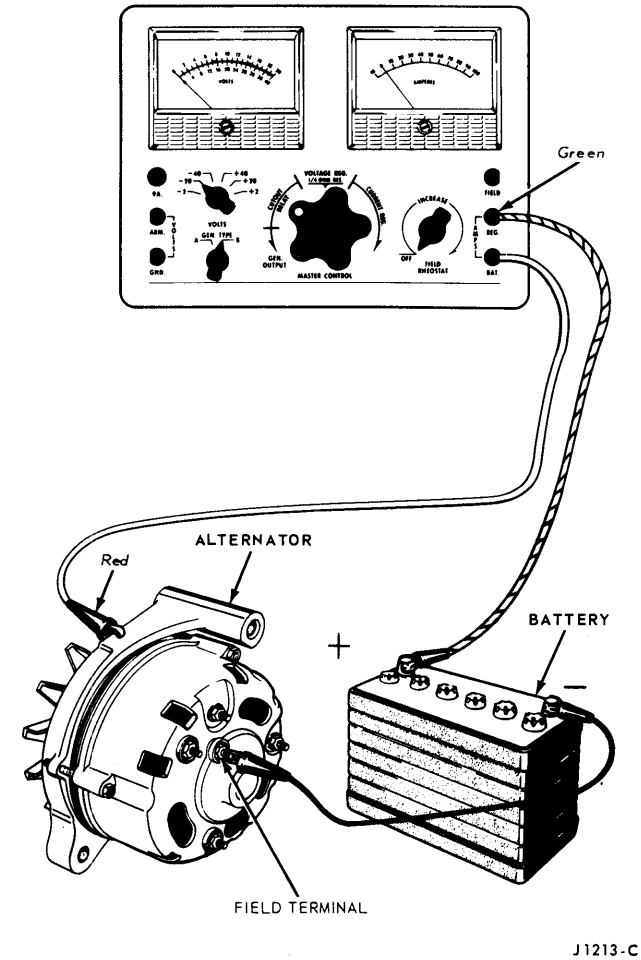


FIG. 2—Field Open or Short Circuit Test

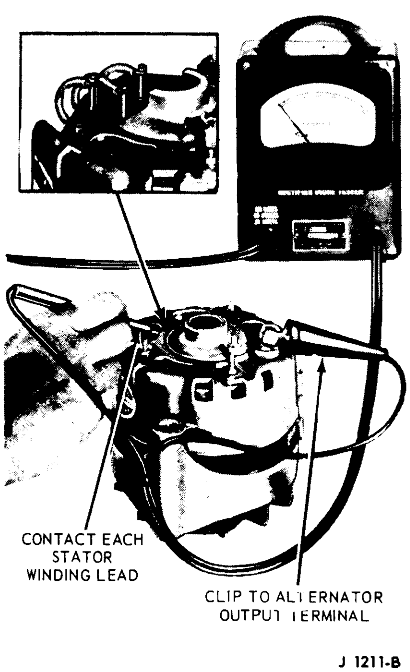


FIG. 3—Positive Diode Test

Good diodes will be indicated as on the meter in Figs. 3 and 4 (2 amperes or more and readings alike within 2 scale divisions).

FIELD OPEN OR SHORT CIRCUIT TEST

Make the connections as shown in Fig. 2. The current draw, as indicated by the ammeter, should be to specifications. If there is little or no current flow, the field or brushes have a high resistance or are open. A current flow considerably higher than that specified above, indicates shorted or grounded turns or brush leads touching. If the test shows that the field is shorted or open and the field brush assembly or slip rings are not at fault, the entire rotor must be replaced.

REGULATOR AND CIRCUIT TESTS

The tests presented are outlined for on-the-car operation. Be sure that the regulator is at normal operating

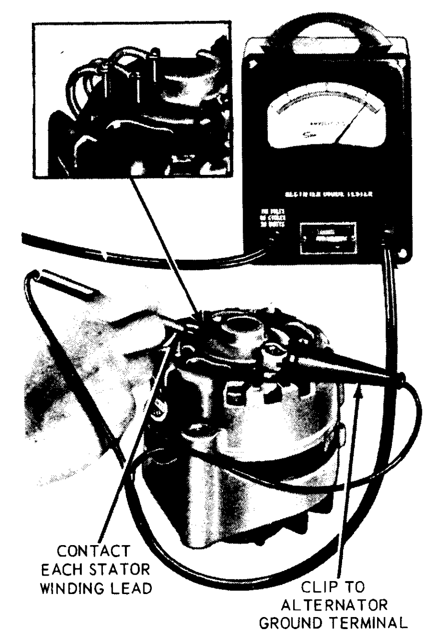


FIG. 4—Negative Diode Test

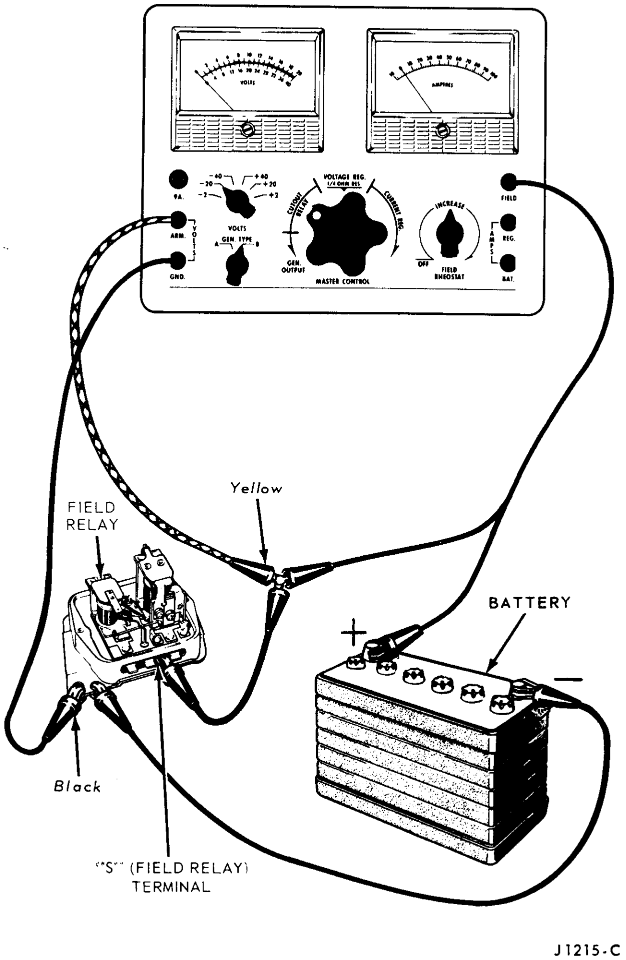


FIG. 5—Field Relay Test

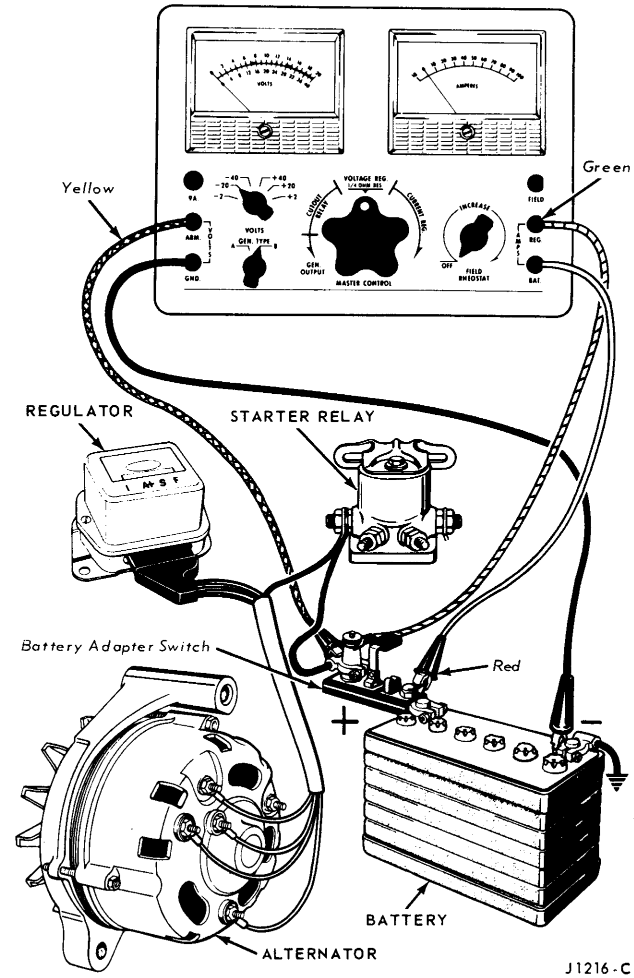


FIG. 6—Voltage Limiter Test

temperature (equivalent to the temperature after 20 minutes of operation on the car with the hood down).

FIELD RELAY TEST

Disconnect the regulator connector plug, and remove the regulator cover. Make the connections as shown in Fig. 5. Slowly rotate the field resistance control clockwise from the OFF position until the field relay contacts close. Observe the voltmeter reading at the moment that the relay closes. This is the relay closing voltage. If the relay closes immediately, even with the field resistance close to the OFF position, use a 6-volt battery for this test. If the closing voltage is not to specifications, adjust the relay (Part 13-3).

VOLTAGE LIMITER TEST

For test purposes, the lower stage (armature vibrating on the lower contact) regulation is used. Voltage limiter calibration tests must be made with the regulator cover in place and the regulator at normal operating temperature (equivalent to the temperature after 20 minutes of operation on the car with the hood down).

Make the test connections as shown in Fig. 6. Turn all accessories off, including door operated dome lights. Close the battery adapter switch, start the engine, then open the adapter switch. Attach the voltage regulator thermometer Tool T56L-10505-A, to the regulator cover. Operate the engine at approximately 1850 rpm for 5 minutes. Turn the master control to the cutout relay position. If the ammeter indicates more than 10 amperes, stop the engine, remove the battery cables and charge the battery.

When the battery is charged, and the voltage regulator has been temperature stabilized, rotate the master control to the VOLTAGE REG. position. The ammeter should indicate approximately 2 amperes.

Cycle the regulator as follows: stop the engine, close the adapter switch, start the engine, and open the adapter switch. Allow the battery to normalize for a short time, then read the voltmeter. Read the thermometer, and compare the voltmeter reading with the voltage given in Table 1 for the ambient temperature indicated on the thermometer. If the

TABLE 1—Voltage Limiter Setting Versus Ambient Air Temperature

Ambient Air Temperature °F	Voltage Limiter Setting (Volts)
50	14.3-15.1
75	14.1-14.9
100	13.9-14.7
125	13.8-14.6
150	13.6-14.4
175	13.5-14.3

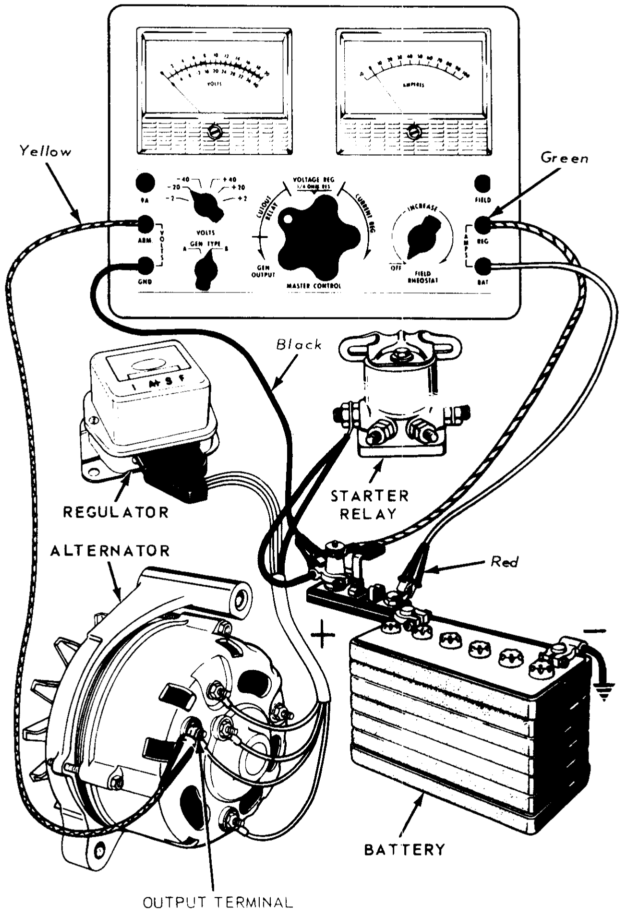


FIG. 7—Voltage Drop Test—Alternator to Battery Positive Terminal

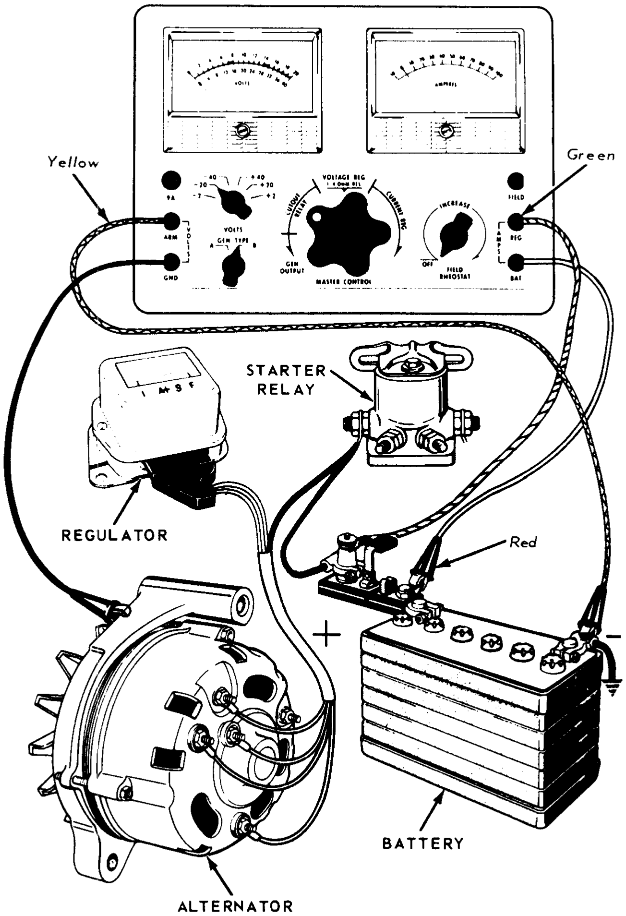


FIG. 8—Voltage Drop Test—Alternator to Battery Ground Terminal

regulated voltage is not within specifications, make a voltage limiter adjustment. After each adjustment, be sure to cycle the regulator before each reading. **The readings must be made with the cover in place.**

CIRCUIT RESISTANCE TESTS

For the purpose of this test, the resistance values of the circuits have been converted to voltage drop readings for a current flow of 20 amperes.

Alternator to Battery Positive Terminal. To check the alternator to battery positive terminal voltage drop, make the connections as shown in Fig. 7. Turn off all electrical accessories and lights. Close the battery adapter switch, start the engine, then open the battery adapter switch. Slowly increase the engine speed until the ammeter reads 20 amperes. Note the voltmeter reading at this point. The voltage reading should be no greater than 0.3 volt.

These voltage drops have been computed for a standard car. The current used by auxiliary, continuously operating, heavy-duty equipment will not show on the ammeter and will have to be taken into account when making this test.

If the battery is fully charged, it may not be possible to reach the 20 amperes required for the test. Connect a battery discharge tester to the battery terminals and adjust the load on the battery until the required 20 amperes is indicated.

Alternator to Battery Ground Terminal. To check the alternator to battery ground terminal voltage drop, make the connections as shown in Fig. 8. Close the battery adapter switch, start the engine and open the adapter switch. Slowly increase the engine speed until the ammeter reads 20 amperes. The voltage indicated on the voltmeter should be less than 0.1 volt. If necessary, use a battery discharge tester, as in the preceding test to obtain the required 20-ampere reading.

BATTERY TESTS AND CONCLUSIONS

Tests are made on a battery to determine the state of charge and also the condition. The ultimate result of these tests is to show that the battery is good, needs recharging, or must be replaced.

If a battery has failed, is low in charge, or requires water frequently, good service demands that the reason for this condition be found. It may be necessary to follow trouble shooting procedures to locate the cause of the trouble (Section 1 in this part).

Hydrogen and oxygen gases are produced in the course of normal battery operation. This gas mixture can explode if flames or sparks

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 attempting to test a battery, it is important that it be given a thorough visual examination to determine if it has been damaged. The presence of moisture on the outside of the case and/or low electrolyte level in one or more of the cells are indications of possible battery damage.

The Ford and Mercury batteries incorporate a single one-piece cover which completely seals the top of the battery and the individual cell connectors. This cover must not be pierced with test probes to perform individual cell tests.

A battery can be tested by determining its ability to deliver current. This may be determined by conducting a Battery Capacity Test. Fig. 9 shows the battery capacity test in outline form.

BATTERY CAPACITY TEST

A high rate discharge tester (Battery-Starter Tester) in conjunction with a voltmeter is used for this test.

1. Turn the control knob on the Battery-Starter Tester to the OFF position.

2. Turn the voltmeter selector switch to the 16 or 20-volt position.

3. Connect both positive test leads to the positive battery post and both negative test leads to the negative battery post. **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.**

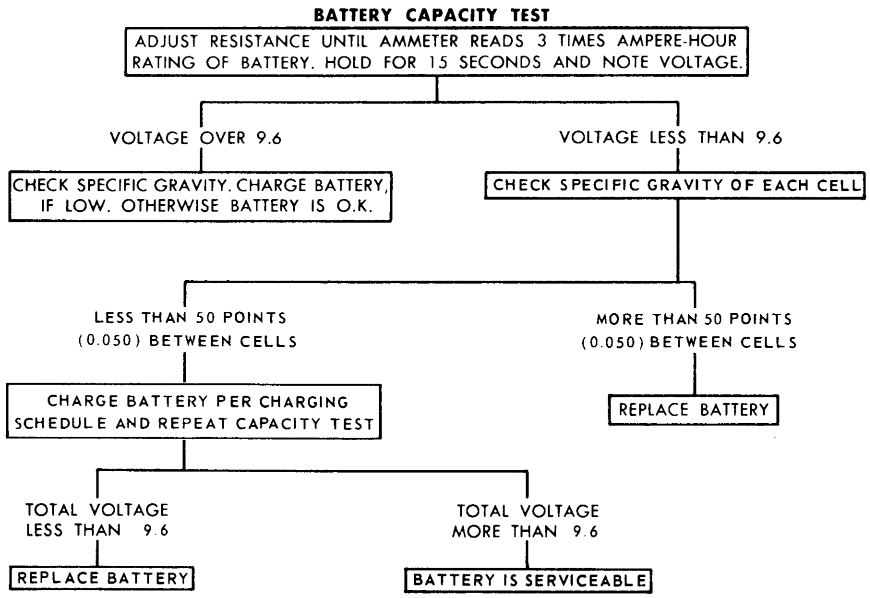


FIG. 9—Battery Capacity Test Outline J 1039-D

4. Turn the load control knob in a clockwise direction until the ammeter reads three times the ampere hour rating of the battery (a 45 ampere-hour battery should be tested at 135 amperes load).

5. With the ammeter reading the required load for 15 seconds, note the voltmeter reading. **Avoid leaving the high discharge load on the battery for periods longer than 15 seconds.**

6. If the voltmeter reading is 9.6 volts or more, the battery has good output capacity and will readily accept a charge, if required. Check the specific gravity. If the specific gravity reading is 1.240 or below, charge the battery until it is fully charged.

The battery is fully charged when the cells are all gassing freely and the specific gravity ceases to rise for three successive readings taken at hourly intervals. Additional battery testing will not be necessary after the battery has been properly charged.

7. If the voltage reading obtained during the capacity test is below 9.6 volts, check the specific gravity of each cell.

8. If the difference between any two cells is more than 50 points (0.050), the battery is not satisfactory for service and should be replaced.

9. If the difference between cells is less than 50 points (0.050), the battery should be charged according to the following charging schedule. In some cases the electrolyte level will be too low to obtain a specific gravity reading. In such cases water should be added until the electrolyte level just covers the ring in the filler well, then charge the battery at 35 amperes for 15 minutes. Check the specific gravity of each cell and if the difference between cells is less than 50 points (0.050), charge the battery according to the schedule.

10. After the battery has been charged, repeat the capacity test. If the capacity test battery voltage is still less than 9.6 volts, replace the battery. If the voltage is 9.6 volts or more, the battery is satisfactory for service.

11. If the battery is found to be discharged only, check for a loose fan belt, loose electrical connections, charging system performance, and

TABLE 2—Allowable Battery High Rate Charge Time Schedule

Specific Gravity Reading	Charge Rate Amperes	Battery Capacity—Ampere Hours			
		45	55	70	80
1.125-1.150*	35	65 min.	80 min.	100 min.	115 min.
1.150-1.175	35	50 min.	65 min.	80 min.	95 min.
1.175-1.200	35	40 min.	50 min.	60 min.	70 min.
1.200-1.225	35	30 min.	35 min.	45 min.	50 min.
Above 1.225	5	**	**	**	**

*If the specific gravity is below 1.125, use the indicated high rate of charge for the 1.125 specific gravity, then charge at 5 amperes until the specific gravity reaches 1.250 at 80°F.

Charge at 5 ampere rate ***only* until the specific gravity reaches 1.250 at 80°F.

make a battery drain test (in this section).

BATTERY DRAIN TEST

This test will determine if there is any external load that would cause unwanted battery discharge.

Disconnect the battery ground cable and connect the positive lead of a voltmeter to the cable. Connect the negative lead of the voltmeter to the battery negative post.

With all circuits off, the meter should read zero. Any battery external load will cause the voltmeter to read full battery voltage.

If the car is equipped with an electric clock, momentarily connect the battery ground cable to the battery negative post to make certain that the clock is wound. When the clock runs down at the end of approximately 2 minutes the voltmeter will show full battery voltage.

2 COMMON ADJUSTMENTS AND REPAIRS

BELT ADJUSTMENT

1. Loosen the alternator mounting bolt and the adjusting arm bolts.

2. **Apply pressure on the alternator front housing only** and tighten the adjusting arm to alternator bolt.

3. Check the belt tension using tool T63L-8620-A. Adjust the belt for specified tension.

4. Tighten all mounting bolts.

3 CLEANING AND INSPECTION

1. The rotor, stator, and bearings must not be cleaned with solvent. Wipe these parts off with a clean cloth.

2. Rotate the front bearing on the drive end of the rotor shaft. Check for any scraping noise, looseness or roughness that will indicate that the bearing is excessively worn. Look for excessive lubricant leakage. If any of these conditions exist, replace the bearing.

3. Inspect the rotor shaft at the rear bearing surface for roughness or severe chatter marks. Replace the rotor assembly if the shaft is not smooth.

4. Place the rear end bearing on the slip-ring end of the shaft and rotate the bearing on the shaft. Make the same check for noise, looseness or roughness as was made for the front bearing. Inspect the rollers and cage for damage. Replace the bearing if these conditions exist, or if the lubricant is lost or contaminated.

5. Check the pulley and fan for excessive looseness on the rotor shaft. Replace any pulley or fan that is loose or bent out of shape. Check the rotor shaft for stripped or damaged threads. Inspect the hex hole in the end of the shaft for damage.

6. Check both the front and rear housings for cracks. Check the front housing for stripped threads in the mounting ear. Replace defective housings.

7. Check all wire leads on both the stator and rotor assemblies for loose soldered connections, and for burned insulation. Resolder poor connections. Replace parts that show burned insulation.

8. Check the slip rings for nicks and surface roughness. Nicks and scratches may be removed by turning down the slip rings. Do not go beyond the minimum diameter limit of 1.22 inches. If the slip rings are badly damaged, the entire rotor will have to be replaced, as they are serviced as a complete assembly.

9. Replace any parts that are burned or cracked. Replace brushes and brush springs that are not to specification.

PART 13-2 ALTERNATOR

1 DESCRIPTION AND OPERATION

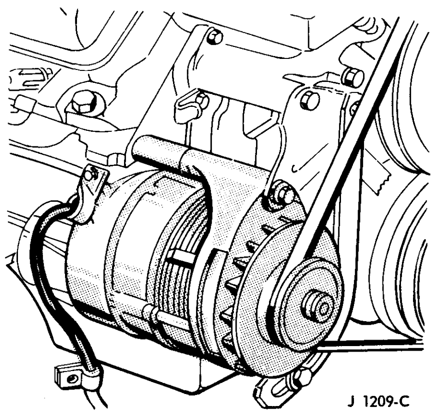


FIG. 1—Alternator Mounting

The charging system is a negative (−) ground system, and consists of an alternator, a regulator, a storage battery and associated wiring. Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

An alternator is belt driven from the engine. The alternator mounting is shown in Fig. 1.

The mechanical construction of the alternator differs from a generator in that the field rotates, and the generating windings are stationary. Energy is supplied from the system to the rotating field through two brushes to two slip rings. The slip rings are mounted on the rotor shaft (Fig. 2).

The alternator produces power in the form of alternating current. The alternating current is rectified to direct current by six diodes (Fig. 2) for use in charging the battery and supplying power to the electrical system.

2 REMOVAL AND INSTALLATION

1. Disconnect the battery ground cable.

2. Loosen the alternator mounting bolt and remove the adjustment arm to alternator bolt.

3. Disengage the alternator belt. Remove the alternator mounting bolt and spacer, disconnect the alternator wiring harness, and remove the alternator.

4. Attach the alternator wiring harness. Position the alternator on the engine, and install the spacer and alternator mounting bolt finger-tight (Fig. 1).

5. Install the adjustment arm to alternator bolt.

6. Adjust the belt tension using tool T63L-8620-A. **Apply pressure on the alternator front housing only, when tightening the belt.** Tighten the adjusting arm bolts and the mounting bolt.

7. Connect the battery ground cable.

3 MAJOR REPAIR OPERATIONS

DISASSEMBLY

Fig. 2 shows a disassembled view of the Ford alternator.

1. Mark both end housings and the stator with a scribe mark for assembly.

2. Remove the three housing through bolts.

3. Separate the front end housing and rotor from the stator and rear end housing.

4. Remove all the nuts and washers from the rear end housing and remove the rear end housing from the stator and diode plate assembly.

5. Remove the brush holder mounting screws and remove the holder, brushes, brush springs, insulator and terminal.

6. If replacement is necessary, press the bearing from the rear end housing, supporting the housing on the inner boss.

7. If either diode plate assembly is being replaced, carefully unsolder the stator leads from the printed-circuit board terminals, slip the stator neutral lead split terminal lug out from under the head of the terminal screw, and separate the stator from the diode plate assembly. Use only a 100-watt soldering iron. Leave the soldering iron in contact with the terminals only long enough to remove the wires. Excess heat can damage the printed-circuit board.

8. Hold the diode plate that is to be replaced, in a vise. Use a thin hacksaw blade and cut the three diode leads as close to the diodes as possible. Be careful not to break the printed-circuit board.

9. Press the insulated terminal bolt out of the insulators, and remove the insulators.

10. Separate the diode plate from the printed-circuit board. Discard the roll pins.

11. Carefully unsolder and remove the cut diode leads from the printed-

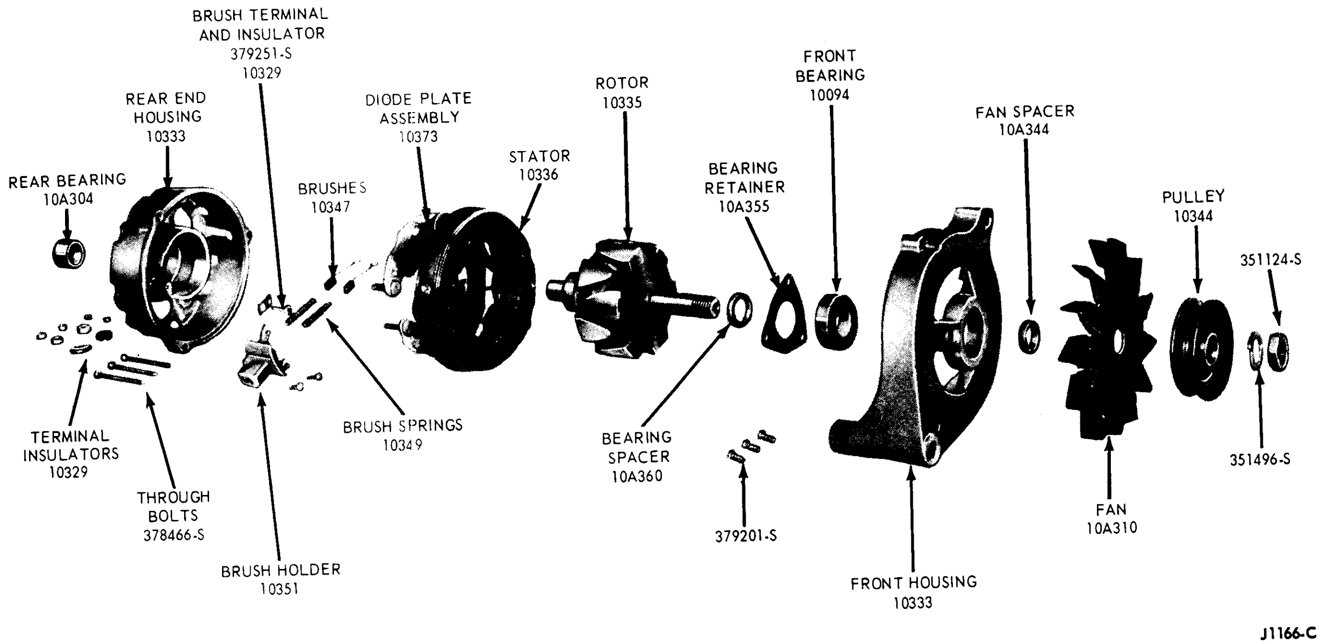


FIG. 2—Disassembled Alternator

circuit board, using a 100-watt soldering iron. Remove any remaining solder and washers from the diode lead holes.

12. If the printed-circuit board is being replaced, cut the printed-circuit board into six separate pieces and unsolder each piece from the diode it is attached to. Remove and discard the roll pins from the diode plates.

13. Remove the drive pulley nut, pulley, fan, fan spacer, rotor and bearing spacer (Fig. 3).

14. Remove the three screws that hold the front end bearing retainer, and remove the retainer. Support the housing close to the bearing boss, and press out the old bearing from the housing, only if the bearing is loose or has lost its lubricant.

15. Perform a diode test and a field open or short circuit test (Part 13-1).

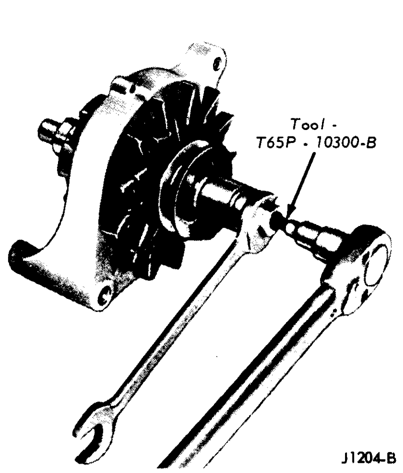


FIG. 3—Pulley Removal

PARTS REPAIR OR REPLACEMENT

Nicks and scratches may be removed from the rotor slip rings by turning down the slip rings. Do not go beyond the minimum diameter limit of 1.22 inches. If the slip rings are badly damaged, the entire rotor must be replaced as it is serviced as an assembly. All other assemblies are to be replaced rather than repaired.

ASSEMBLY

1. Press the front end bearing in the bearing boss and install the bearing retainer.

2. If the stop-ring on the rotor drive shaft was damaged, install a new stop-ring. Push the new ring on the shaft and into the groove. **Do not open the ring with snap ring pliers as permanent damage will result.**

3. Position the front end bearing spacer on the drive shaft with the recessed side against the stop-ring.

4. Position the drive end housing, fan spacer, fan, pulley and lock washer on the drive shaft and install the retaining nut (Fig. 3), to specified torque.

5. If the rear end housing bearing was removed, support the housing on the inner boss and press in a new bearing flush with the outer end surface.

6. Place the brush springs, brushes, brush terminal and terminal insulator in the brush holder and hold the brushes in position by inserting a piece of stiff wire in the brush holder as shown in Fig. 4.

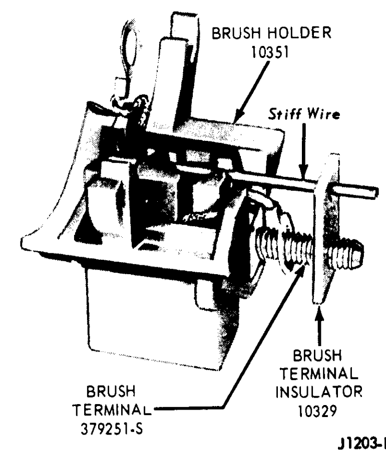


FIG. 4—Brush Holder Assembly

7. Position the brush holder assembly in the rear end housing and install the mounting screws. Position the brush leads in the brush holder as shown in Fig. 5.

8. If a new diode plate or printed-circuit board is being installed, position the diode plate so that the diode leads go through the three holes in the printed-circuit board. Install the terminal bolt and insulator. Maintain the ½-inch insulator spacing between the printed-circuit board and the diode plate. Install a small tinned washer and a solder ring on each diode lead and solder the diode leads to the printed-circuit board. Use a 100-watt iron. Avoid excess heat on the printed-circuit board so as not to loosen the printed-circuit wiring from the board.

9. Wrap the three stator winding leads around the printed-circuit board terminals and solder them. Use a 100-watt soldering iron and rosin-core solder. Slip the stator neutral lead split-terminal lug under the head of the stator terminal screw (Fig. 6).

10. Install the STA and BAT terminal insulators (Fig. 6). Position the stator and diode plate assembly in the rear end housing. Position the STA (black), BAT (red) and FLD (white) insulators, on the terminal bolts, and install five retaining nuts (Fig. 7).

11. Wipe the rear end bearing surface of the rotor shaft with a clean lint-free rag.

12. Position the rear end housing and stator assembly over the rotor and align the scribe marks made during disassembly. Seat the machined portion of the stator core into the step in both end housings. Install the housing through bolts. Remove the brush retracting rod, and put a daub of waterproof cement over the hole to seal it.

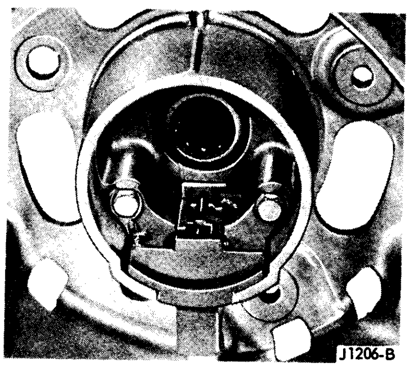


FIG. 5—Brush Lead Positions

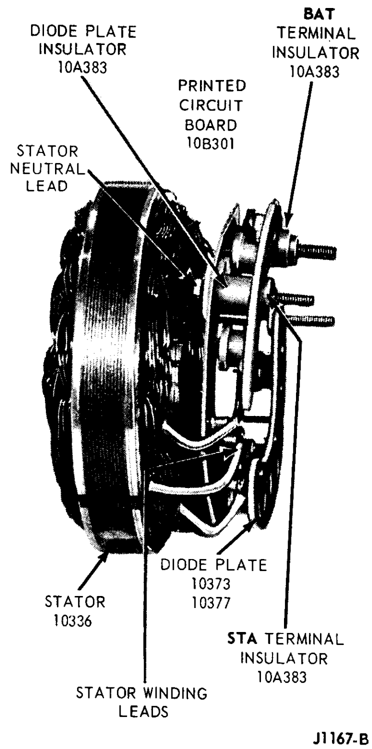


FIG. 6—Stator Lead Connections

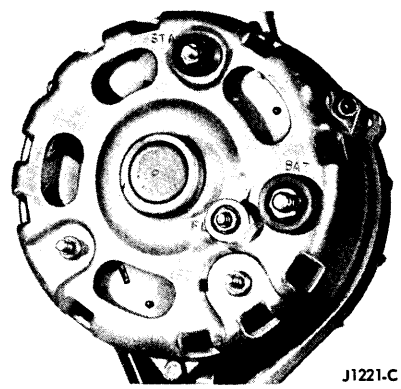


FIG. 7—Alternator Terminal Locations

PART 13-3 REGULATOR

1 DESCRIPTION AND OPERATION

The alternator regulator is composed of two control units, a field relay and a voltage limiter, mounted as an assembly (Fig. 1). Because the reverse current through the rectifier is small, a reverse current cut-out relay is not needed. The alternator is self current limiting, thus a current limiter is not needed. Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

FIELD RELAY

The field relay serves to connect the battery and alternator output to the field circuit when the engine is running. When the ignition switch is closed, the field relay is energized. Closing of the relay contacts, connects the battery and alternator output to the field through the voltage limiter contacts.

VOLTAGE LIMITER

The temperature compensated voltage limiter is a double contact unit. Limiting is accomplished by controlling the amount of current supplied to the rotating field.

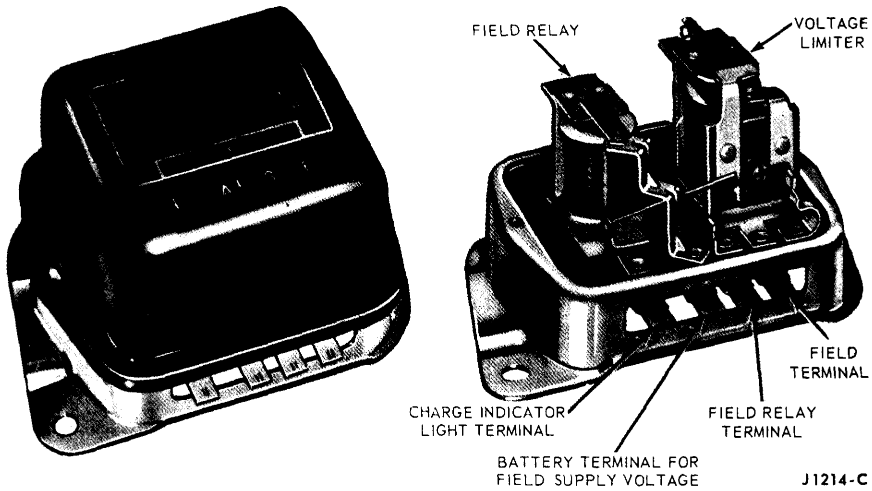


FIG. 1—Alternator Regulator

When the upper contacts are closed, full system voltage is applied to the field and maximum field current will flow. When the limiter armature floats between the contacts, field current is reduced by flowing through the field resistor. When the limiter lower contacts are closed, zero current flows to the field. At low engine speed and with a load applied, the armature vibrates on the upper contacts. At high engine speed and light or no load, the armature vibrates on the lower contacts.

A 50-ohm resistor is connected from the field terminal to ground to absorb electrical surges in the alternator circuits as the voltage limiter armature vibrates on the contacts.

2 IN-CAR ADJUSTMENTS AND REPAIRS

REGULATOR ADJUSTMENTS

Erratic operation of the regulator, indicated by erratic movement of the voltmeter pointer during a voltage limiter test, may be caused by dirty or pitted regulator contacts. Use a very fine abrasive paper such as silicon carbide, 400 grade, to clean the field relay and the voltage limiter contacts. Wear off the sharp edges of the abrasive by rubbing it against another piece of abrasive paper. Fold the abrasive paper over and pull the paper through the contacts to clean them. Keep all oil or grease from contacting the points. Do not use compressed air to clean the regulator. When adjusting the gap spacing use only hospital-clean feeler gauges.

REGULATOR GAP ADJUSTMENTS

Voltage Limiter. The difference between the upper stage and lower stage regulation (0.3 volt), is determined by the voltage limiter point and core gaps. Make the gap adjustments with the regulator removed from the car.

Adjust the point gap first. Loosen the left side lock screw ¼ turn. Use a screwdriver blade in the adjustment slot above the lock screw. Adjust the upper contact until there is 0.017 to 0.022-inch gap between the lower contacts. Tighten the lock screw and recheck the contact gap.

Adjust the core gap with the upper contacts closed. Loosen the center lock screw ¼ turn. Use a screwdriver blade in the adjustment slot under the lock screw. Adjust the core gap for 0.049 to 0.056-inch clearance between the armature and the core at the edge of the core closest to the contact points. Tighten the lock screw and recheck the core gap.

Field Relay. Place a 0.012 to 0.022-inch feeler gauge on top of the coil core closest to the contact points. Hold the armature down on the gauge. Do not push down on the contact spring arm. Bend the contact post arm (Fig. 2) until the bottom contact just touches the upper contact.

REGULATOR VOLTAGE ADJUSTMENTS

Final adjustment of the regulator must be made with the regulator at normal operating temperature.

The field relay closing voltage is adjusted by bending the armature frame (Fig. 2). To increase the closing voltage, bend the frame down. To decrease the closing voltage, bend the frame up.

The voltage limiter is adjusted by bending the voltage limiter spring arm (Fig. 2). To increase the voltage setting, bend the adjusting arm downward. To decrease the voltage setting, bend the adjusting arm upward.

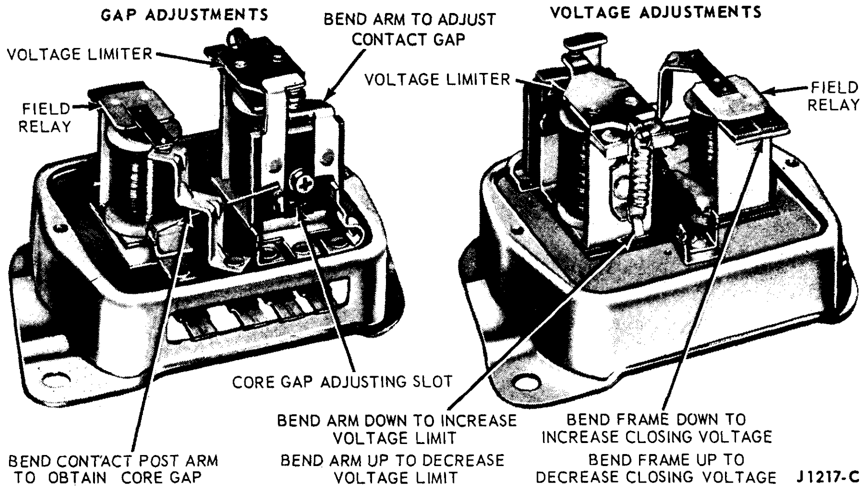


FIG. 2–Regulator Adjustments

Before setting the voltage and before making a final voltage test, the alternator speed must be reduced to zero and the ignition switch opened momentarily, to cycle the regulator.

3 REMOVAL AND INSTALLATION

1. Remove the battery ground cable.
2. Remove the regulator mounting screws.
3. Remove the cable disconnect from the regulator.
4. Attach the cable disconnect to the new regulator.
5. Mount the regulator to the radiator left air deflector. The main wiring harness hold-down clamp mounts under the upper mounting screw. The radio suppression condenser mounts under the lower mounting screw, with an external tooth lock washer between the condenser bracket and the regulator frame.
6. Connect the battery ground cable, and test the system for proper voltage regulation.

PART 13-4 SPECIFICATIONS

ALTERNATOR

Supplier	Amperes (@ 15V)	Watts (@ 15V)	Field Current (Amperes @ 12V 75°F.)	Cut-In Speed Engine R.P.M.	Rated Output Speed Engine R.P.M.	Minimum Slip Ring Turn Down Diameter	Maximum Slip Ring Run Out	Brushes New Length (Inches)	Brushes Wear Length (Inches)	Pulley Nut Torque (Ft. Lbs.)	Belt Tension (Pounds)†
Autolite	42	630	2.8-3.3	350	1800 Cold 2750 Hot	1.220	.0005	½	5/16	60-80	80-110
Autolite	45	675	2.8-3.3	300	1800 Cold 2350 Hot	1.220	.0005	½	5/16	60-80	80-110
Autolite	55	825	2.8-3.3	350	1800 Cold 2350 Hot	1.220	.0005	½	5/16	60-80	80-110

†Used belt. New belt 110-140. A used belt is one that has been in operation more than 10 minutes.
Alternator Pulley nut torque. 60-80 foot pounds.

REGULATOR

Supplier	Current Rating	Voltage Regulation @ + 75°F	Voltage Limiter Contact Gap (Inches)	Voltage Limiter Armature Air Gap (Inches)	Field Relay Armature Air Gap (Inches)	Field Relay Closing Voltage @ + 75°F
Autolite	Used with 42, 45 & 55 Ampere Alternator	14.1 to 14.7	0.017 to 0.022	0.049 to 0.056	0.012 to 0.022	2.5

VOLTAGE REGULATION SETTING

Ambient Temperature °F.	Standard Alternator Regulator
50	14.3-15.1
75	14.1-14.9
100	13.9-14.7
125	13.8-14.6
150	13.6-14.4
175	13.5-14.3

BATTERY

Filler Cap Color	Number of Plates	Ampere Hours
Gray	66	55
Black	78	80

BATTERY FREEZING TEMPERATURES

Specific Gravity	Freezing Temperature
1.280	−90°F.
1.250	−62°F.
1.200	−16°F.
1.150	+ 5°F.
1.100	+19°F.

TOOLS

Ford Tool No.	Former No.	Description
T56L-10505-A	M-183-RT6-5	Voltage Regulator Setting Thermometer
T63L-8620-A	8620 BT-33-73-F	Belt Tension Gauge

ALLOWABLE BATTERY HIGH RATE CHARGE TIME SCHEDULE

Specific Gravity Reading	Charge Rate Amperes	Battery Capacity—Ampere Hours 45	55	70	80
1.125-1.150*	35	65 min.	80 min.	100 min.	115 min.
1.150-1.175	35	50 min.	65 min.	80 min.	95 min.
1.175-1.200	35	40 min.	50 min.	60 min.	70 min.
1.200-1.225	35	30 min.	35 min.	45 min.	50 min.
Above 1.225	5	**	**	**	**

*If the specific gravity is below 1.125, use the indicated high rate of charge for the 1.125 specific gravity, then charge at 5 amperes until the specific gravity reaches 1.250 at 80°F.
**Charge at 5 ampere rate only until the specific gravity reaches 1.250 at 80°F.

STARTING SYSTEM

GROUP 14

PART 14-1 GENERAL STARTING SYSTEM SERVICE

1 DIAGNOSIS AND TESTING

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 will not start with a booster battery connected, tow the car to the shop for a complete diagnosis. **Do not attempt to start the car by pushing or towing it. Do not tow a car at more than 30 mph or for more than 15 miles without raising the rear wheels off the ground, or disconnecting the driveshaft. Be sure that the transmission is in neutral.**

STARTER TROUBLE DIAGNOSIS GUIDE

ENGINE WILL NOT CRANK AND STARTER RELAY DOES NOT CLICK

1. The battery may be discharged.
2. The ignition switch, starter neutral switch or starter relay may be inoperative.
3. The relay control circuit may be open or contain high resistance.

CHECK BATTERY

Perform a Battery Capacity Test (Group 13). If the battery does not test as having good capacity, make a Battery Test Charge (Group 13). 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. On a car with a transistor ignition, also disconnect the brown wire from the starter relay I terminal. Place the transmission lever in the N or P position.

2. With a fully charged battery, operate the ignition switch to crank the engine. If 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. 1, connection ①). If the engine does not crank, and the relay does not click, the starter relay is probably defective.

3. If the engine cranks in Step 2, remove the quick disconnect from the starter neutral switch which is located on the steering column under the instrument panel. Connect a jumper wire between the quick disconnect terminals that are connected to the two red-blue stripe wires. Operate the ignition switch to crank the engine.

4. If the engine cranks in Step 3, the starter neutral switch is defective or out of adjustment.

5. If the engine does not crank in

CONTINUED ON NEXT PAGE

STARTER TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE WILL NOT CRANK AND STARTER RELAY DOES NOT CLICK (Continued)	Step 3, there are three possible defects: The hot wire from the battery terminal of the starter relay to the battery terminal of the ignition switch is loose or broken. The ignition switch is defective. The wire from the ignition switch to the automatic transmission neutral switch or from the neutral switch to the S terminal of 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, and the engine does not crank, connect a heavy jumper from the relay battery terminal to the relay starter terminal (Fig. 1, connection ②). 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, badly corroded, or loose at the connecting points. 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, and it must be repaired or replaced. **CHECK ENGINE AND STARTER DRIVE** If a heavy spark is obtained when the jumper wire is connected, loosen the starter mounting bolts to free the starter pinion. If the starter drive 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 badly worn or damaged. If the starter drive is not locked, remove the starter from the engine, and perform the no-load current test. The starter should run freely. If the current reading at no-load speed is below specifications (70 amperes), 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 it if possible, or replace the starter. If the no-load current reading of the starter is normal, install the starter and remove all the spark plugs, and attempt to crank the engine with the starter. 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 still will not crank, 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 is worn out, broken, seized to the shaft or has a broken armature bypass switch or actuating lever. Repair or replace parts as necessary.
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

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STARTER TROUBLE DIAGNOSIS GUIDE (Continued)

ENGINE CRANKS SLOWLY (Continued)	starter relay for possible internal shorts to ground that may have caused the battery to discharge. Perform a Battery Capacity Test (Group 13). If the battery does not test as having good capacity, make a Battery Test Charge (Group 13). 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 cranking circuit voltage drop. The voltage drop will be either excessive or normal. **VOLTAGE DROP (RESISTANCE) EXCESSIVE** Locate the exact part of the circuit with the excessive resistance. To correct excessive resistance in the battery to starter relay cable, starter relay to starter cable or battery to ground cable, clean and	tighten the cable connections. Recheck the voltage drop. If it is still excessive, replace the cables. To correct excessive resistance of the starter relay contacts, replace the starter relay. **VOLTAGE DROP (RESISTANCE) NORMAL** If the voltage drop (resistance) is normal, make a starter load test. If the starter load current is not to specifications (250 amperes), proceed as follows: **Cranking Current Low.** Remove the starter from the engine, and repair and replace it. **Cranking Current Normal or High.** Remove the starter from the engine, and test the starter current draw at no-load. If the no-load current draw is above or below specifications, repair or replace the starter. 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.

STARTER LOAD TEST

Connect the test equipment as shown in Fig. 2. 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.

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.

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, on the test bench only.

Make the test connections as shown in Fig. 3. The starter will run at no-load. Be sure that no current is flowing through the ammeter (rheostat at maximum counterclockwise position). Determine the exact reading on the voltmeter.

Disconnect the starter from the battery, and reduce the resistance of the rheostat until the voltmeter indicates the same reading as that obtained while the starter was running. The ammeter will indicate the starter no-load current draw.

ARMATURE 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.

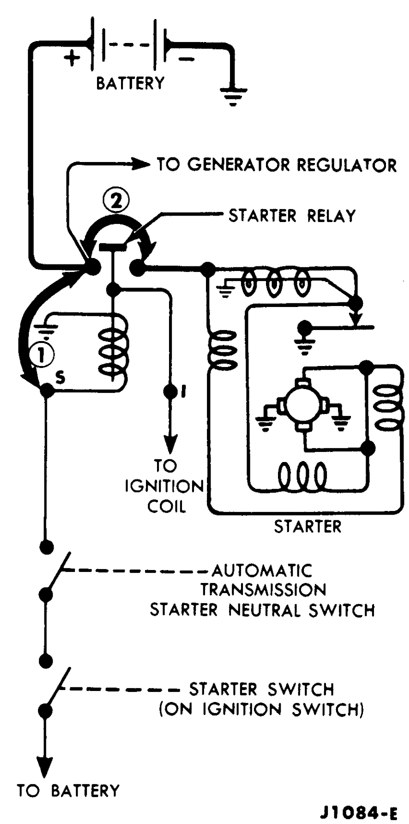

FIG. 1 —Starting Control Circuit Test

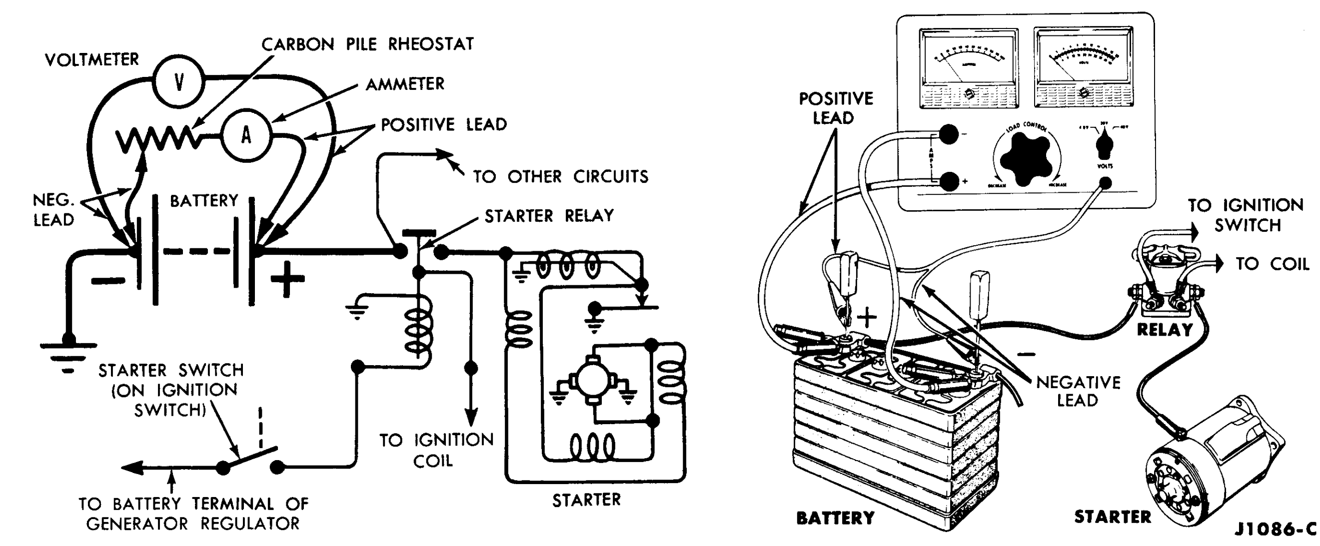

FIG. 2—Starter Load Test

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. 4. If the voltmeter indicates any voltage, the windings are grounded.

Grounded field windings can be detected by making the connections as shown in Fig. 5. If the voltmeter indicates any voltage, the field windings are grounded.

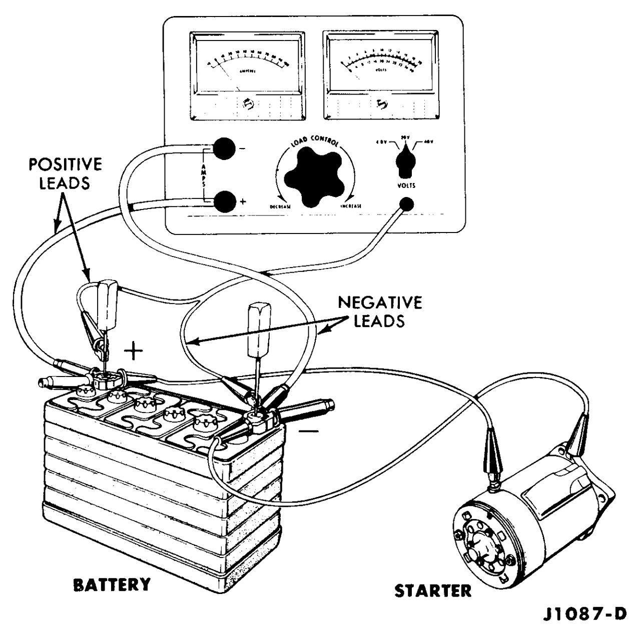

FIG. 3—Starter No-Load Test on Test Bench

STARTER CRANKING 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. 6. Crank the engine with the ignition OFF. This 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(s) of the relay.

The voltage drop in the circuit

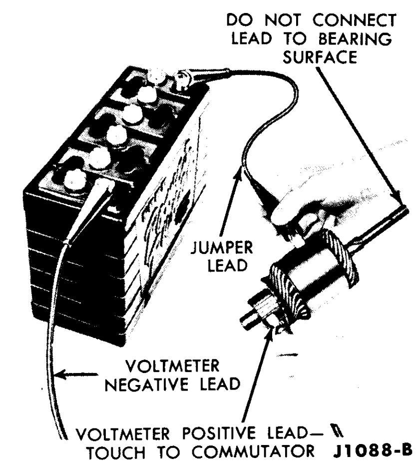

FIG. 4—Armature Grounded Circuit Test

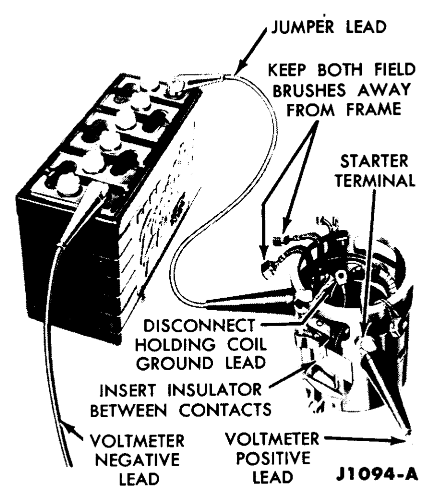

FIG. 5—Field Grounded Circuit Test

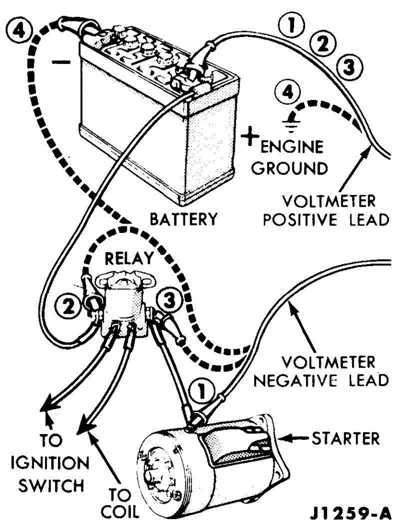

FIG. 6—Starter Cranking Circuit Test

will be indicated by the voltmeter (0 to 4 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. 6, connection①)..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. 6, connection②) ....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. 6, connection③).............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. 6, connection④) ....0.1 volt.

2 COMMON ADJUSTMENTS AND REPAIRS

STARTER DRIVE 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.

4. Remove the drive gear stop-ring retainer and stop ring from the end of the armature shaft and remove the drive gear assembly.

5. Apply a thin coating of Lubriplate 777 on the armature shaft splines. Install the drive gear assembly on the armature shaft and install a new stop ring.

6. Position the starter gear actuating lever on the starter frame and install the pivot pin. **Be sure that the actuating lever properly engages the starter drive assembly.**

7. Install a new stop-ring retainer. Position the starter drive actuating lever return spring and drive gear housing to the starter frame, and then tighten the through bolts to specification (55-75 inch pounds).

8. Position the starter drive acuating lever cover and the brush cover band, with its gasket, on the starter. Tighten the brush cover band retaining screw.

BRUSH REPLACEMENT

Replace the starter brushes when they are worn to ¼ inch. Always install a complete set of new brushes.

1. Loosen and remove the brush cover band and starter drive actuating lever cover. Remove the brushes from their holders.

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 pin and lever, and remove the armature.

5. 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 brush terminal block, as close to the brush lead terminal as possible).

7. Cut (or unsolder) the insulated brush leads from the field coils, as close to the field connection point as possible.

8. Clean and inspect the starter motor.

9. Replace the brush end plate if the insulator between the field brush holder and the end plate is cracked or broken.

10. Position the new insulated field brushes lead on the field coil terminal. Install the clip provided with the brushes to hold the brush lead to the terminal. Solder the lead, clip, and terminal together, using rosin core solder (Fig. 4), Part 14-2. 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 starter drive gear actuating lever to the frame and starter drive assembly, and install 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 and tighten to specified torque (55-75 inch pounds). Be sure that the stop-ring retainer is seated properly in the drive gear housing.

17. Install the commutator brushes in the brush holders. Center the brush springs on the brushes.

18. Position the actuating lever cover and the brush cover band, with its gasket, on the starter. Tighten the band retaining screw.

19. Connect the starter to a battery to check its operation.

ARMATURE REPLACEMENT

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive actuating lever cover. Remove the brushes from their holders.

2. Remove the through bolts, the drive gear housing, and the 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 the starter drive gear assembly is being reused, remove the stop ring retainer and the stop ring from the end of the armature shaft, and remove the assembly.

5. Place the drive gear assembly on the new armature with a new stop ring.

6. Install the fiber thrust washer on the commutator end of the armature shaft and install the armature.

7. Position the drive gear actuating lever to the frame and drive gear assembly and install the pivot pin.

8. Position the drive actuating lever return spring, the drive gear housing, and the brush plate to the starter frame, and then install and tighten the through bolts to specification. Be sure that the stop ring retainer is seated properly in the drive gear housing.

9. Place the brushes in their holders, and center the brush springs on the brushes.

10. Position the actuating lever cover and the brush cover band, with its gasket, and then tighten the retaining screw.

11. Connect the starter to a battery to check its operation.

3 CLEANING AND INSPECTION

1. Use a brush or air to clean the field coils, armature, commutator, and armature shaft. Wash all other parts in solvent and dry the parts.

2. Inspect the armature windings for broken or burned insulation and unsoldered connections.

3. Check the armature for open circuits and grounds.

4. Check the commutator for runout (Fig. 7). Inspect the armature shaft and the two bearings for scoring and excessive wear. If the commutator is rough, or more than 0.005 inch out-of-round, turn it down.

5. Check the brush holders for broken springs and the insulated brush holders for shorts to ground. Tighten any rivets that may be loose. Replace the brushes if worn to ¼ inch in length.

6. Check the brush spring tension. Replace the springs if the tension is not within specified limits (40 ounces minimum).

7. Inspect the field coils for burned or broken insulation and continuity. Check the field brush connections and lead insulation.

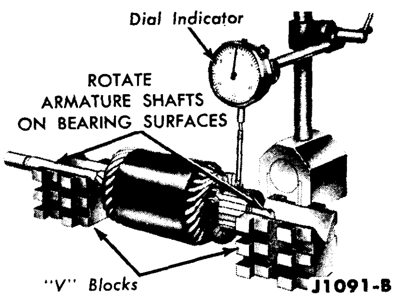

FIG. 7—Commutator Runout Check

PART 14-2 STARTER

1 DESCRIPTION AND OPERATION

The function of the starting system is to crank the engine at high enough speed to permit it to start. The system includes the starter motor and drive, the battery, a remote control starter switch (part of the ignition switch), the starter neutral switch, the starter relay, and heavy circuit wiring. The starter mounting is shown in Fig. 1.

Turning of the ignition key to the START position actuates the starter relay, through the starter control circuit. The starter relay then connects the battery to the starter.

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 starter utilizes an integral positive-engagement drive (Fig. 2). When the starter is not in use, one of the field coils is connected directly to ground through a set of contacts. When the starter is first connected to the battery a large current flows through the grounded field coil, actuating a movable 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 movable 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 movable pole shoe in the fully seated position, during the time that the starter is turning the engine.

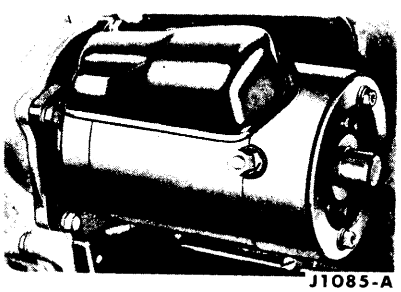

FIG. 1—Starter Mounting

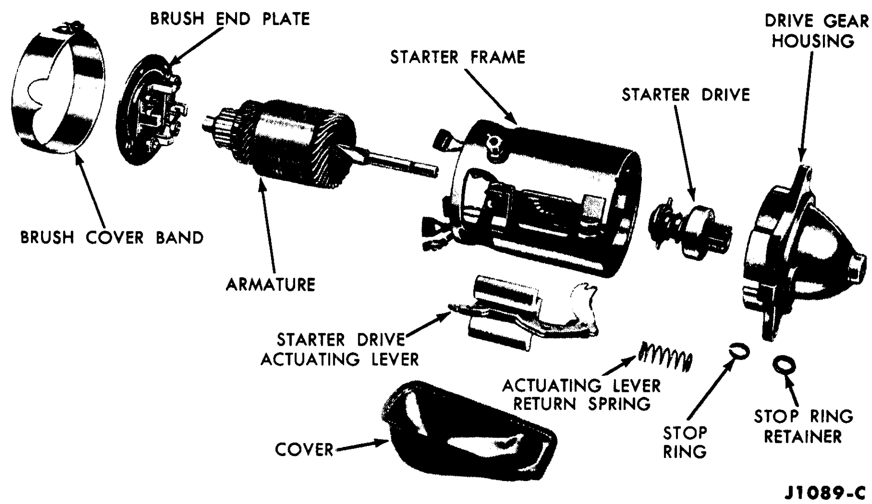

FIG. 2—Starter Disassembled

2 REMOVAL AND INSTALLATION

1. Disconnect the starter cable at the starter terminal.
2. Remove the starter mounting bolts. Remove the starter assembly.
3. Position the starter assembly to the flywheel housing, and start the mounting bolts.
4. Snug all bolts, then torque them to 12-15 ft.-lbs, tightening the middle bolt first.
5. Connect the starter cable.

3 MAJOR REPAIR OPERATIONS

Use the following procedure when it becomes necessary to completely overhaul the starter. Figure 2 illustrates a partially disassembled starter.

DISASSEMBLY

1. Loosen the brush cover band retaining screw and remove the brush cover band and the starter drive actuating lever cover. Observe the lead positions for assembly and then remove the commutator brushes from the brush holders.
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 and the armature.
4. Remove the stop ring retainer. Remove and discard the stop ring retaining the starter drive gear to the end of the armature shaft, and remove the starter drive gear assembly.
5. Remove the brush end plate.
6. Remove the two screws retaining the ground brushes to the frame.

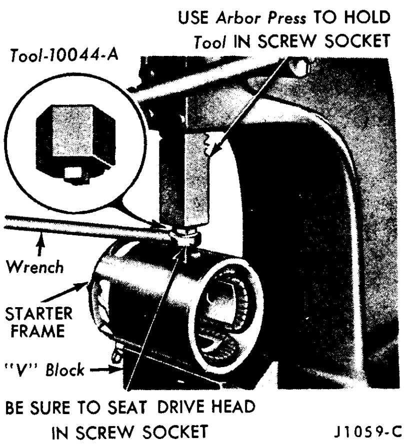

FIG. 3—Pole Shoe Screw Removal

7. On the field coil that operates the starter drive gear actuating lever, bend the tab up on the field retainer and remove the retainer.

8. Remove the three coil retaining screws, using tool 10044-A and an arbor press (Fig. 3). 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 (use a 300-watt iron).

9. Cut (or unsolder) the insulated brush leads from the field coils, as close to the field connection point as possible.

10. Remove the starter terminal nut, washer, insulator and terminal from the starter frame. Remove any excess solder from the terminal slot.

PARTS REPAIR OR REPLACEMENT

Nicks and scratches may be removed from the commutator by turning it down. A brush kit and a contact kit are available. All other assemblies are to be replaced rather than repaired.

ASSEMBLY

1. Install the starter terminal, insulator, washers, and retaining nut in the frame (Fig. 4). 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 (Fig. 3). 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 and retainer and bend the tabs to retain the coils to the frame.

4. Solder the field coils and solenoid wire to the starter terminal using rosin core solder. Use a 300-watt iron.

5. Check for continuity and grounds in the assembled coils.

6. Position the new insulated field brushes lead on the field coil terminal. Install the clip provided with the brushes to hold the brush lead to the terminal. Solder the lead, clip, and terminal together, using rosin core solder (Fig. 4). Use a 300-watt iron.

7. Position the solenoid coil ground terminal over the nearest ground screw hole.

8. Position the ground brushes to the starter frame and install the retaining screws (Fig 4).

9. Position the starter brush end plate to the frame, with the end plate boss in the frame slot.

10. Apply a thin coating of Lubriplate 777 on the armature shaft splines. Install the starter motor drive gear assembly to the armature shaft and install a new retaining stop ring. Install the stop ring retainer.

11. Position the fiber thrust washer on the commutator end of the armature shaft and position the armature in the starter frame.

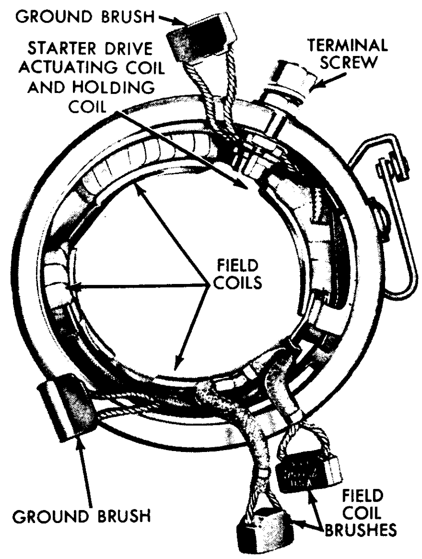

FIG. 4—Field Coil Assembly

12. Position the starter drive gear actuating lever to the frame and starter drive assembly, and install the pivot pin.

13. Position the starter drive actuating lever return spring and the drive gear housing to the frame and install and tighten the through bolts to specification (55-75 inch pounds). **Do not pinch the brush leads between the brush plate and the frame.** Be sure that the stop ring retainer is seated properly in the drive housing.

14. Install the brushes in the brush holders. **Be sure to center the brush springs on the brushes.**

15. Position the drive gear actuating lever cover on the starter and install the brush cover band with a gasket. Tighten the band retaining screw.

16. Check the starter no-load amperage draw.

PART 14-3 SPECIFICATIONS

Vendor	Current Draw Under Normal Load (Amperes)	Normal Engine Cranking Speed (rpm)	Minimum Stall Torque @ 5 Volts (Foot Pounds)	Maximum Load (Amperes)	No-Load (Amperes)	Brushes		
						Mfg. Length (Inches)	Wear Limit (Inches)	Brush Spring Tension (Ounces)
Ford Positive Engagement 4.5-inch Diameter	250	250-290	15.5	670	70	0.5	0.25	40

Maximum commutator runout in inches is 0.005.
Maximum starting circuit voltage drop (battery — terminal to starter terminal @ normal engine temperature) 0.5 volt.
Starter through-bolt torque 55-75 inch pounds.
Starter mounting-bolt torque 12-15 foot pounds.

SPECIAL TOOLS

Ford Tool No.	Former No.	Description
TOOL 10044-A	10044-A	Generator Pole Screw Wrench

GROUP 15

PART 15-1 GENERAL LIGHTING SYSTEM, HORNS, AND INSTRUMENTS SERVICE

1 DIAGNOSIS AND TESTING

LIGHT TROUBLE DIAGNOSIS GUIDE

ALL HEADLIGHTS DO NOT LIGHT	1. Loose battery cable. 2. Loose quick disconnect or broken wire from the battery to the headlight switch. 3. Defective headlight switch. 4. Disconnected or broken wire from the headlight switch to the beam selector switch. 5. Loose or broken wire to the bulbs. 6. Defective beam selector switch. 7. All headlight bulbs burned out. This may be caused by a defective or improperly adjusted alternator voltage regulator (Group 13).
INDIVIDUAL LIGHTS DO NOT LIGHT	1. Burned out bulb. 2. Loose or broken wires to the bulb. 3. Poor ground.
LIGHTS BURN OUT REPEATEDLY	1. Loose or corroded electrical connections. 2. Excessive vibration. 3. Improperly adjusted or defective alternator voltage regulator (Group 13).

INSTRUMENT TROUBLE DIAGNOSIS GUIDE

FUEL GAUGE ERRATIC OR INOPERATIVE	1. Loose or broken wire from the constant voltage regulator to the fuel gauge. 2. Defective fuel gauge (Part 15-4). 3. Loose, broken, or shorted wire from fuel gauge to the fuel tank sending unit. 4. Defective constant voltage regulator (Part 15-4). 5. Defective fuel tank sending unit. 6. Defective radio suppression choke. 7. Poor ground between fuel tank and body.

CONTINUED ON NEXT PAGE

INSTRUMENT TROUBLE DIAGNOSIS GUIDE (Continued)

TEMPERATURE GAUGE ERRATIC OR INOPERATIVE	1. Loose or broken wire from the constant voltage regulator to the temperature gauge. 2. Defective temperature gauge (Part 15-4). 3. Loose or broken wire from the temperature sending unit to the temperature gauge. 4. Defective temperature sending unit. 5. Defective constant voltage regulator (Part 15-4). 6. Defective radio suppression choke.
FUEL, TEMPERATURE AND OIL PRESSURE GAUGES ERRATIC	1. Loose or corroded constant voltage regulator ground. 2. Defective constant voltage regulator (Part 15-4). 3. Broken or loose wire from or to the constant voltage regulator. 4. Defective ignition switch. 5. Defective radio suppression choke.
OIL PRESSURE INDICATOR GAUGE INOPERATIVE	1. Loose or broken wire from the constant voltage regulator to the oil pressure gauge. 2. Grounded or broken wire from the engine oil pressure sending unit. 3. Defective oil pressure gauge. (Part 15-4). 4. Defective oil pressure sending unit (Part 15-4). 5. Defective radio suspension choke.
CHARGE INDICATOR GAUGE INOPERATIVE	1. Defective charge indicator gauge (Part 15-4). 2. Loose or broken wires. 3. Alternator system malfunction (Group 13).

HORN TROUBLE DIAGNOSIS GUIDE

HORNS DO NOT SOUND	1. Loose connections at horn button contact. 2. Open wire (blue-yellow stripe) from horn to horn button. 3. Open wire (yellow) from battery to horn button. 4. Horns defective or out of adjustment.
ONE HORN FAILS TO OPERATE	1. Broken or loose wire to the horn. 2. Horn defective or out of adjustment.
HORNS OPERATE CONTINUOUSLY	1. Horn button defective.

TURN INDICATOR TROUBLE DIAGNOSIS GUIDE

TURN INDICATOR LIGHTS INOPERATIVE	1. Burned out bulbs or loose sockets. 2. Burned out fuse. 3. Loose or broken wire from ignition switch to flasher. 4. Defective flasher. 5. Loose or broken wire from flasher to turn indicator switch. 6. Defective turn indicator switch. 7. Broken, shorted, or loose wires from switch to lights.
TURN INDICATOR LIGHTS OPERATE INCORRECTLY	1. Loose, broken, or shorted wires from switch to light. 2. Defective indicator switch. 3. Defective flasher. 4. Burned out bulb.
TURN INDICATOR CANCELS IMPROPERLY	1. Cam improperly positioned on steering wheel hub. 2. Coil spring on switch plate assembly loose or weak.

WINDSHIELD WIPER TROUBLE DIAGNOSIS GUIDE

WINDSHIELD WIPER INOPERATIVE	1. Control cable not properly adjusted. 2. Control cable broken. 3. Wiper binding. 4. Defective wiper motor. 5. Low fluid pressure.

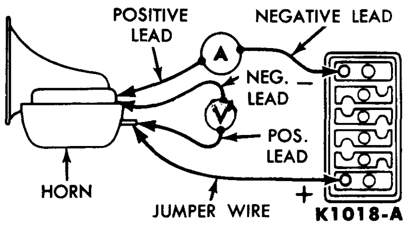

FIG. 1—Horn Current Draw Test

TESTING

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

HORN TEST

The only test necessary on the horns is for current draw.

Current Draw Test. Connect a voltmeter and ammeter to the horn and to a voltage supply as shown in Fig. 1. The normal current draw for the horns at 12 volts is 4.0-5.0 amperes.

HEADLIGHT AND BEAM SELECTOR SWITCH TESTS

The following tests may be made to determine whether a headlight switch or a beam selector switch is defective:

Set the headlight switch at 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 stripe wire from the headlight switch to the beam selector 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 selector 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.

CONSTANT VOLTAGE REGULATOR TEST

Turn the ignition switch ON. Check for voltage at the gauge feed wire (black with green stripe) 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, the radio suppression choke is defective, or there is a short to ground between the voltage regulator and the gauges.

If a gauge unit is inaccurate or does not indicate, replace it with a new unit. If the gauge unit still is erratic in its operation, the sending unit or wiring to the sending unit is faulty.

If the fuel gauge, the temperature gauge, and the oil pressure gauge indicate improperly and in the same direction, the constant voltage regulator could be defective as it supplies the three gauges.

FUEL GAUGE AND FUEL LEVEL SENDING UNIT TEST

Disconnect the wire from the fuel level sending unit and connect it to a known good sending unit. Connect a jumper wire from the sending unit mounting plate to the car frame. Raise the float arm to the upper stop; the instrument panel gauge should read full. Lower the float arm to the bottom stop, the gauge should read empty.

If the gauge now reads properly, the sending unit in the gas tank is defective.

If the gauge unit still indicates improperly or is erratic in its operation, the gauge unit or the wiring to the gauge unit is faulty. Repair the wire or replace the gauge unit.

LOW FUEL WARNING SYSTEM TEST

The warning light circuit is tested each time the ignition switch is turned to the START position. When the ignition switch is turned from ON to START, the warning light is illuminated. This proves that both the circuit and the light are functioning properly.

In the event of system failure, make the following tests:

1. Check to see that the bulb lights with the ignition switch in the START position.
2. Check for loose connections.
3. Turn the ignition switch to the ACC or ON position. Disconnect the wiring from the fuel level sender assembly and ground the relay to thermistor lead (green-black stripe). If the warning light lights, replace the sender assembly. If the warning light does not light, replace the relay. Fig. 2, Part 15-4, shows the location of the thermistor terminal with the fuel level sender mounted in the tank.

TEMPERATURE GAUGE TEST

Start the engine and allow it to run until it has reached normal operating temperature. Place a thermometer in the coolant at the radiator filler cap. The temperature should read close to the temperature range of the coolant thermostat that is being used. The gauge in the instrument panel should indicate within the normal band.

If the gauge does not indicate, momentarily short the temperature sender unit terminal wire to ground (ignition switch on). If the gauge now indicates, the sender unit is defective or it was not properly sealed to the engine. **Be sure to use the electrically conductive sealer C3AZ-19554-B.** If the gauge does not indicate, the gauge, the wires leading to the gauge or the constant voltage regulator are at fault. **Do not leave the sender wire grounded longer than necessary to make the test, as the gauge may be damaged.**

OIL PRESSURE INDICATOR GAUGE TEST

Remove the oil pressure sender unit and temporarily attach an oil pressure gauge in its place. Operate the engine to determine the oil pressure. If the oil pressure is normal, the gauge should indicate within the normal band.

If the gauge did not indicate, momentarily short the oil pressure sender wire to ground. If the gauge now indicates the sender unit is defective or it was not properly sealed to the engine. **Be sure to use electrically conductive sealer C3AZ-19554-B.** If the gauge does not indicate, the gauge, the wires leading to the gauge or the constant voltage regulator are at fault. **Do not leave the sender wire grounded longer than necessary to make the test, as the gauge may be damaged.**

AMMETER TEST

To test the ammeter, turn the headlights on with the engine stopped. The meter pointer should move toward the "D" or discharge scale. If no movement of the needle is observed, check the loop on the rear of the meter housing to see if the battery to circuit breaker wire passes inside the loop. If the wire is in the loop, and the meter does not indicate a discharge, the meter is inoperative. **If the meter pointer moves toward the "C" or charge**

scale when the headlights are turned on, the wire passes through the loop in the wrong direction or the battery is reversed. Feed the wire through in the opposite direction to correct this condition after checking first to make sure that the battery is not reversed.

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. Refer to the Ford Car Master Parts Catalog for the proper gears to use for various rear axle-tire size combinations.

2 COMMON ADJUSTMENTS AND REPAIRS

WINDSHIELD WIPER ADJUSTMENT

The only adjustment required on the hydraulic motor is the control cable adjustment.

1. Remove the wiper arm and blade assemblies.
2. Remove the bezels and nuts from the wiper pivot shafts.
3. Remove the 14 screws retaining the cowl top panel and remove the panel.
4. Adjust the control cable with the adjustment screw so that the control lever on the instrument panel moves the valve control lever on the motor from OFF to full ON.
5. Position the cowl top panel and install the 14 retaining screws.
6. Install the nuts and bezels on the wiper pivot shafts.
7. Position and install the wiper arm and blade assemblies.

HORN ADJUSTMENT

Current is adjusted by changing the contact tension. Connect the horn as shown in Fig. 1. Turn the self-locking adjusting nut until the current is within the limits for the horn being adjusted.

PART 15-2 LIGHTING SYSTEM AND HORNS

1 DESCRIPTION AND OPERATION

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

HEADLIGHTS

Four sealed-beam headlights are used. The two outboard lights have two filaments each for low beam and high beam, and are marked by a numeral "2" molded in the glass lens. Locating tabs molded in the glass allow the mounting of the No. 2 lights in the outboard headlight support frames only. The low beams are used for city driving, when meeting oncoming traffic on the highway, and for No. 2 headlight alignment.

The inboard headlights with a numeral "1" molded in the glass lens have only one filament and are used for highway driving along with the high beams of the No. 2 headlights. Locating tabs molded in the glass allow the mounting of the No. 1 lights in the inboard headlight support frames only. A conventional beam selector switch is located on the floor board near the left.

Quick disconnect terminals are provided at the left and right of the radiator support assembly. The terminals are color coded. Like colored terminals are connected together.

HORNS

The Thunderbird is equipped with a pair of tuned horns. The horn button switch closes the circuit to the horns without the use of a relay. One of the horns has a high-pitched tone; the other has a low-pitched tone.

2 IN-CAR ADJUSTMENTS AND REPAIRS

HEADLIGHT ALIGNMENT

All headlight adjustments should be made with a half-full fuel tank, plus or minus one gallon, with a person seated in the driver's seat, the car unloaded and the trunk empty except for the spare tire and the jacking equipment, and the 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.

To align the No. 1 headlights (inboard lights) by means of a wall screen, select a level portion of the shop floor. Lay out the floor and wall as shown in Fig. 1.

Establish the headlight horizontal centerline by substracting 20 inches from the actual measured height of the headlight lens center from the floor and adding this dimension (dimension "B", upper diagram Fig. 2) to the 20-inch reference line obtained by sighting over the uprights. Draw a horizontal line two inches below, and parallel to the headlight horizontal centerline. Then draw the headlight vertical centerlines on the screen as measured on the car (dimension "A," upper diagram Fig. 2).

NO. 1 HEADLIGHT ADJUSTMENT (INNER LIGHTS)

Adjust each No. 1 headlight (inner light) beam as shown in Fig. 2. **Cover the No. 2 lights when making this adjustment.**

NO. 2 HEADLIGHT ADJUSTMENT (OUTER LIGHTS)

To align the No. 2 headlights (outer lights), a different wall chart (lower diagram Fig. 2) is used. Dimension "B" for the No. 2 lights is the same as "B" for the No. 1 lights; dimension "A" is as measured on the car. **Note that the line of adjustment of the No. 2 lights is the horizontal centerline of the No. 2 lights.** Turn the headlights to low beam and adjust each No. 2 light as shown in Fig. 2.

Each headlight is adjusted by means of two screws located under the headlight trim ring, as shown in

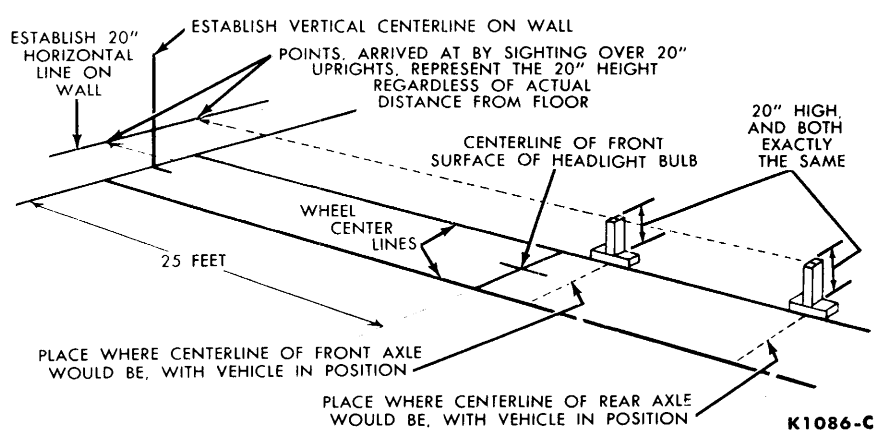

FIG. 1—Floor and Wall Layout

Fig. 3. Always bring each beam into final position by turning the adjusting screws clockwise, so that the headlights will be held against the tension springs when the operation is completed.

Some states may not approve of the 2-inch dimension for the No. 1 headlights. Check the applicable state law, as a 3-inch dimension may be required.

3 REMOVAL AND INSTALLATION

HEADLIGHTS

1. Remove the retaining screws and headlight trim ring.

2. Loosen the retaining ring screws (Fig. 3), rotate the retaining ring counterclockwise, and remove it.

3. The headlight bulb may now be pulled forward far enough to disconnect the wiring assembly plug.

4. Plug in the new bulb and place it in position, making sure that the locating tabs are placed in the positioning slots.

5. Install the headlight bulb retaining ring, rotating it clockwise under the screws, and tighten the screws.

6. Place the trim ring into position and install the retaining screws.

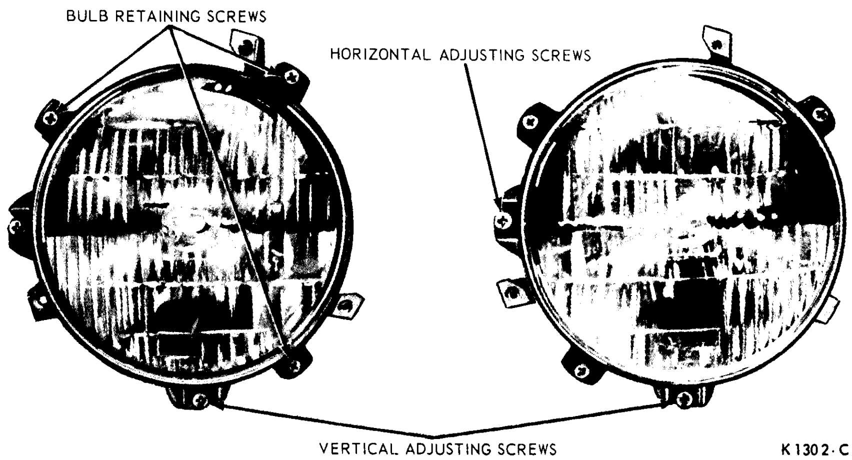

FIG. 3—Headlight Adjustment

PARKING LIGHT

To replace the bulb in the parking light, remove the retaining screws, lens, and bulb (Fig. 4). After the bulb is replaced, install the lens and retaining screws.

TAIL AND STOP LIGHT, BACK-UP LIGHT, AND LICENSE PLATE LIGHTS

The tail, stop light and back-up light are shown in Fig. 5. To replace the bulbs, remove the retaining screws, and lens.

To remove the license plate light, remove the bezel retaining screw, bezel, and lens. Remove the bulb.

ASH TRAY LIGHT

The bulb and socket assembly is mounted on the forward face of the glove box. Remove the ash tray to replace the bulb.

GLOVE BOX LIGHT

The bulb and socket assembly is located in the forward end of the glove box. The assembly is held in place by a spring retainer clip. To replace the bulb, compress the clip and remove the bulb and socket assembly from the opening.

COURTESY LIGHTS

Courtesy lights are located on the lower trim panel of both the right

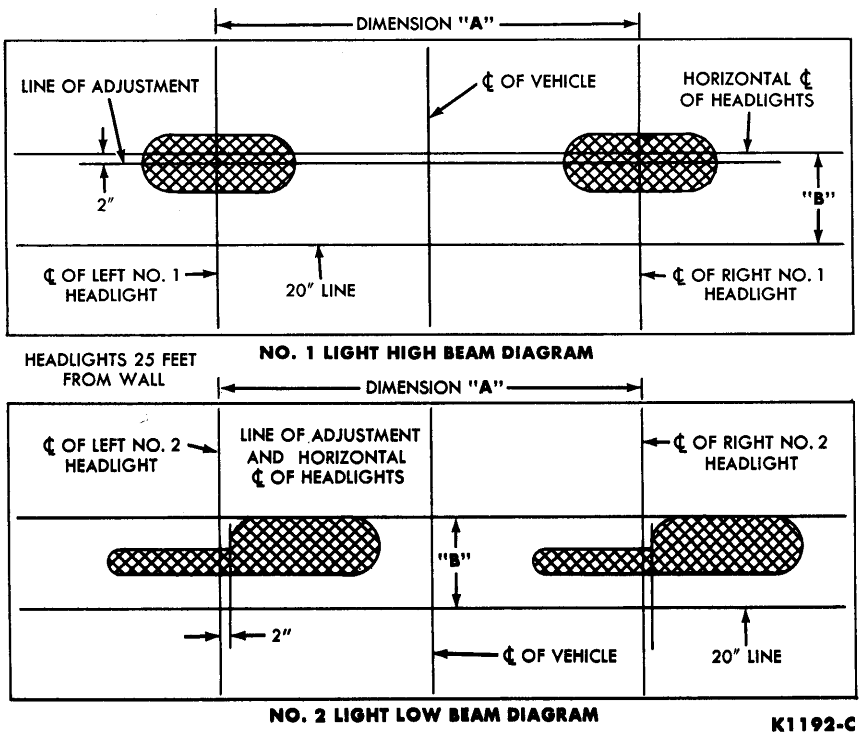

FIG. 2—Headlight Wall Screens

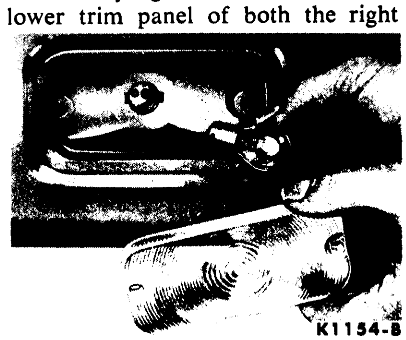

FIG. 4—Parking Light

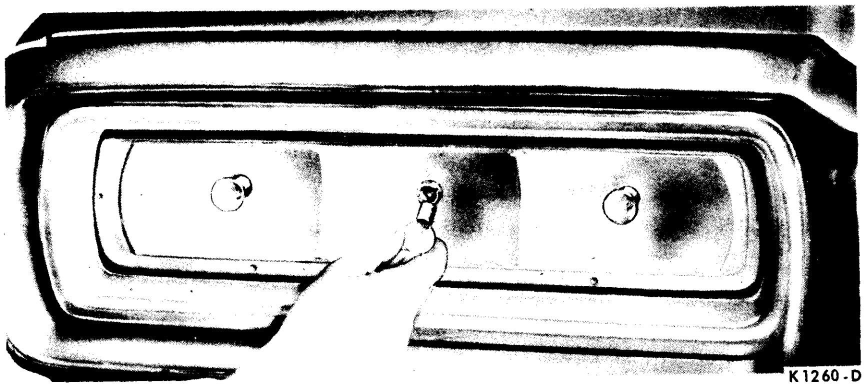

FIG. 5—Tail and Stop Light

and left door of convertible models, and on the right and left roof quarter trim panel of hardtop models. To replace the bulbs, remove the bezel from the trim panel. Pry the bezel and lamp assembly from the roof quarter trim panel on the hardtop models.

INSTRUMENT LIGHTS

OIL, FUEL, TEMPERATURE AND CHARGE INDICATOR GAUGE LIGHTS

To remove the light bulb remove the retaining screw and the indicator cover. Then remove the light bulb.

MAP LIGHT

To remove the light bulb remove the two retaining screws and the lens, then remove the bulb.

HEADLIGHT SWITCH LIGHT

To remove the light bulb remove two screws and one nut and remove the bracket under the left end of the instrument panel that connects the movable steering column to the instrument panel. Remove the socket from the light housing, then remove the bulb.

CLOCK LIGHT

1. Remove the retaining screws and remove the wiper, the washer, the left air, and the right air control knobs.
2. Remove the screws retaining the clock housing to the upper instrument panel and lower the housing.
3. Remove the socket from the clock, then remove the bulb.

IGNITION SWITCH LIGHT

1. Remove the two retaining screws and remove the left console trim moulding.
2. Remove the four retaining screws and remove the carpet retainer.
3. Remove the seven retaining screws and remove the console side panel.
4. Remove the socket, then remove the bulb.

SEAT BELT WARNING LIGHT

1. Remove the radio knobs, the two nuts, and the radio bezel.
2. Remove the heater control knobs.
3. Remove the retaining screws and raise the center finish panel.
4. Remove the socket, then remove the bulb.

HEATER CONTROL LIGHT

1. Remove the radio knobs, the two nuts, and the radio bezel.
2. Remove the heater control knobs.
3. Remove the retaining screws and raise the center finish panel.
4. Remove the socket, then remove the bulb.

HIGH BEAM INDICATOR LIGHT

Removal

1. Remove the battery ground cable.
2. Remove the radio knobs, the two nuts, and the radio bezel.
3. Remove the headlight switch control knob and the bezel nut.
4. Remove the retaining screws and the center instrument finish panel, and moulding.
5. Remove three retaining screws and push the headlight switch toward the front of the car.
6. Remove the five retaining screws from the left lower instrument panel moulding.
7. Cover the steering column and instrument panel where necessary.
8. Remove the four retaining screws and remove the covers from the indicating gauges.
9. Remove the retaining screws and remove the knobs from the wiper, the washer, the left air and the right air control levers.
10. Remove the retaining screws and position the clock housing back from the instrument panel.
11. Disconnect the wires and remove the clock housing.
12. Remove the retaining screws from the upper console moulding, and from under the instrument panel.
13. Through the indicator gauge openings remove the screws retaining the lower instrument panel to the upper instrument panel, and remove the lower instrument panel.
14. Pull out the high beam indicator socket and remove the light bulb.

Installation

1. Install the light bulb in the socket and install the socket in the upper instrument panel.
2. Position the lower instrument panel to the upper instrument panel and install the retaining screws through the indicator gauge openings.
3. Position the indicator gauge covers and install the retaining screws.
4. Check the operation of all of the indicator gauges and the instrument panel lights.
5. Install the retaining screws to the console moulding and the lower instrument panel.
6. Position the headlight switch to the instrument panel and install the retaining screws.
7. Install the instrument panel moulding and finish panel, and install the retaining screws.
8. Install the light switch control knob and bezel nut.
9. Install the radio bezel, the retaining nuts, and the knobs.
10. Position the clock housing, connect the wires, install the clock housing and the retaining screws.
11. Install the wiper, the washer, the left air, and the right air con-

trol knobs, and install the retaining screws.

12. Remove the covers from the steering column and the instrument panel.

13. Install the battery ground cable.

TURN SIGNAL INDICATOR LIGHTS

The indicator lights are located on the right and left front fenders. To replace the bulb, unscrew the special nut holding the lens and light socket in place. Remove the lens and turn the bulb counterclockwise to release.

HORNS

The horns are mounted on the left radiator support assembly. Disconnect the horn wire from the terminal. Remove the retaining bolt and lift the horn out from below the support.

To install, position the horn from the bottom and install the retaining bolt. Connect the horn wire.

HORN BUTTONS

1. Disconnect the battery ground cable.

2. Remove the center steering wheel medallion assembly.

3. Remove the three retaining screws from the center of the steering wheel and remove the horn buttons.

4. Position the new horn buttons and install the three retaining screws.

5. Install the steering wheel medallion assembly.

6. Connect the battery ground cable.

PART 15-3 SWITCHES, CIRCUIT BREAKERS AND FUSES

1 DESCRIPTION AND OPERATION

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

HEADLIGHT SWITCH

A combination headlight switch and two circuit breakers is used (Fig. 1). The headlight circuit is protected by an 18 ampere circuit breaker. The tail, parking and license plate light circuits are protected by a 15 ampere circuit breaker.

FUSES

The fuse panel is mounted on the right cowl panel under the right end of the instrument panel. The fuses and circuit breakers on the panel are illustrated in Fig. 2.

DOME LIGHT SWITCH

The dome light switch is part of the headlight switch. It is actuated by rotating the switch control knob to the maximum counterclockwise position.

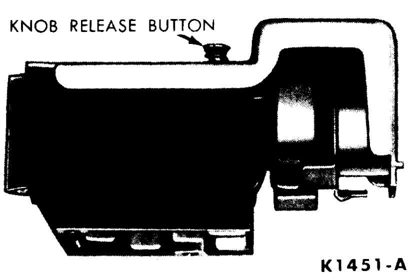

FIG. 1—Headlight Switch

MECHANICAL STOP LIGHT SWITCH

The mechanical stop light switch differs from the hydraulic switch formerly used. The switch assembly is installed on the pin of the brake pedal arm so that it straddles the master cylinder push rod. The switch assembly is a slip fit on the pedal arm pin and thus the switch assembly moves with the pedal arm whenever the brake pedal is depressed.

The brake pedal arm pin has a designed-in clearance with the eye of the master cylinder push rod (Fig. 3). Because of this clearance, whenever the brake pedal is pushed forward, the stop light switch contacts, moving with the pedal arm, are actually pushed against the end of the master cylinder push rod, through the switch actuating pin. It is this movement of the switch with respect to the actuating pin and master cylinder push rod that closes the switch contacts completing the circuit to the stop lights.

When the brake pedal is released, the spring in the stop light switch returns the actuating pin to its normal position and the circuit to the stop lights opens.

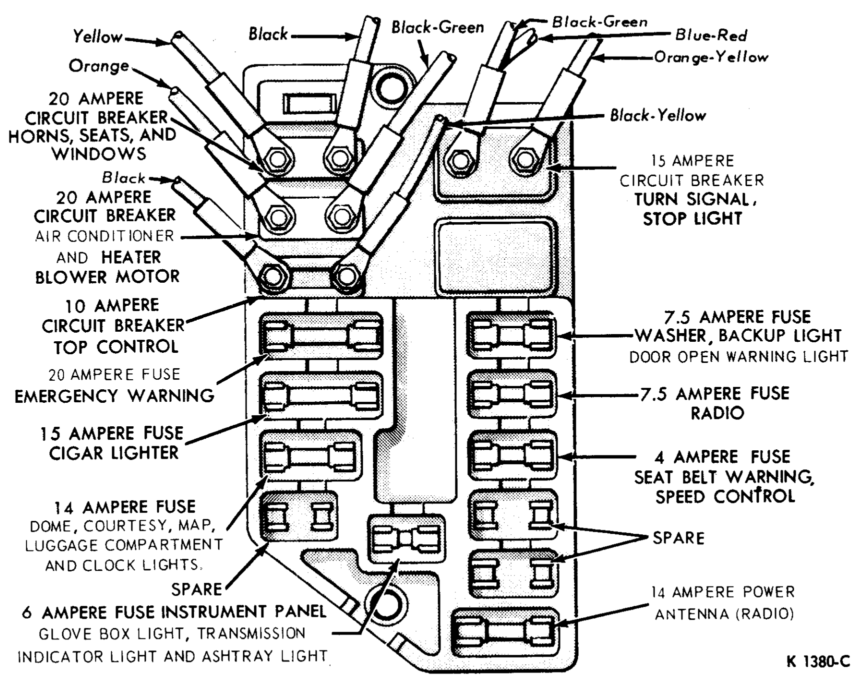

FIG. 2—Fuse Panel

2 REMOVAL AND INSTALLATION

SWITCHES

Before removing any switch, disconnect the battery ground cable from the battery.

HEADLIGHT SWITCH

1. Remove the control knob and shaft by pressing the knob release button on the switch housing (Fig. 1) with the knob in the full ON position. Pull the knob and shaft out of the switch.

2. Remove the switch bezel and

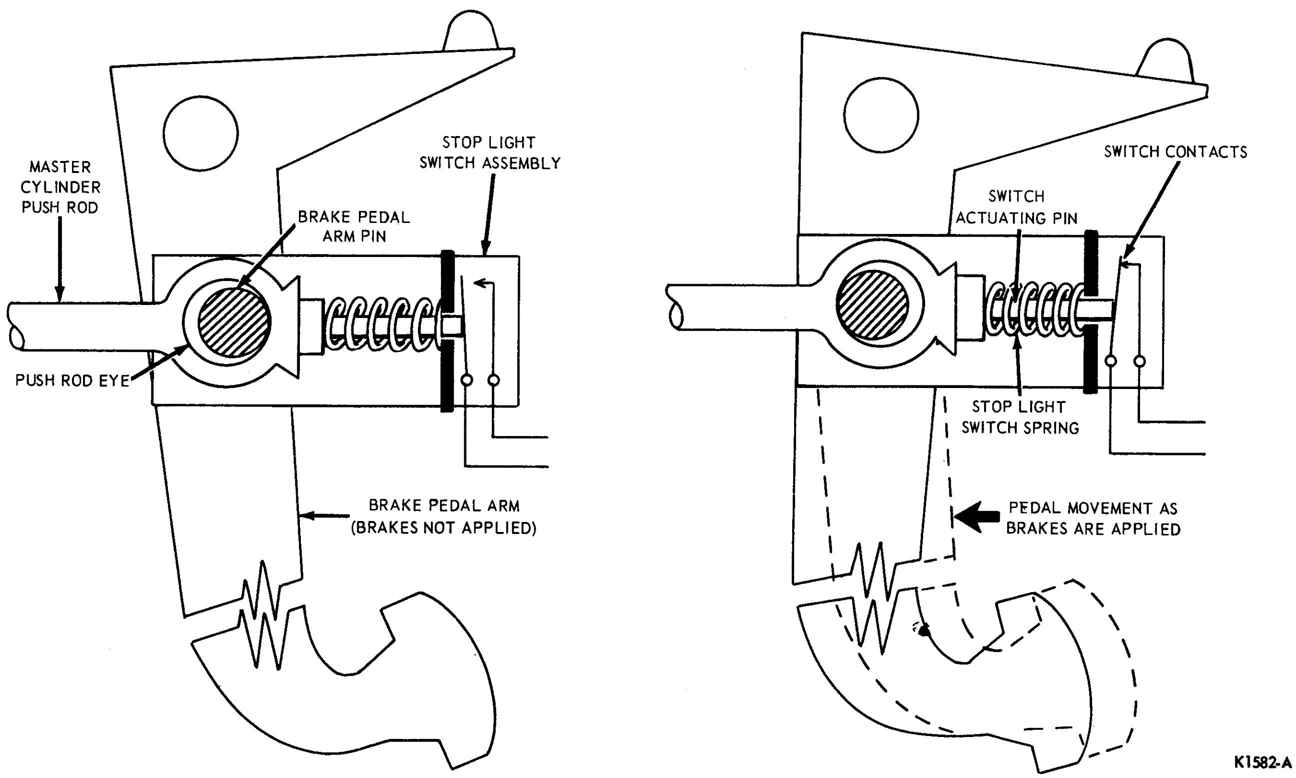

FIG. 3—Mechanical Stoplight Switch Operation

the retaining nut. Remove the switch from the instrument panel.

3. Disconnect the electrical connection from the switch and remove the switch.

4. To install the switch, connect the electrical connector to the switch. Position the switch in the instrument panel and install the retaining nut. Install the switch bezel.

5. Install the knob and shaft assembly by inserting it all the way into the switch until a distinct click is heard. In some instances, it may be necessary to rotate the shaft slightly until it engages.

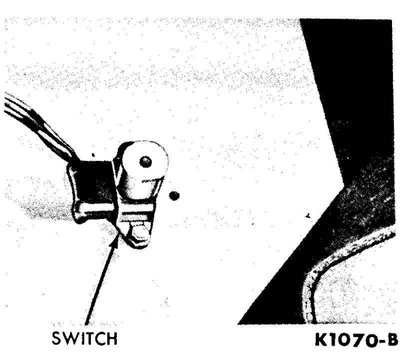

FIG. 4—Headlight Beam Selector Switch

HEADLIGHT BEAM SELECTOR SWITCH

Lay the floor mat back from the area of the switch and remove the mounting screws (Fig. 4). Disconnect the wire terminal block from the switch.

To install the switch, connect the terminal block to the switch and install the switch to the floor. Replace the floor mat.

STOP LIGHT SWITCH

1. Disconnect the wires at the connector.
2. Remove the hairpin retainer, slide the stop light switch, the push rod and the nylon washers and bushing away from the pedal, and remove the switch (Fig. 5).
3. Position the switch, push rod, and bushing and washers on the brake pedal pin, in the order shown in Fig. 5, and install the hairpin retainer.
4. Connect the wires at the connector, and install the wires in the retaining clip (Fig. 5).

IGNITION SWITCH AND LOCK CYLINDER

1. Disconnect the negative cable from the battery.

2. Turn the ignition key to the accessory position. Slightly depress the pin shown in Fig. 6, 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. Remove the five retaining screws and remove the lower instrument panel shield.

4. Press in on the rear of the switch and rotate the switch ⅛ turn counterclockwise (as viewed from the terminal end). Remove the bezel and switch.

5. Remove the lock nut and the retaining nut and pull the connector from the switch.

6. If a new ignition switch as well as the lock cylinder 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.

7. Install the connector to the back of the switch and install the retaining nut and lock nut.

8. Position the switch in the instrument panel with the light bulb and retainer. Position the bezel in the instrument panel. Rotate the

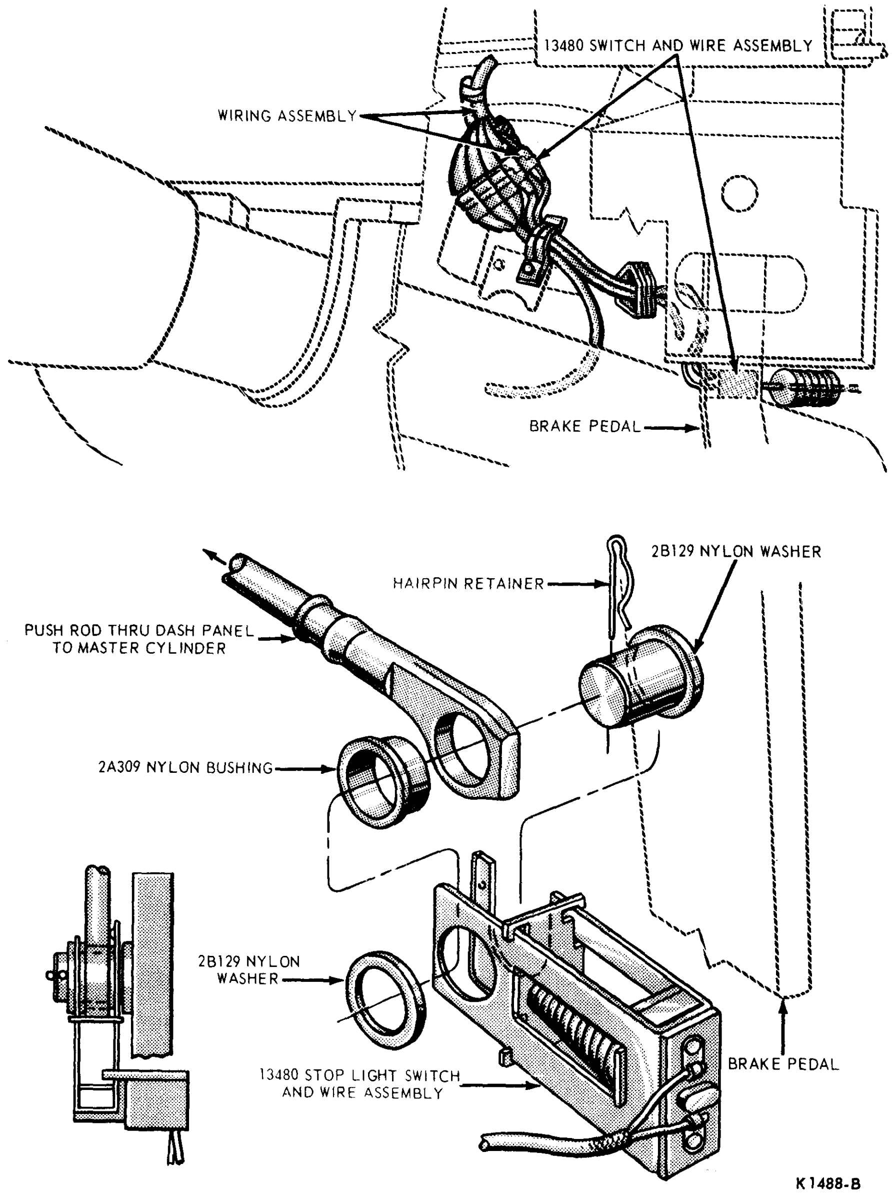

FIG. 5—Mechanical Stop Light Switch Assembly

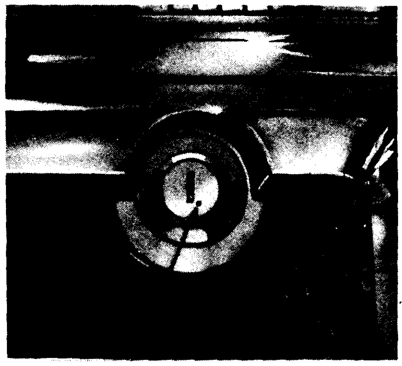

FIG. 6—Ignition Switch and Lock

switch 1/8 turn to lock it in 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 the ignition switch, depress the pin slightly (Fig. 6), and turn the key counterclockwise. Push the lock cylinder into the switch. Turn the key to check the lock cylinder operation.

10. Position the lower instrument panel shield and install the five retaining screws.

11. Connect the battery cable and check the ignition switch operation.

MAP LIGHT SWITCH

Remove the control knobs from the windshield wiper, windshield washer, and the right- and left-hand air vent control levers from below the clock housing. Remove the four screws retaining the clock housing to the instrument panel and lower the clock housing. Disconnect the switch wires. Remove the two switch retaining screws and remove the switch.

PART 15-4 INSTRUMENTS

1 DESCRIPTION AND OPERATION

All of the instruments are electrically operated exécept the speedometer. Illumination is provided by lights controlled by a rheostat on the lighting switch.

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

GAUGES

The instrument cluster includes a fuel gauge, oil pressure indicator gauge, temperature gauge, charge indicator gauge, speedometer, and a high-beam indicator light.

CONSTANT VOLTAGE REGULATOR

The constant voltage regulator (Fig. 1) used with the fuel, temperature, and oil gauges maintains an average value of 5.0 volts at the gauge terminals.

The regulator operates by means of a bimetallic arm and a heating coil. When the ignition switch is turned on, the heating coil (Fig. 1) heats the bimetallic arm causing it to bend and break the contacts, disconnecting the voltage supply from the heating coil. The bimetallic arm then cools and brings the contacts together again. The making and breaking of the contacts, causes a pulsating voltage, with an effective average value of 5.0 volts to be supplied to the gauges. Although these pulsations are quite rapid, there is in each gauge a bimetallic arm which changes temperature quite slowly, and this assures steady average readings.

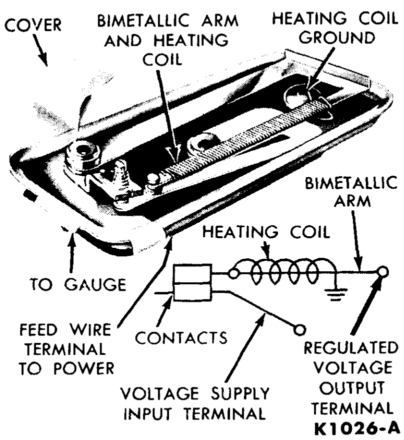

FIG. 1—Constant Voltage Regulator

As the pulsating voltage would normally cause radio interference, a radio interference suppression choke is connected in series with the constant voltage regulator supply wire.

FUEL GAUGE

The fuel gauge consists of a sending unit, located on the gas tank and a remote register unit 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 rheostat is operated by a float control. As the fuel level rises or falls the float control arm moved by the float, varies the resistance.

LOW FUEL LEVEL WARNING SYSTEM

The low fuel level warning system consists of the fuel level sending unit located on the gas tank, the warning relay, and the warning lamp located in the center of the instrument panel. The warning lamp will light up just before the fuel gauge pointer indicates empty and/or when there are approximately three and one-half gallons of fuel in the tank.

A thermistor assembly (Fig. 2), attached to the fuel sender outlet tube, is kept cool when covered by gasoline. When the fuel level drops low enough to expose the thermistor to air, the thermistor heats up. The thermistor resistance then drops and allows current to flow through a warning signal relay. The relay contacts then close, to light the warning lamp.

TEMPERATURE GAUGE

The temperature gauge consists of a sending unit mounted in the cylinder head, and a remote register unit (temperature gauge) mounted on the instrument panel. Changes of engine temperature vary the resistance of the sending unit, which in turn operates the temperature gauge.

OIL PRESSURE INDICATOR GAUGE

A meter-type oil pressure gauge is used. The gauge consists of a send-

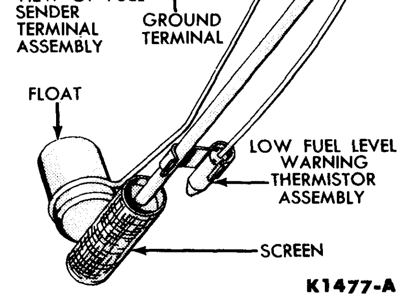

FIG. 2—Fuel Level Warning Sender Assembly

ing unit on the engine and a remote register unit (oil pressure gauge) mounted in the instrument cluster. The sending unit operates by varying resistance according to the actual oil pressure against it, which in turn operates the oil pressure gauge.

SEQUENTIAL TURN SIGNAL INDICATOR

The sequential turn signal indicator system is composed of the following component parts: A turn signal switch which is located in the steering column; a current relay mounted on the brake pedal support to operate the indicator pilot lights; a relay, and a flasher assembly which are located in the luggage compartment behind the rear seat.

The flasher assembly consists of a motor and 4 cams. One cam returns the motor to the start position after the turn signal indicators are canceled. The remaining 3 cams are staggered and each set of contacts is connected to one of the three rear light bulbs.

When the turn signal indicator switch is moved to indicate a right or left turn, the circuit is completed to the flasher motor and to the flasher cam contacts. This starts the motor in operation and the cams begin to rotate. As the cams rotate, the inboard rear light bulb is illuminated first and remains on until the cycle is completed. The center light bulb is then illuminated and it remains on while the outboard rear light bulb is illuminated. All three lights go out at the same time and the cycle is repeated, as long as the turn signal indicator switch is closed to indicate a turn. The front parking light bulb flashes in sequence with the center rear light bulb.

When the turn signal indicator switch is canceled, the light bulbs go out immediately. The motor cam allows the motor to travel to the park position so that the sequence always starts with the inboard rear light.

The turn signal pilot light, located on each front fender, is controlled by a current relay. The relay is adjusted so that it will open a set of contacts whenever the 4 signal light bulbs are on. The relay remains closed and the pilot light is illuminated until the 4 exterior light bulbs are all on. The relay contacts then open and the pilot light goes out until all 4 exterior lights are off. The relay contacts then close to illuminate the pilot light. If one or more of the exterior light bulbs are not functioning (burned out), the relay contacts will remain closed and the pilot light will remain on.

CHARGE INDICATOR GAUGE

The charge indicator gauge is an ammeter which indicates whether the battery is being charged or discharged. The ammeter is non-adjustable and should be replaced if proved to be defective.

EMERGENCY FLASHER WARNING SYSTEM

The emergency flasher warning system is controlled by a combination switch and flasher assembly. All turn signal lights can be made to flash at the same time by closing the switch of the switch-flasher assembly.

SPEEDOMETER

The speedometer incorporates a long drum. It is painted one-half red and one-half white on the diagonal so that as the drum revolves, a red line moves horizontally across the dial face indicating the miles per hour being driven.

The speedometer is connected to the output shaft of the transmission by means of a flexible shaft and drive gear located inside the transmission. The flexible shaft drives the speedometer which registers speed in miles per hour. It also drives an odometer which records distance traveled in miles and tenths of a mile.

CLOCK

Adjustment of the clock is automatic. If the clock runs slow or fast, merely reset the clock to the proper time. This action adjusts the clock automatically.

The clock fuse is located on the fuse panel mounted on the right cowl panel.

WINDSHIELD WIPER

The windshield wiper motor is hydraulically operated. The hydraulic power for the motor is obtained from the power steering unit. The hydraulic fluid flows from the pump through the steering gear to the wiper motor, and then to the fluid reservoir. During wiper operation, a part of the fluid is by-passed through the motor by a valve on the motor. The speed of the wiper is controlled by adjusting the valve on the wiper motor with a bowden wire control operated from the upper instrument panel.

WINDSHIELD WASHER

The windshield washer is operated by pulling out the control lever. This action closes a switch attached to the control, which operates the windshield washer pump.

2 IN-CAR ADJUSTMENTS AND REPAIRS

WINDSHIELD WIPER BLADE ADJUSTMENT

Start the engine. Turn the wiper control on, then off, to bring the wiper pilot shafts to their proper park position. Stop the engine. Install the wiper blades so that they lie flat against the lower edge of the windshield.

3 REMOVAL AND INSTALLATION

GAUGES

The fuel gauge, oil pressure indicator gauge, and temperature gauge, can be replaced without removing the instrument cluster assembly. To replace the speedometer, constant voltage regulator or charge indicator gauge it is necessary to first remove the cluster assembly.

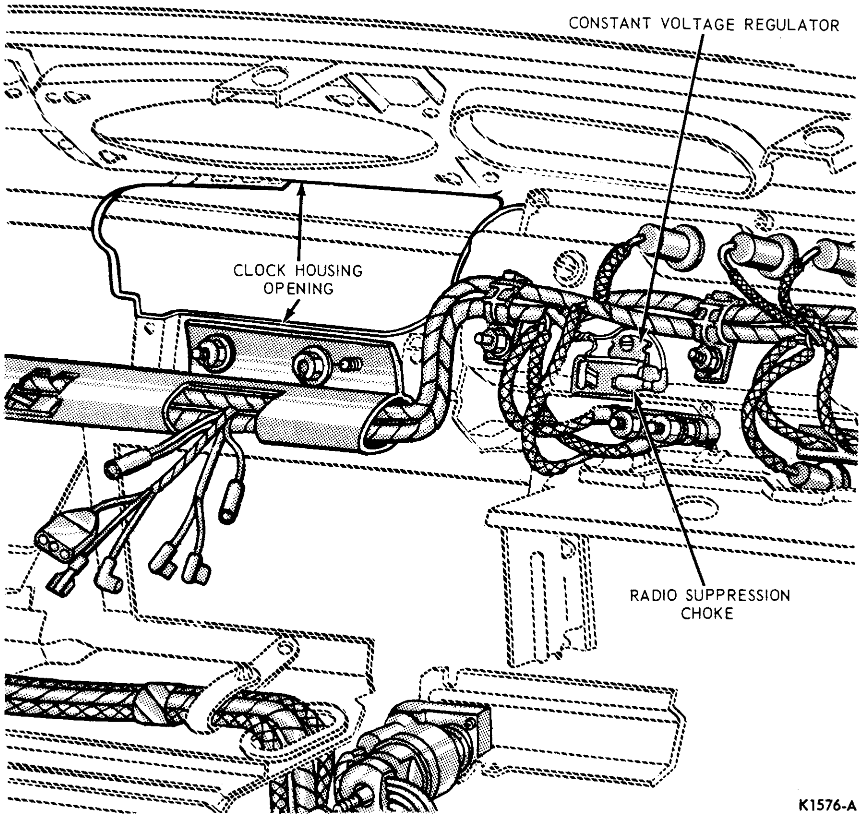

FIG. 3—Constant Voltage Regulator Mounting

CONSTANT VOLTAGE REGULATOR

REMOVAL

1. Disconnect the battery ground cable.
2. Remove the four retaining screws and remove the knobs from the wiper, the washer, the left air, and the right air control levers.
3. Remove the screws retaining the clock housing to the upper instrument panel, and lower the clock housing assembly.
4. Disconnect the wires and remove the clock housing.
5. Reaching left through the clock housing opening, remove the one retaining screw, remove the constant voltage regulator from the right side of the speedometer, and disconnect the two wires (Fig. 3).

INSTALLATION

1. Position the constant voltage regulator and install the one retaining screw and connect the two wires.
2. Connect the wires, position the clock housing and assemble the retaining screws.
3. Position the knobs on the wiper, the washer, the left air, and the right air control levers, and install the retaining screws.
4. Connect the battery ground cable.

FUEL GAUGE

1. Remove the pod bezel retaining screw and remove the bezel and lens.
2. Remove the two fuel gauge retaining screws.
3. Pull the fuel gauge out of the pod and disconnect the wires.
4. Connect the wires to the fuel gauge.
5. Position the fuel gauge in the pod and install and tighten the retaining screws.
6. Position the lens and bezel and install the bezel retaining screw.

FUEL SENDING UNIT

REMOVAL

1. Raise the car on a hoist.
2. Drain the fuel from the tank.
3. Disconnect the wires from the sending unit.
4. Disconnect the fuel lines from the sending unit.
5. Remove any dirt that has collected around the sending unit so that it will not enter the tank.
6. Remove the sending unit and gasket from the tank.

INSTALLATION

1. Clean the sending unit mounting surface at the fuel tank.
2. Install the sending unit with a new gasket.
3. Connect the wires and the fuel lines.
4. Lower the car.
5. Fill the fuel tank with the fuel removed.
6. Check the operation of the fuel gauge, the low fuel warning light, and check for leaks.

TEMPERATURE GAUGE

1. Remove the pod bezel retaining screw and remove the bezel and lens.
2. Remove the two temperature gauge retaining screws.
3. Pull the temperature gauge out of the pod and disconnect the wires.
4. Connect the wires to the temperature gauge.
5. Position the temperature gauge in the pod and install and tighten the retaining screws.
6. Position the lens and bezel and install the bezel retaining screw.

TEMPERATURE SENDING UNIT

1. Disconnect the temperature sending unit wire from the sending unit.
2. Prepare the new temperature sending unit for installation by applying a small amount of electrically conductive sealer C3AZ-19554-B 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.

OIL PRESSURE INDICATOR GAUGE

1. Remove the pod bezel retaining screw, bezel and lens.
2. Remove the two oil pressure gauge retaining screws.
3. Pull the oil pressure gauge out of the pod and disconnect the wires.
4. Connect the wires to the oil pressure gauge.
5. Position the oil pressure gauge in the pod. Install and tighten the retaining screws.

6. Position the lens and bezel, and install the bezel retaining screw.

OIL PRESSURE SENDING UNIT

1. Disconnect the oil pressure sending unit wire from the unit (Fig. 4).
2. Remove the sending unit.
3. Apply electrically conductive sealer C3AZ-19554-B to the threads of the new sending unit and install the unit.
4. Connect the wire to the sending unit.
5. Check the operation of the unit.

CHARGE INDICATOR GAUGE

REMOVAL

1. Disconnect the battery ground cable.
2. Cover the steering column and instrument panel where necessary with tape to prevent paint damage when the instrument cluster is removed.
3. Remove the radio knobs and bezel (Fig. 5).
4. Remove the headlight switch control knob and bezel nut.
5. Remove the instrument finish panel (Fig. 5 two pieces).
6. Remove the headlight switch mounting screws and push the headlight switch toward the front of the car.
7. Remove the console panel finish moulding cap, and remove the five screws retaining the left lower half of the instrument cluster housing assembly (Fig. 5).
8. Remove the wiper, washer, left air and right air control knobs.
9. Remove the clock housing retaining screws, disconnect all wires, and remove the clock housing.
10. Remove two screws from the instrument panel upper moulding (Fig. 5), and five screws under the cluster. Pull the moulding away from the instrument panel for access to the cluster screws.
11. Remove the four instrument indicator cover retaining screws and remove the covers (Fig. 5).
12. Through the indicator openings, remove the four screws retaining the lower cluster to the upper cluster.
13. Position the lower cluster out from the upper cluster, remove the wire retaining nuts from the charge indicator, remove the wires and retaining block, and remove the bulb socket.
14. Remove the two screws which retain the charge indicator to the cluster, and remove the charge indicator.

INSTALLATION

1. Position the new charge indicator in the cluster and install the two retaining screws.
2. Position the wires and the retaining block to the charge indicator and install the retaining nuts. Install the bulb socket.
3. Position the lower instrument panel cluster to the upper cluster and through the indicator openings install the four screws retaining the lower cluster to the upper cluster.
4. Check the operation of all indicators and the instrument panel lights.
5. Install the indicator covers.
6. Install the screws retaining the left lower half of the cluster housing to the instrument panel. Install the console panel finish moulding cap.
7. Position the headlight switch in the instrument panel and install the mounting screws.
8. Install the screws retaining the instrument panel upper moulding.
9. Position the instrument finish panel (two pieces), and install the retaining screws.
10. Install the light switch bezel, nut and control knob.
11. Install the radio bezel, retaining nuts and knobs.
12. Position the clock housing to the instrument panel, connect all the wires, check the operation of the clock and warning lights, and install the retaining screws.
13. Install the wiper, washer, left air, and right air control knobs.
14. Connect the battery ground cable and remove the protective tape from the cluster and steering column.

TURN INDICATOR SWITCH

To remove the turn indicator switch, the steering wheel must first be removed.

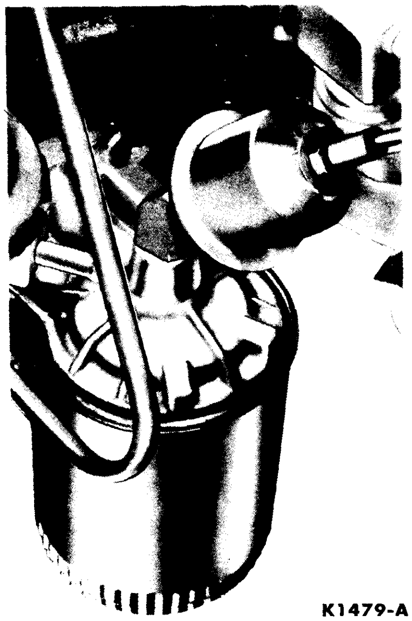

FIG. 4—Oil Pressure Sending Unit

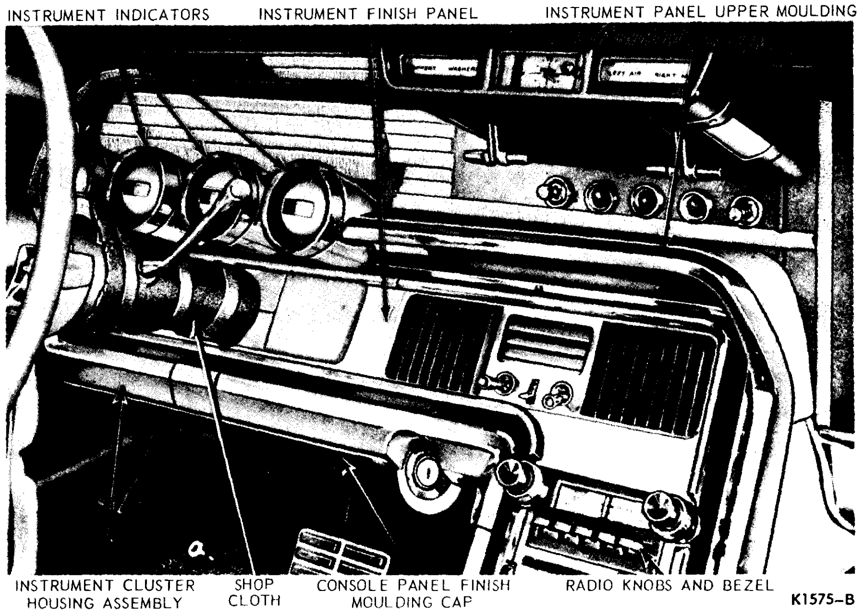

FIG. 5—Instrument Panel

1. Unscrew the turn signal switch lever from the steering column.

2. Remove the switch mounting bracket screw; then remove the switch and bracket from the steering column.

3. Remove the conical tension spring and the switch actuating arm.

4. Disconnect the switch wires from the bullet connectors, remove the wire protector from the side of the steering column, remove the switch to mounting bracket screws, and remove the switch and wires.

When installing the new switch, make certain that the canceling cam on the steering wheel makes contact with the canceling pawls on the switch. The clearance between the steering wheel hub and steering shaft housing flange should not be more than 1/16 inch for proper switch canceling. Reposition the steering shaft housing if necessary.

TURN INDICATOR FLASHER (MOTOR AND CAMS)

1. Open the luggage compartment door.

2. Disconnect the negative (ground) cable from the battery.

3. Disconnect the wires from the motor operated flasher (located in the forward area of the luggage compartment) at the 2 multiple connectors.

4. Remove the ground wire attaching screw.

5. Remove 2 flasher attaching screws and remove the flasher from the car.

6. Position the flasher in the luggage compartment and install the 2 attaching screws.

7. Position the ground wire and install the attaching screw.

8. Connect the flasher wires at the 2 connectors.

9. Connect the negative (ground) cable to the battery and check the operation of the flasher.

10. Close and lock the luggage compartment door.

TURN INDICATOR RELAY

1. Open the luggage compartment door.

2. Disconnect the negative (ground) cable from the battery.

3. Disconnect the wires from the relay (located in the forward area of the luggage compartment) at the 2 multiple connectors.

4. Remove 2 relay attaching screws and remove the relay.

5. Position the relay in the luggage compartment and install the 2 attaching screws.

6. Connect the relay wires at the 2 multiple connectors.

7. Connect the negative (ground) cable to the battery and check the operation of the relay.

8. Close and lock the luggage compartment door.

SPEEDOMETER CLUSTER

REMOVAL

1. Disconnect the battery ground cable.

2. Cover the steering column and instrument panel, where necessary (Fig. 5), with tape to prevent paint damage when the instrument cluster is removed.

3. Remove the radio knobs and bezel (Fig. 5).

4. Remove the headlight switch control knob and bezel nut.

5. Remove the instrument finish panel (Fig. 5 two pieces).

6. Remove the headlight switch mounting screws and push the headlight switch toward the front of the car.

7. Remove the console panel finish moulding cap, and remove the five screws retaining the left lower half of the instrument cluster housing assembly (Fig. 5).

8. Remove the clock housing retaining screws. Rotate the clock housing upward and rearward to expose the two tab screws retaining the instrument panel upper moulding.

9. Remove two screws from the instrument panel upper moulding (Fig. 5), and five screws under the cluster. Pull the moulding away from the instrument panel for access to the cluster screws. Tape the tabs to prevent scratches.

10. Remove the four instrument indicator cover retaining screws and remove the covers (Fig. 5).

11. Through the indicator openings, remove the four screws retaining the lower cluster to the upper cluster. Position the four instrument indicator covers on the instruments to prevent damage to the indicators. Install the retaining screw on the charge indicator cover.

12. Remove the four screws retaining the speedometer cluster to the instrument panel at the top of the cluster, and position the speedometer cluster out from the instrument panel.

13. Disconnect the light bulbs across the top of the speedometer. Remove the wiring harness from the plastic clips, disconnect the speedometer cable, and the constant voltage regulator wires, and remove the speedometer cluster.

14. Remove the speedometer housing-to-cluster mounting screws and remove the speedometer housing assembly.

15. Remove the screws retaining the speedometer housing cover to the speedometer assembly and remove the speedometer.

INSTALLATION

1. Position the speedometer in the housing cover and install the mounting screws.

2. Position the speedometer housing assembly in the speedometer cluster and install the retaining screws.

3. Position the speedometer cluster in the instrument panel, connect the speedometer cable, connect the wires to the constant voltage regulator, plug in the light bulbs, position the wiring harness in the plastic clips and install the cluster with the retaining screws at the top of the cluster.

4. Position the lower instrument panel cluster to the upper cluster, remove the four instrument indicator covers, and through the indicator openings install the four screws retaining the lower cluster to the upper cluster.

5. Check the operation of all indicators and the instrument panel lights.

6. Install the indicator covers.

7. Install the screws retaining the left lower half of the cluster housing to the instrument panel. Install the console panel finish moulding cap (Fig. 5).

8. Position the headlight switch in the instrument panel and install the mounting screws.

9. Remove the tape from the tabs and install the screws retaining the instrument panel upper moulding.

10. Position the instrument finish panel (two pieces), and install the retaining screws.

11. Install the light switch bezel, nut, and control knob.

12. Install the radio bezel, retaining nuts and knobs.

13. Position the clock housing to

the instrument panel, and install the retaining screws.

14. Connect the battery ground cable and remove the protective tape from the cluster and steering column.

SPEEDOMETER LIGHTS

Two of the speedometer lights are accessible from the left-hand side of the car under the instrument panel. The balance of the lights require the following procedure for their replacement.

REMOVAL

1. Disconnect the battery ground cable.
2. Cover the console.
3. Remove the clock housing.
4. Remove the retainer screws from the radio speaker grille.
5. Remove the radio speaker retainers and remove the speaker from the instrument panel and position it next to the console.
6. Remove the retaining nuts at the radio speaker grille, and remove the grille.
7. Remove the retaining nuts and remove the defroster nozzle from the instrument panel, disconnect the nozzle from the hose and remove the nozzle through the speaker opening. Position the defroster hose to the right side of the clock opening.
8. Remove the retaining screws and remove the windshield washer and vent control mounting plate from the instrument panel and rest it on top of the console.
9. Reaching through the clock housing opening remove the defective bulb(s).

INSTALLATION

1. Install the new bulb(s).
2. Install the windshield washer and vent control mounting plate to the instrument panel, and install the retaining screws.
3. Reaching through the radio speaker opening, install the defroster nozzle to the hose, then install the nozzle to the instrument panel.
4. Position the radio speaker grille, then install the retaining nuts.
5. Position the radio speaker to the instrument panel, and install the retainers.
6. Install the radio speaker grille retaining screws.
7. Install the clock housing.
8. Remove the cover from the console.
9. Install the battery ground cable.

SPEEDOMETER CABLE

REMOVAL

1. Disconnect the battery ground cable.
2. Cover the seat.
3. Remove the four retaining screws and remove the knobs from the wiper, the washer, the left air, and the right air control levers.
4. Remove the screws retaining the clock housing to the upper instrument panel, and lower the clock housing assembly.
5. Disconnect the wires, and the vacuum hoses at the door lock switch, and remove the clock housing.
6. Reaching through the clock housing opening disconnect the speedometer cable at the speedometer head.
7. Remove the upper part of the speedometer drive cable.
8. Raise the car on a hoist.
9. Remove one mounting bolt and disconnect the speedometer cable casing from the transmission (Fig. 6).
10. Remove the lower part of the speedometer drive cable and the driven gear.

INSTALLATION

1. Install the driven gear in the speedometer cable casing and install the speedometer cable casing in the transmission.
2. Install the mounting bolt and torque to 20-25 foot-pounds.
3. Lower the car to the floor.
4. Using the two parts of the old cable set end to end, carefully determine the exact length, then subtract $\frac{9}{16}$ inch.
5. Cut the new cable to this length, and remove any burrs or frayed edges. **Be certain not to cut from the squared end of the cable.**
6. Install the tip on the cable making certain to seat the cable in the bottom of the tip.
7. Place the cable and tip in a crimping die, and placing the die on a solid surface strike it squarely with a hammer to crimp it.
8. Remove the crimping die.
9. Lubricate the cable with cable lubricant B5A-19581-A (do not over lubricate) and install it in the speedometer cable casing. When the cable is nearly seated, twist it slightly to make sure that the squared drive is engaged in the speedometer driven gear.
10. Connect the speedometer cable casing to the speedometer head.
11. Connect the wires, and the vacuum hoses at the door lock switch, and position the clock housing.
12. Install the retaining screws.
13. Position the knobs on the wiper, the washer, the left air, and the right air control levers, and install the retaining screws.
14. Remove the cover from the seat.
15. Connect the battery ground cable.

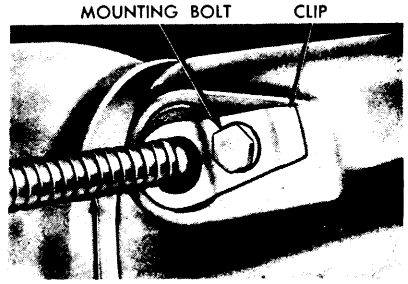

FIG. 6—Speedometer Cable Mounting

CLOCK

REMOVAL

1. Disconnect the battery cable.
2. Remove the control knobs from the wiper, washer, left air and right air control levers, from below the clock housing.
3. Remove the four screws retaining the clock housing to the instrument panel, lower the housing and disconnect the two courtesy light wires.
4. Disconnect the two clock quick disconnects and the two light sockets.
5. Remove the two clock retaining screws and remove the clock.

INSTALLATION

1. Position the clock in the clock housing and install the two retaining screws.
2. Connect the two quick disconnects and plug in the two light sockets.
3. Position the courtesy light wire over the windshield wiper control cable and the other wire over the air vent control cable and connect the wires.
4. Position the clock housing in the instrument panel and install the four retaining screws.
5. Install the control knobs on the

wiper, washer, left air, and right air control levers.

6. Connect the battery cable and check the operation of the clock.

WINDSHIELD WIPER

WIPER MOTOR

Removal

1. Remove the wiper arm and blade assemblies.
2. Remove the wiper pivot shaft bezels and nuts.
3. Remove the air cleaner.
4. Remove the 14 retaining screws and remove the cowl top panel.
5. Remove the two retaining screws and the seal plate from the dash panel.
6. Remove the two clips retaining the wiper links to the wiper motor. Rotate the link to remove the left clip.
7. Disconnect the hydraulic line under the hood (Fig. 7). Be careful not to burn the hands with the hot hydraulic fluid.
8. Disconnect the hydraulic line in the cowl from the motor.
9. Remove the two bolts retaining the motor to the mounting bracket. Disconnect the wiper control cable and remove the motor.

Installation

1. Transfer the one hydraulic line and fitting to the new motor.

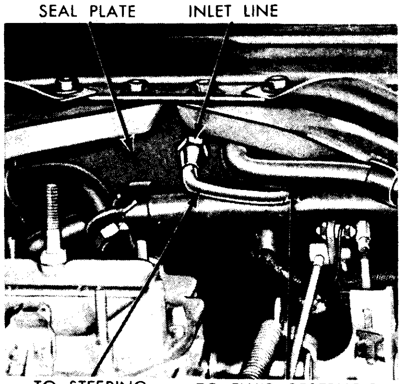

FIG. 7—Wiper Motor Hydraulic Line Connections

2. Remove the one nut and two bolts retaining the wiper pivot shaft and link assembly to the cowl.
3. Position the wiper pivot shaft and link assembly and install the one nut and the two retaining bolts.
4. Position the wiper motor. Connect the wiper control cable, and install the two hydraulic lines so that they are snug. Adjust the control cable so that the control on the instrument panel moves the valve control lever from OFF to full ON.
5. Install the two wiper motor to mounting bracket retaining bolts.
6. Tighten the two hydraulic lines.
7. Install the wiper links on the motor and install the two retaining clips.
8. Position the seal plate and install the two retaining screws.
9. Start the engine and check for leaks. Check the power steering fluid. Add fluid if necessary.
10. Position the cowl top panel and install the 14 retaining screws.
11. Install the pivot shaft nuts and bezels.
12. Install the wiper arm and blade assemblies.
13. Install the air cleaner.

WIPER CONTROL

Removal

1. Disconnect the battery cable.
2. Remove the windshield wiper, windshield washer, and right- and left-hand air vent control knobs.
3. Remove the four screws retaining the clock housing to the instrument panel, lower the housing and disconnect the two courtesy light wires.
4. Remove the two screws retaining wiper control to the control plate assembly.
5. Remove the wiper arm and blade assemblies.
6. Remove the wiper pivot shaft bezels and nuts.
7. Remove the 14 retaining screws and remove the cowl top panel.
8. Disconnect the wiper control cable from the motor.
9. Inside the passenger compartment, pull the control cable through the dash panel and remove the wiper control and cable assembly.

Installation

1. Position the new wiper control and cable assembly and feed the cable through the dash panel. Insert the rubber grommet in the dash panel.
2. Connect the wiper control cable to the motor.
3. Position the cowl top panel and install the 14 retaining screws.
4. Install the pivot shaft nuts and bezels.
5. Install the wiper arm and blade assemblies.
6. Install the two screws retaining the wiper control to the control plate assembly.
7. Position one courtesy light wire over the wiper control cable and the other over the air vent control cable and connect the wires.
8. Position the clock housing in the instrument panel and install the four retaining screws.
9. Install the windshield wiper, windshield washer, and right- and left-hand air vent control knobs.
10. Connect the battery cable.

WIPER PIVOT SHAFT AND LINK

1. Remove the wiper arm and blade assemblies.
2. Remove the wiper pivot shaft bezels and nuts.
3. Remove the 14 retaining screws and remove the cowl top panel.
4. Remove the clip retaining the link at the motor. Rotate the link to remove the left clips.
5. Remove one nut and two bolts retaining the pivot shaft and link assembly to the cowl and remove the pivot shaft and link assembly.
6. Position the pivot shaft and link assembly and install the one nut and the two retaining bolts.
7. Position the cowl top panel and install the 14 retaining screws.
8. Install the pivot shaft nuts and bezels.
9. Install the wiper arm and blade assemblies.

PART 15-5 SPECIFICATIONS

BULB CHART

Unit	Candela* or Wattage	Trade No.
Headlight—No. 1 (Inner)	37.5 w	4001
Headlight—No. 2 (Outer)	37.5/50 w	4002
Front Turn Signal/Parking	4/32 c.	1157-A
Rear Turn Signal & Stop/Tail	4/32 c.	1157
Map Light	6 c.	631
License Plate	4 c.	1155
Back-Up Lights	32 c.	1076
Spot Light	30 w	4405
Instrument Panel Indicators:		
Hi Beam	2 c.	1895
Oil Pressure Gauge	3 c.	1816
Ammeter	3 c.	1816
Turn Signal Indicator (Fender)	1 c.	53X**
Parking Brake Warning	2 c.	1895
Illumination:		
Speedometer	2 c.	1895
Cluster	2 c.	1895
Heater Control	1½ c.	1445
Clock	2 c.	1895
Radio Dial—AM	2 c.	1891
Radio Dial—AM-FM	1 c.	1892
Courtesy and/or Map (Door Mounted)	15 c.	1004
Automatic Transmission Control	2 c.	158

*Candela is the new international term for candlepower.
**For Minnesota and Wisconsin—2 c. No. 1895-G (Instrument Panel)

HORN CURRENT DRAW

Either	4-5 Amperes at 12 Volts

SPEEDOMETER CABLE

Transmission Mounting Clip Bolt Torque	20-25 ft-lbs.

CIRCUIT PROTECTION

Circuit	Protective Device	Location
Instrument Panel	14 Amp. Fuse	Fuse Panel
Dome, Courtesy, Interior Lights, and Clock	14 Amp. Fuse	Fuse Panel
Tail and Park Lights	15 Amp. Circuit Breaker	Fuse Panel
Stop Light	15 Amp. Circuit Breaker	Fuse Panel
Cigar Lighter	15 Amp. Fuse	Fuse Panel
Heater	20 Amp. Circuit Breaker	Fuse Panel
Turn Signal	15 Amp. Circuit Breaker	Fuse Panel
Radio	7.5 Amp. Fuse	Fuse Panel
Back-Up Lights	7.5 Amp. Fuse	Fuse Panel
Windshield Washer	7.5 Amp. Fuse	Fuse Panel
Power Seats	20 Amp. Circuit Breaker	Fuse Panel
Power Windows	20 Amp. Circuit Breaker	Fuse Panel
Convertible Top Control (Neutral Relay)	10 Amp. Circuit Breaker	Fuse Panel
Convertible Top Control (Motor Feed)	60 Amp. Circuit Breaker	At Starter Relay
Seat Belt Warning	4 Amp. Fuse	Fuse Panel
Horns	20 Amp. Circuit Breaker	Fuse Panel
Automatic Transmission Control	6 Amp. Fuse	Fuse Panel
Transistorized Ignition	2 Amp. Fuse	In Line

VENTILATING, HEATING AND ACCESSORIES

GROUP 16

PART 16-1 VENTILATING SYSTEM AND HEATER

1 DESCRIPTION AND OPERATION—VENTILATING SYSTEM

FRESH AIR VENTS

Two levers are mounted near the centerline of the instrument panel on the underside of the ledge.

The right lever controls the right fresh air door in the heater assembly.

With the lever in the forward position, fresh air is routed through the heater assembly.

With the lever in the rearward position, fresh air enters the car through the fresh air outlet.

The left lever actuates the left ventilation door located in the ventilation duct to the left of the steering column.

With the lever in the forward position, the door is closed.

With the lever in the rearward position, the door is open and fresh air enters the passenger compartment.

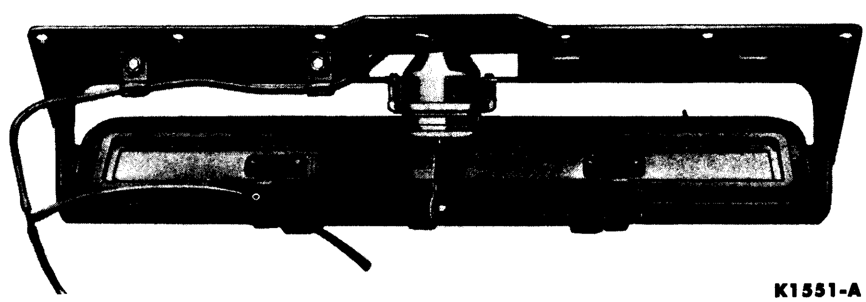
K1551-A

FIG. 1—Rear Vent in Open Position

REAR VENT

The rear vent (Fig. 1) on the hardtop models is opened and closed by a vacuum control switch on the console. Operation of the switch allows quiet, window-up driving in warm weather under all climatic conditions while speeding ventilation and smoke removal. The rear vent is also valuable in rear window defogging.

2 DESCRIPTION AND OPERATION—HEATING SYSTEM WITHOUT AIR CONDITIONING

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

For the heating system used with air conditioning refer to Part 16-2.

The heater used when air conditioning is not installed is a by-pass air control heater. Fresh air enters the heater from the cowl air inlet into the fresh air inlet chamber of the heater through and/or around the heater core, into the mixing chamber and into the plenum chamber to the discharge air outlets or defroster outlets (Fig. 2).

Air temperature is controlled by the lower horizontal lever on the control assembly located in the console below the radio. Movement of the lever through its range from MIN to MAX actuates the tempera-

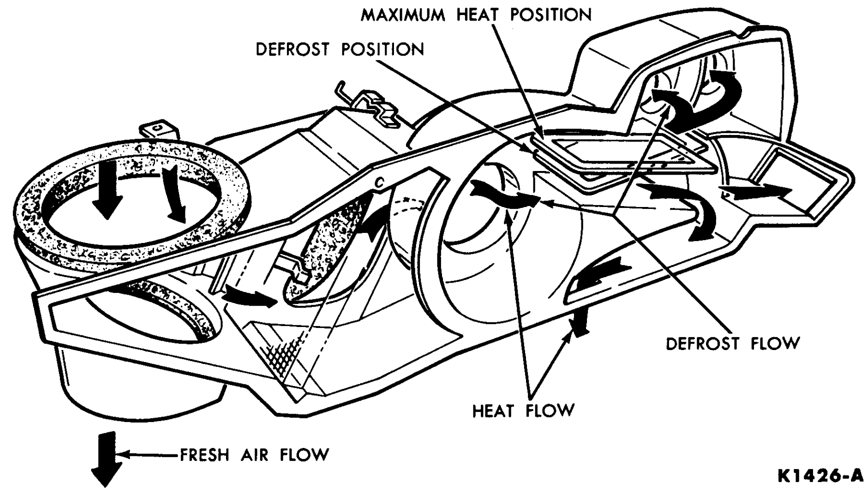

FIG. 2—Heater Air Distribution

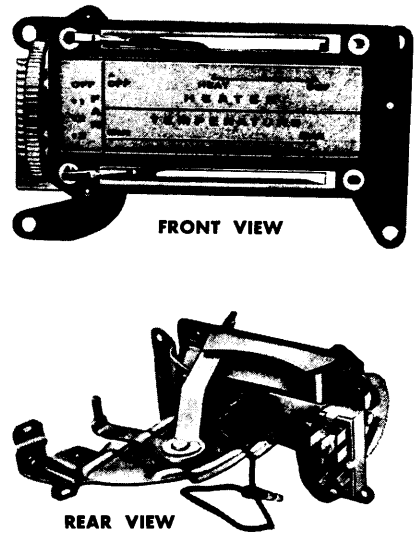

FIG. 3—Heater Control Assembly

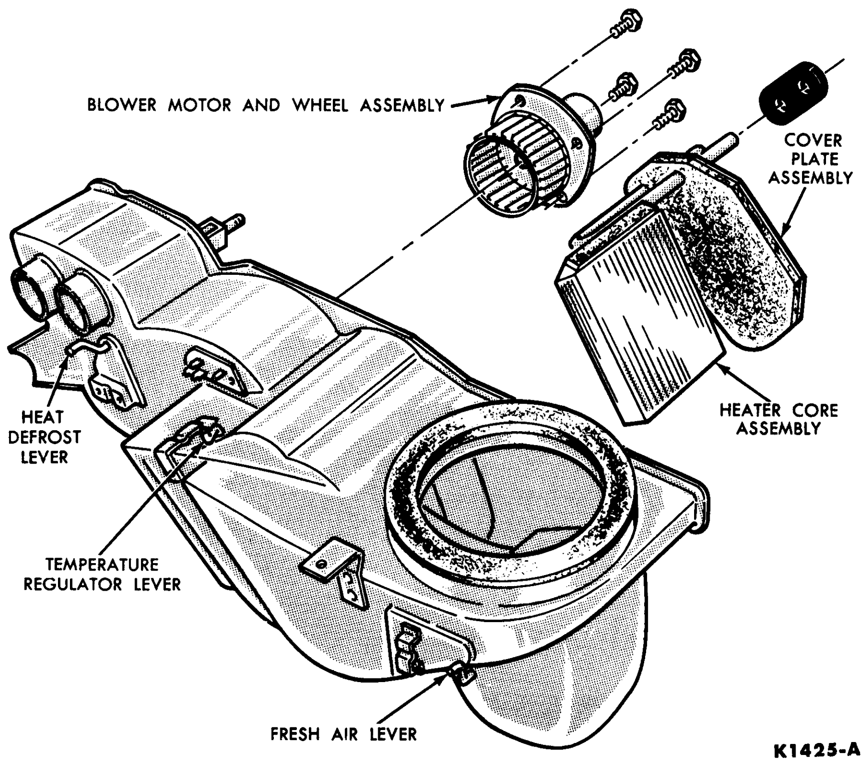

FIG. 4—Heater Components

ture regulator door within the heater assembly (Fig. 3).

With the control set on MIN, the temperature regulator door restricts air flow through the heater core.

With the control set on MAX, the door restricts air flow through the core by-pass chamber.

With the control set in any position between MIN and MAX, fresh cold air is mixed with heated air from the core, pulled in through the blower housing and discharged through the heater air outlets or defroster outlets.

The upper horizontal lever on the control assembly actuates the heat-defrost door in the heater plenum chamber and may be modulated between the two positions. With the lever in the OFF position, the door is closed (Fig. 4).

The blower motor is operated by a three-position toggle switch with a serrated vertical lever located to the left of the horizontal levers on the control asembly.

3 DIAGNOSIS AND TESTING

VENTILATING AND HEATING 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. Defective blower motor. 6. A kinked, clogged, or collapsed water hose. 7. Improperly connected heater hoses. 8. Plugged heater core. 9. Improperly installed engine thermostat. 10. Incorrectly installed and adjusted control cables on cable controlled heater. 11. Air leaks in the ventilation system.

CONTINUED ON NEXT PAGE

VENTILATING AND HEATING DIAGNOSIS GUIDE (Continued)

INSUFFICIENT OR NO DEFROSTING	1. Improperly adjusted defroster control cable or air duct doors. 2. Disconnected defroster hose. 3. Binding defroster door(s). 4. Plugged or loose defroster nozzle. 5. Obstructed defroster openings at windshield.
TOO MUCH HEAT	1. Improperly operating water control valve on valve controlled heater. 2. Malfunctioning thermostat.

TESTING

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

The following tests may be made on the heater: burned out fuses, loose wire connections, defective wires, collapsed hoses, loose defroster hoses and air leaks in the body may be determined by visual inspection of the parts.

HEATER CURRENT DRAW TEST

This test will determine if the blower motor is defective. Connect a 0-50 ammeter as shown in Fig 5. The blower motor will operate independently of the control switch, and the current drawn by the motor will be indicated on the ammeter. Current draw should be to specifications.

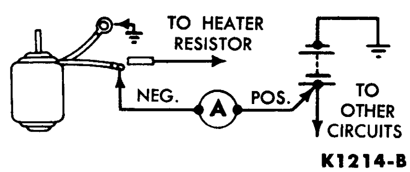

FIG. 5—Heater Motor Current Draw Test

LOOSE MOTOR FAN

Turn on the heater switch, and listen for the sound of the motor. If only a hum is heard, the fan is loose on the motor shaft.

BLOWER SWITCH

Substitute a known good blower switch for the suspected switch.

PLUGGED HEATER CORE

Start the engine and temporarily remove the outlet hose from the heater core (the hose that leads to the water pump). Very little or no flow of water from the core outlet indicates that the core is plugged. Make certain that water is being supplied to the core inlet.

4 COMMON ADJUSTMENTS AND REPAIRS—VENTILATING SYSTEM

RIGHT AND LEFT VENT CABLES

The right and left fresh air vent cables are adjusted at the control lever by removing the clock housing assembly, although they are not preset at the vent doors, and adjustment is possible at the vent doors.

Place each control lever in the forward position. Adjust the Bowden cables so that the vent doors are closed (maximum clockwise position of the right fresh air lever Fig. 4, and maximum counterclockwise position of the left fresh air lever).

REAR VENT SYSTEM

There is an adjustable valve in the vacuum supply line near the switch. To increase bleed-time (time for the vent to operate), turn the adjusting screw clockwise. To decrease bleed-time, turn the adjusting screw counterclockwise.

One-half turn changes the bleed time approximately five seconds. Normal bleed-time is 70 seconds, if the engine vacuum is cut off. The valve is delicate and only a minimum amount of adjustment is recommended.

5 COMMON ADJUSTMENTS AND REPAIRS—HEATING SYSTEM WITHOUT AIR CONDITIONING

The heat-defrost and temperature regulator Bowden cables are pre-set at the heater levers. Bowden cable adjustment can be made at the control head assembly through the access hole on the right side of the console.

HEAT-DEFROST DOOR

Place the heater control (upper lever Fig. 3) in the OFF position. Adjust the Bowden cable at the control head so that the heat-defrost lever (Fig. 4), is in the maximum counterclockwise position.

TEMPERATURE REGULATOR DOOR

Place the temperature control lever (Fig. 3), at the MAX position. Adjust the Bowden cable at the control head so that the temperature regulator lever (Fig. 4) is in the maximum counterclockwise position.

BLEEDING AIR FROM HEATER CORE

Remove the hose at the outlet connection of the heater core (hose that leads to the water pump). Allow any trapped air to flow out. When a continuous flow of coolant is obtained, connect the hose to the core.

HEATER HOSE REPLACEMENT

To replace a heater hose, drain the coolant, remove the hose, cut a new hose to the same length as the old hose, install the hose, and replace the coolant. **Make certain that the water hose connection to the block (or manifold) goes to the water valve and not the heater core. Also that the heater hoses can not come in contact with any part of the exhaust system.**

After the coolant has been replaced, bleed the air from the heater core.

6 REMOVAL AND INSTALLATION

HEATER ASSEMBLY—WITHOUT AIR CONDITIONING

REMOVAL

1. Partially drain the cooling system.

2. Disconnect the hoses from the heater core (Figs. 6 and 7).

3. Remove the lower instrument panel.

4. Remove the right hand trim panel from the console.

5. Disconnect the defroster hoses at the heater.

6. Disconnect the Bowden control cables from the heater control head and from the fresh air door on the heater. Disconnect the wiring.

7. From under the hood, remove the four nuts which hold the heater to the dash.

8. Remove the rear support screw near the fresh air intake.

9. Ease the heater to the floor of the car.

10. Remove the heater from the car. Do not allow coolant to drip on carpet or trim.

INSTALLATION

1. Position the heater assembly on the floor of the car.

2. Carefully position the heater assembly to the dash.

3. Install the rear support screw.

4. From under the hood, assemble the nuts to the four mounting studs which hold the heater to the dash.

5. Connect the Bowden control cables at the heater control head and at the fresh air door on the heater.

6. Adjust the control cables at the control head.

7. Connect the defroster hoses.

8. Install the right hand trim panel on the console.

9. Install the lower instrument panel.

10. Connect the heater hoses to the heater core.

11. Refill the cooling system, bleed the system at the upper heater core pipe connection, and add coolant to the correct level.

12. Check for leaks, and check the heater operation.

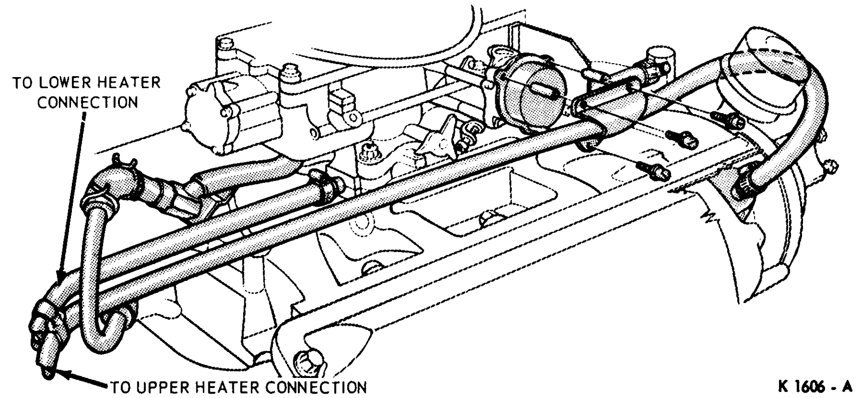

FIG. 6—Heater Hose Connections—Side View

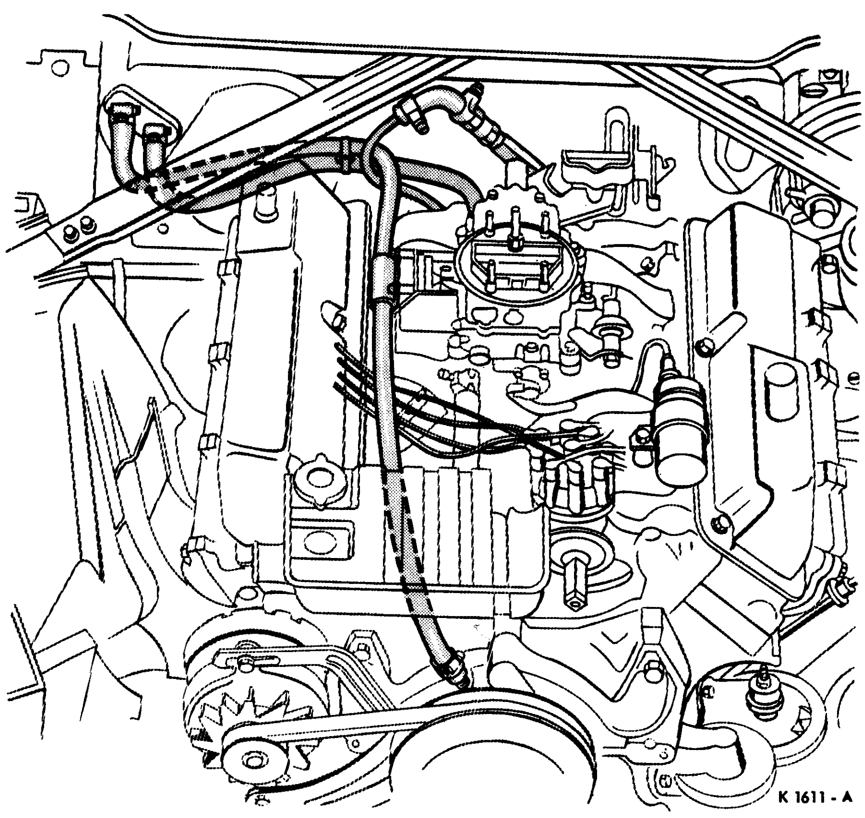

FIG. 7—Heater Hose Connections—Top View

HEATER CORE

Remove the heater assembly, the access plate, and the heater core. Install the core in the heater assembly, install the access plate, then install the heater assembly.

BLOWER MOTOR AND WHEEL ASSEMBLY

The blower motor and wheel assembly can be serviced from the engine compartment. Disconnect the wiring. Remove the mounting screws, then remove the blower motor and wheel assembly.

The blower motor resistor is located on the front face of the heater.

BLOWER SWITCH

Disconnect the battery ground cable, then remove the finish panel and the control panel. One screw mounts the switch to the control.

HEATER BLOWER RESISTOR

Remove the snap-off mouldings from the right side of the instrument panel, remove the right lower instrument panel, then from below, disconnect the resistor wire. Remove the resistor retaining screws and remove the resistor from the plenum chamber.

CONTROL ASSEMBLY

1. Remove the radio knobs and the control bezel.

2. Remove the heater control knobs.

3. Remove 6 retaining screws, disconnect the wires at the top switch and position the console finish panel to one side.

4. Remove 4 retaining screws and position the heater control panel out. Disconnect the lights and wires.

5. Remove the chrome moulding from the right side of the console. Remove 12 screws from the right side of the console. Remove the side panel.

6. Remove the screws retaining the heat-defroster and temperature Bowden cables. Remove the control assembly.

7. Position the new heater control assembly to the mounting area. Install the temperature and heat-defroster Bowden cables. Plug in the switch connector, light wire and ground.

8. Position the heater control assembly in the console and install the 4 retaining screws. Adjust both cables.

9. Install the console side panel with 12 retaining screws. Install the top chrome moulding on the console.

10. Install the side console moulding. Position the console finish panel, connect the top switch and install the 6 retaining screws.

PART 16-2 AIR CONDITIONING

1 DESCRIPTION AND OPERATION

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

The heater-air conditioner, a combined system, incorporates two control levers. The upper lever controls the air duct doors for fresh air, heated air defrosting, cooled recirculated air and cooled fresh air.

The cooled air can be either recirculated or fresh.

The bottom lever controls both heating and cooling temperatures. A blower switch gives three speeds for low, medium, and high volumes of air for heating, cooling, and defrosting (Fig. 1).

The components of the cooling system are shown in Fig. 2.

RECEIVER UNIT

The air cooling system stores the liquid Refrigerant-12 under pressure in a combination receiver and dehydrator (Fig. 2). The pressure in the receiver normally varies from about 80 to 300 psi, depending on the surrounding air temperature and compressor speed. The receiver and condenser comes charged and marked with the total weight, so that any leak, indicated by a loss in weight, can be detected before assembly.

The dehydrator serves the purpose of removing any traces of moisture that may have accumulated in the system. Even small amounts of moisture will cause an air cooling unit to malfunction. A fusible plug is screwed into the receiver. This will release the refrigerant before the refrigerant temperature exceeds 212° F.

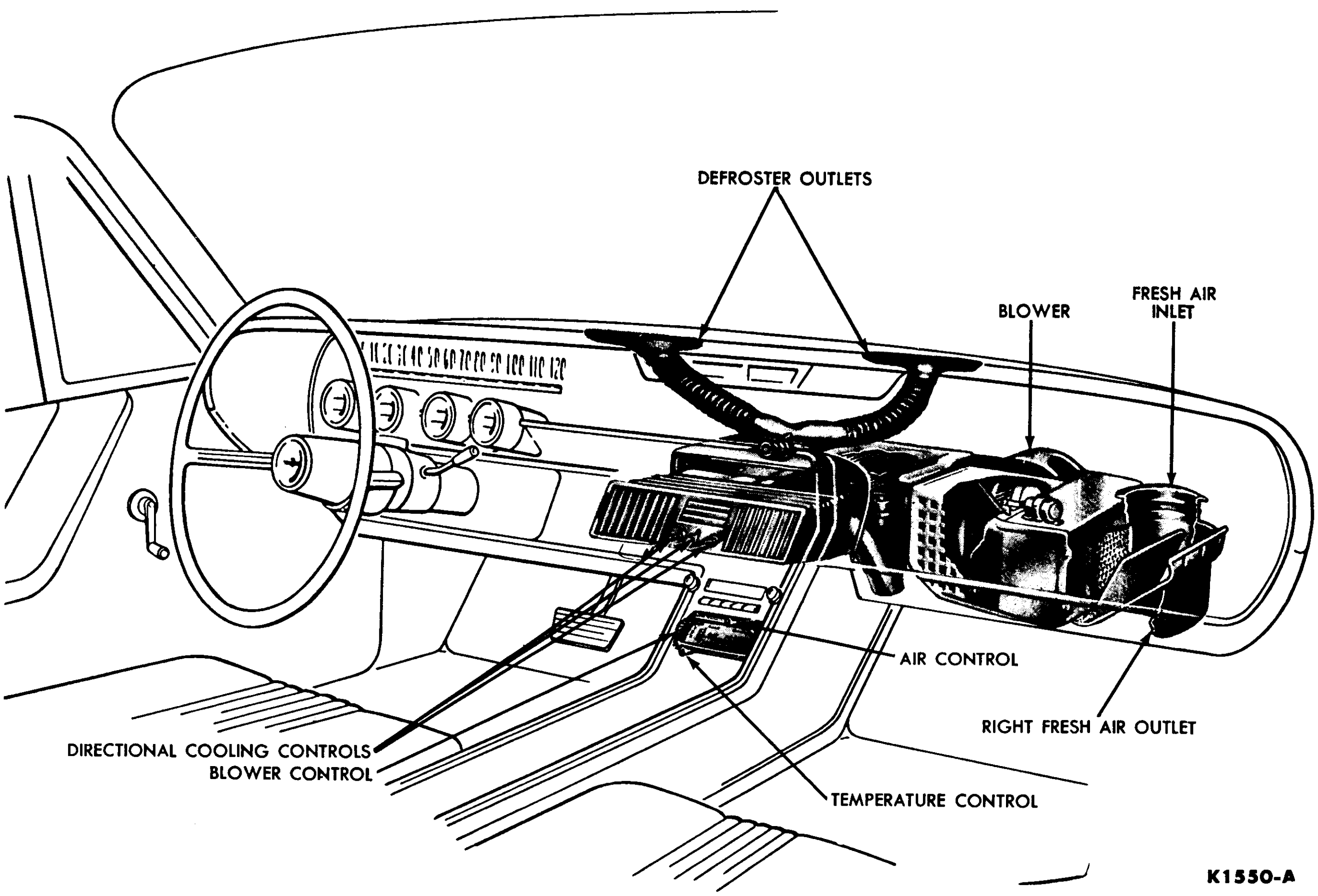

FIG. 1—Heating and Air Conditioning System

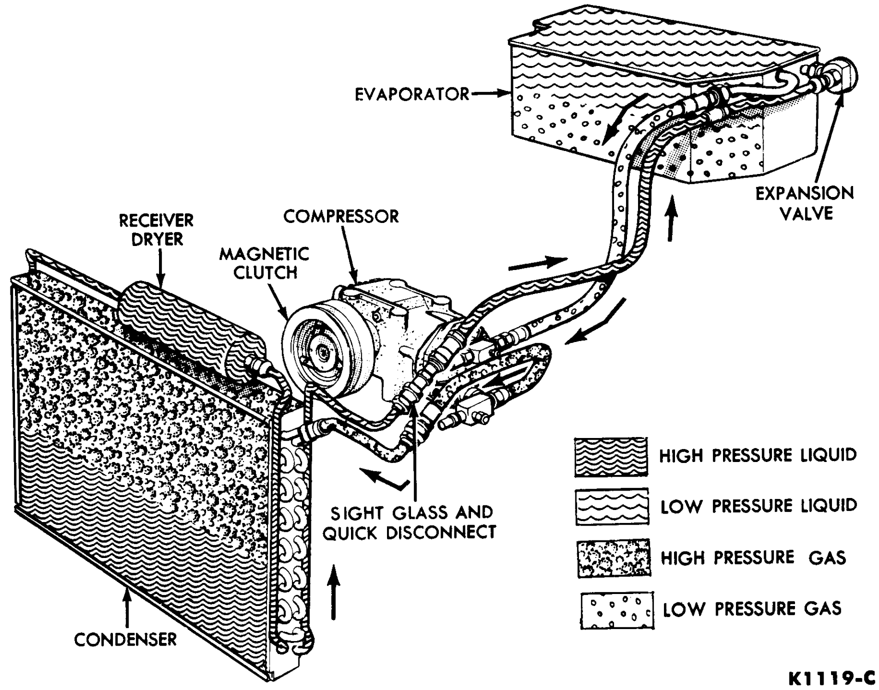

FIG. 2—Air Cooling System—Typical

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 (cooling unit) (Fig. 2), where it is allowed to evaporate at a reduced pressure. The evaporator assembly is mounted on the passenger compartment side of the dash.

EXPANSION VALVE

The rate of refrigerant evaporation is controlled by an expansion valve which allows only enough refrigerant to flow into the evaporator to keep the evaporator operating efficiently, depending on its heat load (Fig. 2).

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. An internal equalizer applies evaporator outlet pressure to one side of the valve diaphragm. Thus, the valve is controlled by both evaporator outlet temperature and outlet pressure.

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.

LIQUID SIGHT GLASS

A liquid sight glass is mounted in the high pressure refrigerant line near the left top corner of the radiator (Fig. 3). The sight glass is used to check whether or not there is enough liquid refrigerant in the system. Foam, seen in the sight glass while the compressor is operating, is an indication of loss of refrigerant. See Diagnosis and Testing.

COMPRESSOR UNIT

The evaporated refrigerant leaves the evaporator at a pressure of 12-50 psi and is pumped by the compressor, located on the engine (Fig. 2) into

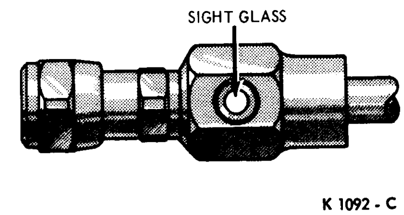

FIG. 3—Sight Glass

the top of the condenser, located in front of the radiator.

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, and the cooled, compressed refrigerant gas condenses to liquid refrigerant which flows into the receiver and then to the expansion valve.

SERVICE VALVES

The service valves on the compressor are used to test and service the cooling system (Fig. 4). 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.

MAGNETIC CLUTCH

It is necessary to control the amount of cooling that the system

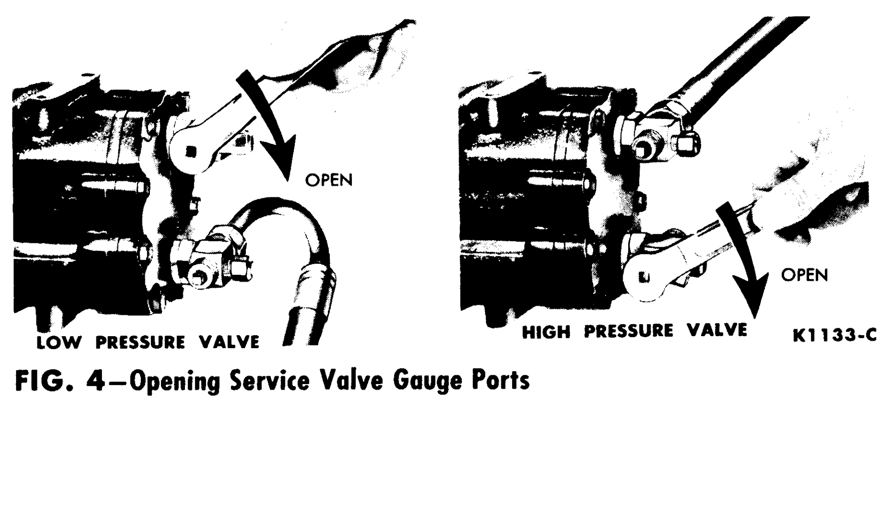

FIG. 4—Opening Service Valve Gauge Ports

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. 2). The magnetic clutch is controlled by a thermostatic switch which has its temperature sensing tube inserted in the fins of the evaporator core.

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 is in the off position, the magnetic clutch is not energized, and the cooling system can not operate.

When the ignition switch is on (engine running), and the cooling control is in the cooling range and the blower is operating, 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. (Fig. 5). The thermostatic switch operating differential temperature at any one setting is 6° F. The switch is controlled by the regulator control.

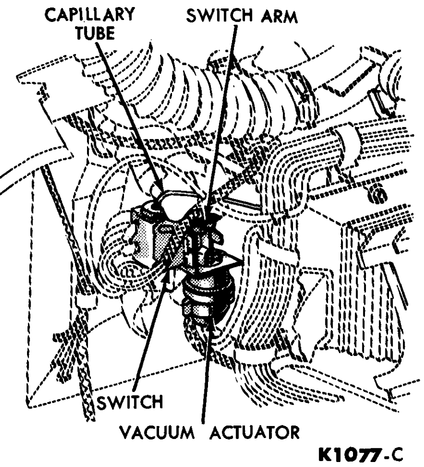

FIG. 5—Thermostatic Switch

2 DIAGNOSIS AND TESTING

AIR CONDITIONING DIAGNOSIS GUIDE

INSUFFICIENT OR NO COOLING	1. Inoperative magnetic clutch. 2. Inoperative blower motor, or switch. 3. Obstructed air passages. 4. Complete loss of charge. (No bubbles in sight glass at system start up.) 5. Partial loss of charge. (Continuous bubbles in sight glass after start up.) 6. Service valves improperly set. (Should be maximum counterclockwise). 7. Inoperative vacuum servo.	8. Compressor defective, or loose or broken compressor belt. 9. Vacuum lines kinked, clogged, loose, or off. 10. A/C thermostat defective. 11. Clutch lead disconnected or broken. 12. Expansion valve inoperative —stays open or closed. 13. Plugs left in compressor under service valve (both gauges indicate the same pressure). 14. Moisture in system.
NOISY COMPRESSOR	1. Loose, torn, or misaligned belt. 2. Loose clutch.	3. Foreign material or damaged parts in compressor. 4. Compressor loose on bracket.
COMPRESSOR VIBRATION	1. Broken or loose mounting bracket, or compressor brace.	2. Loose clutch. 3. Loose belt.

TESTING

Obstructed air passages, broken belts, disconnected or broken wires, loose clutch, loose or broken mounting brackets may be determined by visual inspection of the parts.

CHECKING VACUUM SYSTEM

Use the following procedure to check for malfunction of the heater-air conditioner vacuum system. The procedure will determine if there are leaks, pinched lines or lines not connected.

1. Insert a vacuum gauge in the vacuum supply line (black line) near the dash connector block (Fig. 6). This should be done in the engine compartment.

2. Set the bottom or temperature regulator lever at the MAX position. Set the top or selector lever at the OFF position.

3. Start the engine and run it until at least 16 inches of vacuum is obtained. Stop the engine.

4. Record the vacuum reading. If this reading decreases steadily, there is a leak in the check valve or the vacuum system from the check valve to the selector control (Fig. 6).

5. Move the selector control lever to the positions shown in Table 1 and observe the drop in vacuum on the gauge. Repeat steps 3 and 4 between each lever movement to bring the vacuum back to 16 inches.

6. If any vacuum drop is less than indicated, check for pinched lines, plugged lines, plugged fittings, or partial cycle due to a binding door. If any vacuum is greater than that in-

dicated, check for leaks, lines not connected, or defective components.

If a single vacuum actuator is malfunctioning, check the vacuum at the actuator vacuum line (Table 2). If the vacuum is within limits, the actuator is defective or the door is binding.

TABLE 1—Vacuum Drop vs. Selector Lever Position

Selector Lever Movement	Vacuum Drop Inches of Mercury
DEFROST to HEAT	0.25-2.5
HEAT to OFF	2.5-5.5
FRESH to REC	0.25-2.5

TABLE 2—Heater-Air Conditioner Vacuum Line Installation

Selector Lever Position	Vacuum Line Color Code	Vacuum Applied	Function and Air Door Position
REC	White	Yes	Rec Air Door Open*
	Tan	Yes	Heat Door Closed
	Blue	Yes	Evaporator Shutters Open
	Red	Yes	Defrost Door Closed
	Brown	No	Heat Temperature Control
	Yellow	Regulated	AC Thermostatic Switch
FRESH	White	No	Rec Air Door Closed
	Tan	Yes	Heat Door Closed
	Blue	Yes	Evaporator Shutters Open
	Red	Yes	Defrost Door Closed
	Brown	No	Heat Temperature Control
	Yellow	Regulated	AC Thermostatic Switch
OFF	White	Yes	Rec Air Door Open
	Tan	Yes	Heat Door Closed
	Blue	Yes	Evaporator Shutters Open
	Red	Yes	Defrost Door Closed
	Brown	No	Heat Temperature Control
	Yellow	No	AC Thermostatic Switch
HEAT	White	No	Rec Air Door Closed
	Tan	No	Heat Door Open
	Blue	No	Evaporator Shutters Closed
	Red	Yes	Defrost Door Closed
	Brown	Regulated	Heat Temperature Control
	Yellow	No	AC Thermostatic Switch
HEAT DEFROST	White	No	Rec Air Door Closed
	Tan	No	Heat Door Open
	Blue	No	Evaporator Shutters Closed
	Red	No	Defrost Door Open
	Brown	Regulated	Heat Temperature Control
	Yellow	No	AC Thermostatic Switch
DEFROST	White	No	Rec Air Door Closed
	Tan	Yes	Heat Door Closed
	Blue	No	Evaporator Shutters Closed
	Red	No	Defrost Door Open
	Brown	Regulated	Heat Temperature Control
	Yellow	No	AC Thermostatic Switch

*The Recirculating Air Door is a dual function door. When open to recirculated air, it is closed to fresh air, and vice versa.

CHECKING FOR LEAKS

Attach the manifold gauge set (Fig. 7). Leave both manifold gauge valves at the maximum clockwise position. 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. 8). 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 color to the flame. Be sure to check the manifold gauge set and hoses for leaks as well as the rest of the system.

If the surrounding air is contaminated with refrigerant gas, the leak detector will indicate this gas all the time. Good ventilation is necesary to prevent this situation. A fan, even in a well ventilated area, is very helpful in removing small traces of refrigerant vapor.

USE OF SIGHT GLASS

When observing the sight glass for foam, run the engine at 1500 rpm with the thermostatic switch control lever 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.

No foam in the sight glass will indicate either a full charge or a complete loss of refrigerant. Clean the sight glass. If the system is fully charged, the sight glass will be perfectly clear. If the system is completely empty of refrigerant, the sight glass will look oily and will not be as clear as when refrigerant is flowing through it.

When the compressor is not oper-

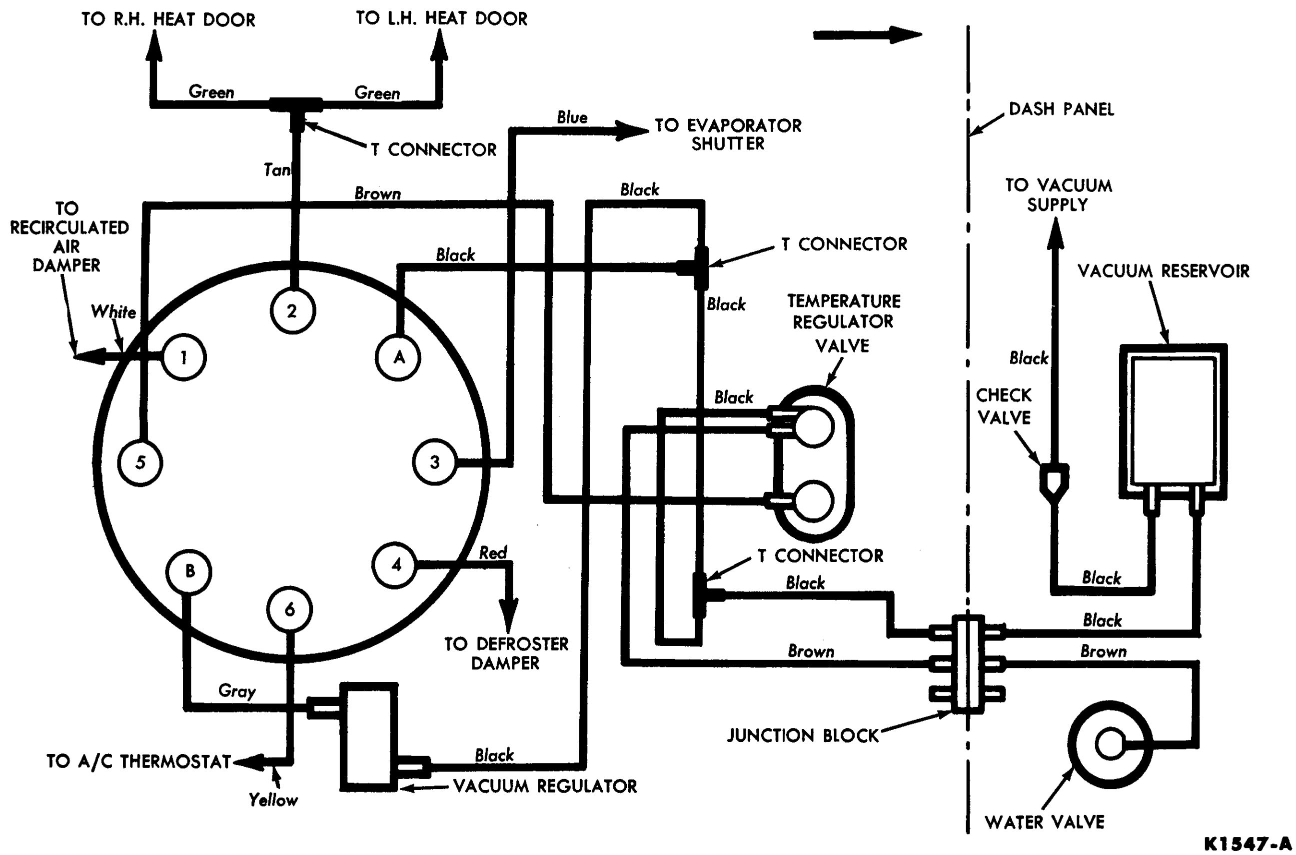

FIG. 6—Heater-Air Conditioner Vacuum Line Connections

ating and when the system is completely charged, an occasional large bubble of Refrigerant-12 vapor will normally be seen in the sight glass.

Under conditions of extremely high temperatures occasional foam or bubbles may appear.

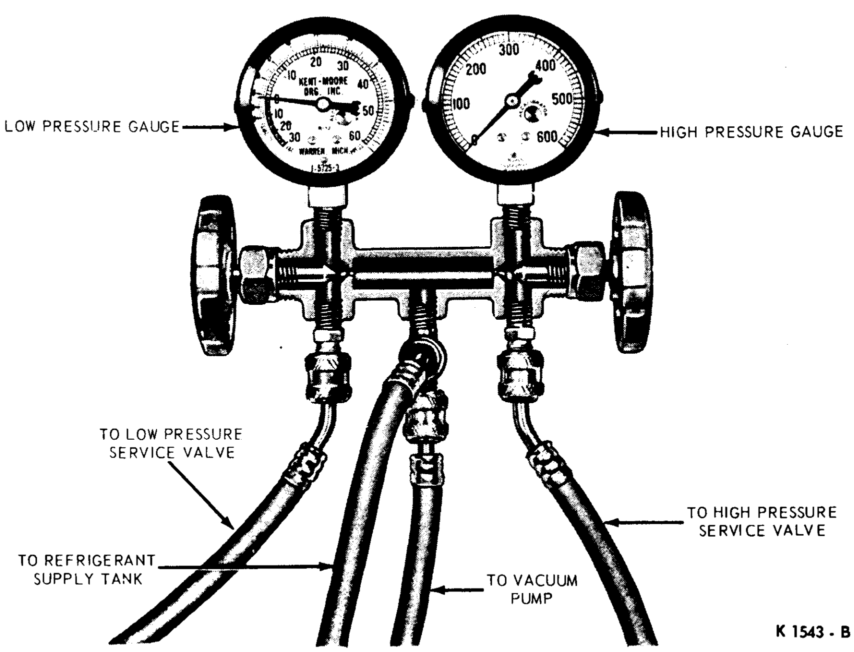

FIG. 7—Manifold Gauge Set

CHECKING SYSTEM PRESSURES

The pressures developed on the high pressure and low pressure side of the compressor indicate whether

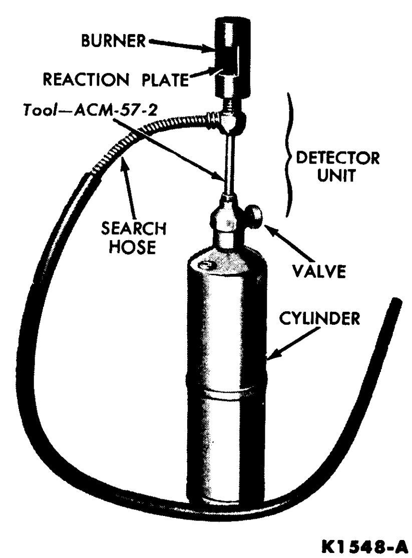

FIG. 8—Flame Type Leak Detector

or not the system is operating properly.

Attach the manifold gauge set. 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. 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 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. The lowest figures given are for an ambient (surrounding air) temperature of 75° F., 50% relative humidity.

The low pressure gauge should indicate a pressure of from 12-50 pounds. The high pressure gauge should indicate a pressure of 6 or 7 times the low pressure or 80-300 pounds.

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.

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 receiver dryer 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 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. Repair 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 ½ pound of refrigerant.

THERMOSTATIC SWITCH TEST

The switch must be removed for this test. Move the switch arm to the coldest temperature setting by holding the arm against the stop nearest to the vacuum actuator. At room temperature the switch should be closed. Use a self powered test light or an ohmmeter connected to the switch leads to check whether or not the switch is closed. Release the switch arm. The switch should be open.

WATER TEMPERATURE VALVE

1. Set the temperature control lever at the MIN position, and start the engine.
2. Remove the vacuum hose from the water temperature valve and attach a vacuum gauge to the hose. It should show no vacuum.
3. Move the temperature control lever to the MAX position. The vacuum gauge should immediately show at least 15 inches of vacuum. If it shows no vacuum, the trouble is in the control head, the thermostat or the connecting hoses.
4. If it shows vacuum, return the temperature control lever to the MIN position and allow the engine to warm up to operating temperature.
5. When the engine reaches operating temperature, check the hose at the bottom of the water temperature valve and at the top connection of the heater core. These two hoses should not be hot. If they are hot it indicates a leak in the water temperature valve which will cause the car to be hotter than normal during warm or hot weather. Replace the water temperature valve.
6. If the two hoses were not hot, move the temperature control lever to the MAX position. In two or three minutes the two hoses should be hot. If they are not, the water temperature valve is defective and should be replaced.

MAGNETIC CLUTCH

Disconnect the magnetic clutch wire at the bullet connector, and connect it to the negative lead of an ammeter. Connect the positive lead of the ammeter to the battery positive terminal. The magnetic clutch should pull it in with a distinct click and the current reading on the ammeter should be to specification.

BLOWER MOTOR

Disconnect the blower motor wire at the bullet connector, and connect it to the negative lead of an ammeter. Connect the positive lead of the ammeter to the battery positive terminal. The motor should operate and the reading on the ammeter should be to specification.

EXPANSION VALVE

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.

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 set the cooling control to the OFF position. 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. 9). Start the engine. Engage the magnetic clutch for 15 second intervals, by moving the cooling control from the OFF position to the maximum cooling position, 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.**

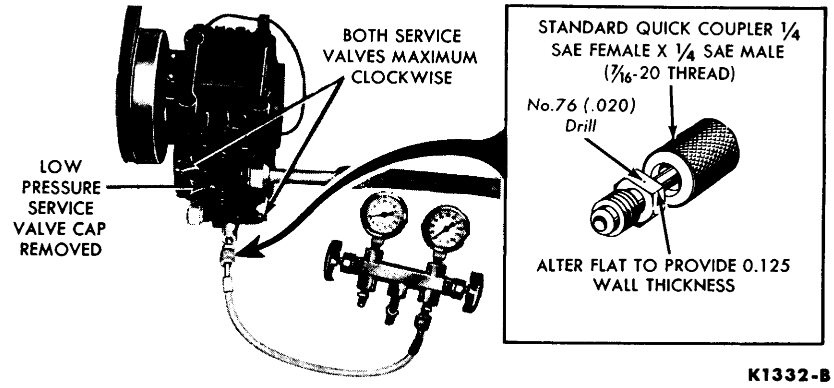

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FIG. 9—Volumetric Efficiency Test

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.

3 COMMON ADJUSTMENTS AND REPAIRS

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 as 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.**

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 not 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.

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. 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. 4) 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.

EVACUATING THE SYSTEM

Attach the manifold gauge set, a tank of Refrigerant-12 and a vacuum pump to the system. Make certain that the Refrigerant-12 tank valve is tightly closed. Set both service valves to the mid-position. Open both manifold valves. 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.

CHARGING THE SYSTEM

MAKING A PARTIAL CHARGE

Attach the manifold gauge set. Open both manifold valves. 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 (Fig. 10).

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, then add ½ pound of Refrigerant-12. Shut the Refrigerant-12 tank valve.

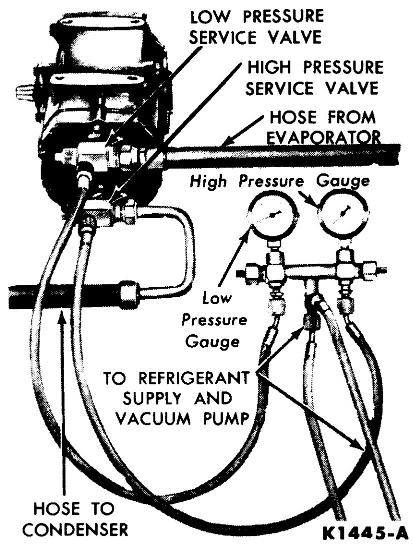

FIG. 10—Charging the Air Conditioning System

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. Remove the gauge set, and cap the service valve gauge ports and valve stems.

MAKING A COMPLETE CHARGE

Check for leaks first (see Diagnosis and Testing), 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. Set the high pressure manifold gauge valve at the maximum clockwise or closed position. Set all controls to the maximum cold position.

Open the Refrigerant-12 tank valve. Run the engine at 1500 rpm. Charge the system until 2½ pounds of refrigerant have been weighed into it. 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. Remove the gauge set, and cap the service valve gauge ports and valve stems.

CHARGING FROM SMALL CONTAINERS

Refrigerant-12 is available in 1 pound cans. A scale is not necessary if these small containers are used instead of a tank.

Attach the hose, that would normally go to the large tank 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 1 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.

Allow only ½ of the third can of refrigerant to be pumped into the system by closing the valve at the can when the frost line has reached ½ way down the can. The system will then have been charged with 2½ pounds of refrigerant.

Check the system pressure, and set both service valves at the maximum counterclockwise position. Remove the gauge set, and cap the service valve gauge ports and valve stems.

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

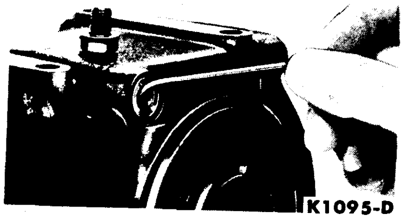

FIG. 11—Oil Level Check

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 temperature or above. Turn off the engine, and isolate the compressor. Remove the oil filler plug from the compressor (Fig. 11) and insert a flattened ⅛-inch diameter rod in the oil filler hole until it bottoms. The rod should show ⅞ inch of oil. This is equivalent to 11 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 or Capella E refrigerator compressor oil, or equivalent.

If more than ⅞ 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.

ISOLATING THE COMPRESSOR

This procedure is used when checking the compressor oil level and when it is desired to replace the compressor without losing the refrigerant charge.

To isolate the compressor from the system, turn both the high and the low pressure service valves to the extreme clockwise position. 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 position, and cap the high pressure service valve gauge port and service valve stems.

VACUUM ACTUATORS

The vacuum actuators are adjustable for proper air door operation.

The single acting actuators are adjusted so that the actuator return springs are preloaded for about ⅛ inch travel of the actuator connecting link with no vacuum applied. Perform the adjustment as follows:

1. Loosen the vacuum actuator attaching screws or nuts.
2. Move the actuator until the preload indicator is flush with the motor body. (The air door must be in its normal position with no vacuum applied.)
3. Tighten the bracket attaching screws or nuts and check the operation of the door.

THERMOSTATIC SWITCH VACUUM ACTUATOR

The factory sealed setting of this vacuum actuator should not be disturbed.

4 REMOVAL AND INSTALLATION

HEATER TEMPERATURE CONTROL VALVE—WITH AIR CONDITIONING

REMOVAL

1. Remove the blower motor.
2. Through the blower motor opening reaching up and slightly outboard, remove the two screws retaining the temperature control valve to the top of the plenum chamber.
3. Lift the valve out through the opening and remove the three vacuum hoses. (Identify the hoses for proper assembly.)

INSTALLATION

1. Connect the three vacuum hoses to the new valve (Fig. 12), position the valve to the plenum chamber and install the two retaining screws.
2. Install the heater blower motor.

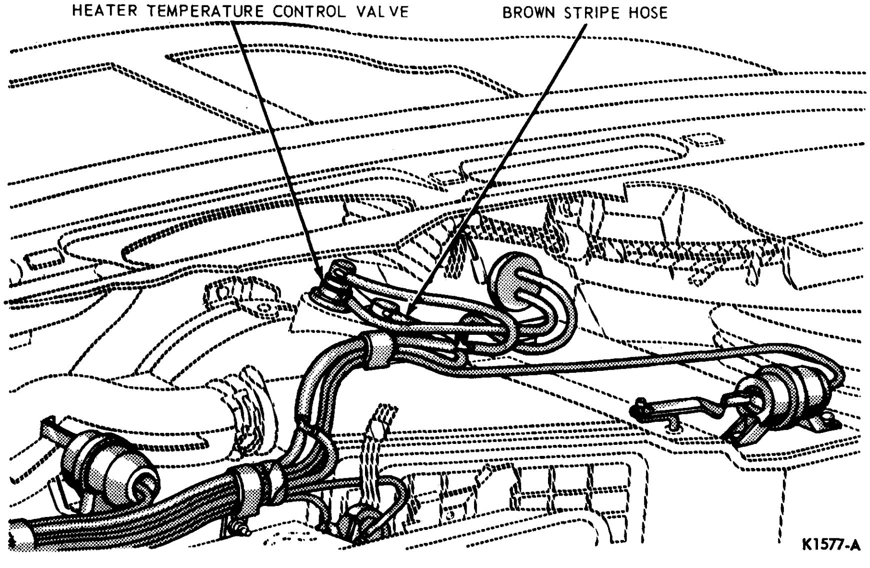

FIG. 12—Temperature Control Valve Mounting

REAR VENT CONTROL SWITCH

Remove the finish panel and the two mounting nuts. Then disconnect and remove the switch.

EVAPORATOR CORE

REMOVAL

1. Remove the instrument panel from the car (Group 18).
2. Drain the coolant, remove the air cleaner, and disconnect the heater hoses at the heater.

3. Remove the retaining screws and the vacuum reservoir tank at the dash panel.

4. Disconnect the blower motor lead, and the vacuum line at the water valve. Remove the blower motor vent tubes.

5. Remove the blower motor cover plates and the gasket.

6. Remove the nuts retaining the evaporator to the dash.

7. Remove the hose cover plates and the grommet at the dash.

8. Make sure that there is no refrigerant in the system, then disconnect the low pressure hose at the compressor and the high pressure hose at the condenser.

9. Remove the clamp retaining the hoses to the dash brace.

10. Disconnect the right air intake boot and the cable.

11. Disconnect the wires at the thermostatic switch and remove the bolt retaining the wiring harness to the evaporator case, and disconnect the vacuum hoses.

12. Loosen the column support at the floor and position it out of the way.

13. Remove the retaining screws and position the door lock control valve out of the way.

14. Remove the screws retaining the heater and air conditioner control assembly to the console. Disconnect the four quick disconnects and remove the console.

15. Disconnect the four quick disconnects at the control assembly.

16. Remove the evaporator assembly with the heater control, feeding the hoses through dash.

17. Remove the insulation from the hose ends and the expansion valve.

18. Disconnect the evaporator-to-compressor hose.

19. Remove the sensing bulb screw and clip, the expansion valve and the hose from the core.

20. Remove the screws retaining the evaporator top cover. Disconnect the vacuum hose, pull upward carefully on the sensing tube and remove the top cover.

21. Remove the retaining screws and remove the evaporator core from the case.

INSTALLATION

1. Position the evaporator core in the case and install the retaining screws.

2. Position the evaporator top cover, feeding the sensing tube in the core fins, and install the retaining screws. Connect the vacuum hose.

3. Install the high pressure hose with the expansion valve to the evaporator.

4. Position the sensing bulb to the core, and install the clamp and the retaining screw.

5. Install the low pressure hose to the evaporator.

6. Apply insulation to the expansion valve and to the hose ends.

7. Feed the evaporator hoses thru the dash panel and position the evaporator assembly in the car.

8. Position the evaporator assembly to the dash, and install the retaining nuts.

9. Connect the vacuum hoses at the temperature valve.

10. Position the blower motor cover plates and seal, then install the retaining screws.

11. Connect the blower motor lead wire and install the blower motor vent tube.

12. Connect the vacuum hose to the water valve. Connect the heater hoses at the heater.

13. Position the vacuum reservoir tank at the dash above the heater motor and install the mounting screws.

14. Position the air conditioner hose cover plates and grommet at the dash and install the retaining screws.

15. Fasten the evaporator hoses to the dash support bracket.

16. Connect the low pressure hose to the compressor. Connect the high pressure hose at the sight glass, and connect the wires to the thermostatic switch.

17. Connect the right air vent boot and cable.

18. Position the door lock valve, and install the retaining screws.

19. Connect the heater blower motor connector.

20. Leak test, evacuate and charge the system. Check the air conditioner operation.

21. Install the instrument panel in the car (Group 18).

COMPRESSOR

REMOVAL

1. Loosen the idler pulley and remove the drive belt.

2. Isolate the compressor (See Common Adjustments and Repairs in this Part) and disconnect the two service valves and hoses from the compressor (Fig. 13). Energize the clutch and loosen and remove the clutch mounting bolt.

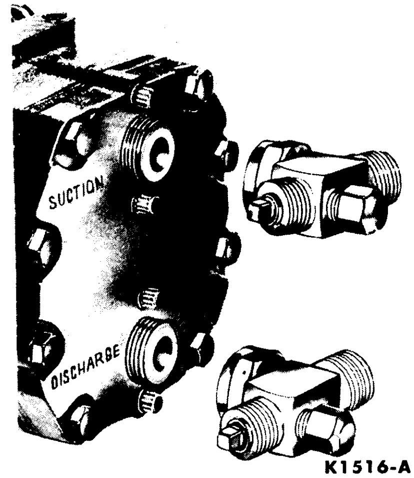

FIG. 13—Compressor—Service Valves Removed

3. Install a ⅝-11 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.

4. Remove the clutch, and then remove the mounting bolts and the compressor.

5. With the compressor on the work bench, remove the key from the shaft.

INSTALLATION

Before installing the compressor, see Cleaning and Inspection in this part.

1. 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, and tighten to specification. Do not exceed the torque specification as misalignment can result.

2. Connect the clutch wire, energize the clutch and torque the clutch mounting bolt to specification. **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 idler pulley.

3. Install the service valves on the compressor using new Teflon seals (Fig. 13). Tighten the service valve flared nuts to specification. **Do not over tighten the flared nuts. The new ROTO-LOK service valves can be rotated slightly on their**

seat without breaking the high pressure seal. This is not an indication of a loose valve. Leak test the compressor, then evacuate it and connect it back into the system.

4. Check the oil level in the compressor and add or remove oil if necessary. (See Cleaning and Inspection in this part.)

COMPRESSOR COMPONENTS

All compressor removal and installation operations, except belt replacement, can be performed only after the unit has been isolated from the rest of the system. (See Common Adjustments and Repairs in this part.)

VALVE PLATE

REMOVAL

1. Isolate the compressor and disconnect the service valves. Remove the 12 head bolts.
2. Remove the cylinder head and valve plate from the top of the compressor body (Fig. 14). Do not tap or hit the head with any hard tool, as damage could result.
3. 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
4. If the cylinders and pistons are in good condition, check the valve plate and valve reeds for damage. If the valve 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 reeds, and the two gaskets (Fig. 14).
5. When the valve plate assembly is re-used, wash it in clean solvent and dry in dry air. Check the oil for dirt. If the system is not clean, replace the oil with new oil, flush out all foreign material from the system.

INSTALLATION

1. Starting with the valve plate gasket, assemble the parts in the order shown in Fig. 14. Insert the cylinder head bolts carefully to avoid damaging the gaskets. Before assembly apply a film of new refrigeration oil to both sides of both gaskets.
2. Tighten all bolts finger tight, then torque the bolts 1/4 turn at a time to specification. Tighten the bolts in a sequence so those diagonally opposite are evenly drawn to the required torque.
3. Connect the compressor into the system. Check the oil level in the compressor, and add or remove oil if necessary. (See Cleaning and Inspection in this part.)

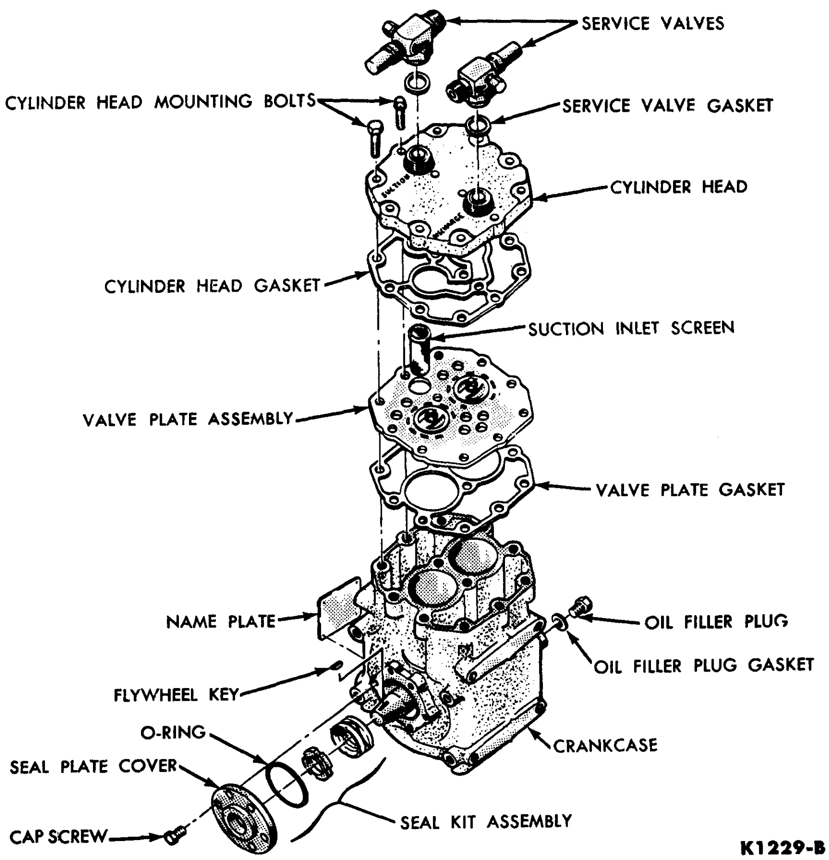

FIG. 14—Tecumseh Cylinder Head and Valve Assembly

CRANKSHAFT SEAL

REMOVAL

1. Isolate the compressor, loosen and remove the belt.
2. Remove the clutch and the Woodruff key.
3. Carefully remove all accumulated dirt and foreign material from the seal plate and surrounding area of the compressor, and position a small drain pan beneath the seal plate.
4. Remove the seal plate bolts, plate and gasket. Do not mar the sealing surfaces or the polished shaft surface.
5. Remove the carbon seal ring and seal housing assembly from the crankshaft. A disassembled view of the crankshaft seal assembly is included in Fig. 14.
6. Clean all old gasket material from the seal plate and the compressor. Make certain that the shaft, the seal plate and the compressor gasket surfaces are completely clean before installing the new seal.

INSTALLATION

1. Lubricate the new shaft seal parts in clean compressor oil, and position the seal assembly on the crankshaft, with the carbon ring toward the seal plate.
2. Position the new gasket on the compressor and install the seal plate.
3. Torque the bolts to specification.
4. Make certain that there are no burrs or dirt on the compressor shaft. Then install the key, the belt, and the clutch.
5. Install and adjust the belt.
6. Check the oil level (see Common Adjustments and Repairs).

EXPANSION VALVE

REMOVAL

1. Discharge the air conditioning system.
2. Remove the instrument panel from the car (Group 18).
3. Drain the coolant, remove the air cleaner, and disconnect the heater hoses at the heater.
4. Remove the heater hose retain-

ing clamp at the heater motor and position it to one side.

5. Disconnect the blower motor lead, and the vacuum line at the water valve. Remove the blower motor vent tubes.

6. Remove the blower motor cover plates and the gasket.

7. Remove the nuts retaining the evaporator to the dash.

8. Remove the hose cover plates and the grommet at the dash.

9. Disconnect the low pressure hose at the compressor and the high pressure hose at the condenser.

10. Remove the clamp retaining the hoses to the dash brace.

11. Disconnect the right air intake boot and the cable.

12. Disconnect the wires at the thermostatic switch and remove the bolt retaining the wiring harness to the evaporator case, and disconnect the vacuum hoses.

13. Disconnect one vacuum hose and two connectors at the control switch assembly.

14. Position the evaporator assembly back from the dash.

15. Remove the insulation from the hose ends and the expansion valve.

16. Remove the sensing bulb screw and clip. Remove the hose from the expansion valve and remove the expansion valve from the core.

INSTALLATION

1. Install the new expansion valve on the core fitting, and install the hose to the expansion valve.

2. Position the sensing bulb to the core. Install the clamp and the retaining screw.

3. Apply insulation to the expansion valve and hose ends.

4. Position the evaporator assembly to the dash, and install the retaining nuts.

5. Connect the vacuum hoses at the temperature valve.

6. Position the blower motor cover plates and seal, then install the retaining screw.

7. Connect the blower motor lead wire and install the blower motor vent tube.

8. Connect the vacuum hose to the water valve. Connect the heater hoses at the heater.

9. Position the air conditioner hose cover plates and grommet at the dash and install the retaining screws.

10. Fasten the evaporator hoses to the dash support bracket.

11. Connect the low pressure hose to the compressor. Connect the high pressure hose at the sight glass, and connect the wires to the thermostatic switch.

12. Connect the right air vent boot and cable.

13. Leak test, evacuate and charge the system. Check the air conditioner operation.

14. Install the instrument panel in the car (Group 18).

THERMOSTATIC SWITCH

REMOVAL

1. Remove the battery ground cable.

2. Remove the left front seat.

3. At the left side of the evaporator remove the retaining nuts, the wires and the vacuum hose from the thermostatic switch.

4. Remove the retaining nuts, radio knobs and the bezel.

5. Remove the retaining screws, the headlight switch control knob and bezel nut, then remove the center finish panel.

6. Remove the retaining screws and remove the evaporator register.

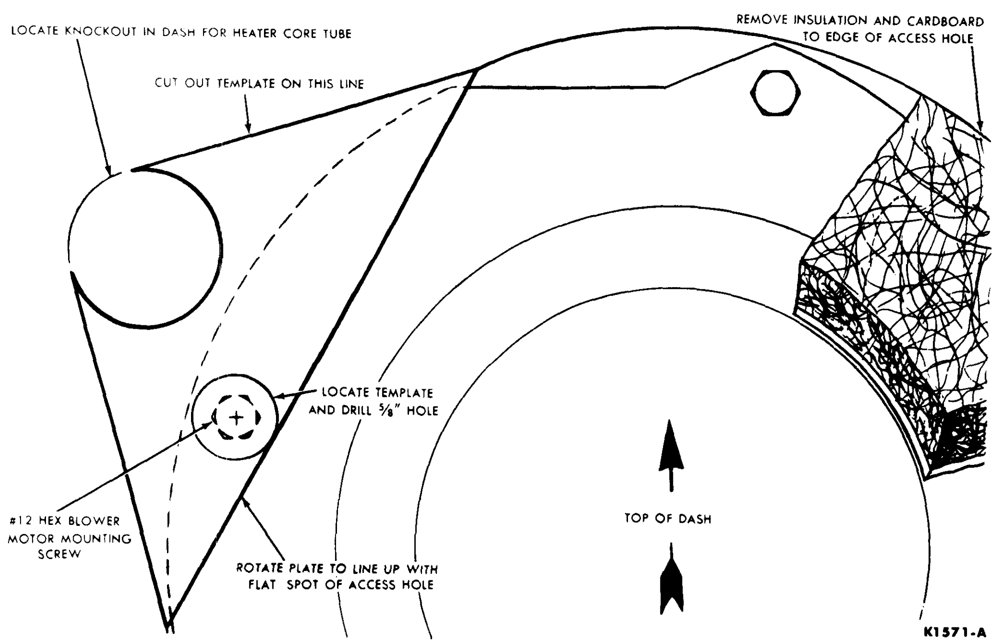

FIG. 15—Air Conditioner Blower Motor Accessibility

7. Draw the capillary tube carefully from the evaporator core and outward to the left of the evaporator case, then remove the thermostatic switch.

INSTALLATION

1. **Carefully** feed the capillary tube back through from the left side of the evaporator case.
2. Position the thermostatic switch and install the retaining nuts.
3. Connect the wires and install the vacuum hose.
4. **Carefully** insert the bulb end of the capillary tube into the center area of the evaporator core, **making certain to insert it one or two fins over from where it was originally withdrawn.** This assures the best contact and transfer of temperature changes.
5. Position the register and install the retaining screws.
6. Position the center finish panel, install the retaining screws, the light switch bezel nut, and the control knob.
7. Position the radio bezel, and install the retaining nuts and the knobs.
8. Install the left front seat.
9. Install the battery ground cable.
10. Check the operation of the thermostatic switch.

BLOWER MOTOR AND WHEEL

REMOVAL

1. Disconnect the battery ground cable.
2. Disconnect the motor wires.
3. Remove five screws and remove the cover and seal.
4. Remove (cut) the insulation from around the motor (Fig. 15).
5. Using a template (Fig. 15) drill one ⅝ inch hole to gain access to one screw which retains the motor and plate to the heater-air conditioner assembly. (Ninety degree drill motor required for this.)
6. Remove the four screws retaining the motor to the heater-air conditioner assembly.
7. Rotate and remove the blower motor.
8. Loosen the set screw and remove the blower wheel.
9. Remove the two nuts, and remove the mounting plate.

INSTALLATION

1. Position the motor mounting plate to the motor and install the two retaining nuts.
2. Position the blower wheel on the motor shaft and tighten the set screw.
3. Cement a new gasket on the motor plate.
4. Position the blower motor to the heater-air conditioner assembly.
5. Install the four screws which retain the blower motor to the heater-air conditioner assembly.
6. Position the seal and cover and install the five retaining screws.
7. Connect the wiring.
8. Connect the battery ground cable.

BELT

1. Loosen the idler pulley and remove the belt.
2. Place the new belt in position, and adjust the tension to specification, then tighten the idler pulley.

CLUTCH

1. Loosen the idler pulley and remove the belt, energize the clutch and loosen and remove the clutch mounting bolt.
2. Install a ⅝-11 bolt in the clutch drive shaft hole. With the clutch still energized, tighten the bolt to loosen the clutch from the shaft, then remove the magnetic clutch.
3. Install the clutch, the clutch mounting bolt, and the washer.
4. Energize the clutch, and torque the bolt to specification.
5. Place the new belt in position and adjust the tension to specification, then tighten the idler pulley.

5 CLEANING AND INSPECTION

On compressor clutch installations, carefully remove any burrs or dirt that may be on the compressor shaft. The shaft must be dry and brightly polished. Then install the key in the shaft.

When the compressor is disassembled, completely clean all surfaces of gasket shreds and foreign objects.

If the compressor shaft seal is being replaced, inspect the compressor internally and clean out dirt or chips as required.

When installing a new control assembly or parts, inspect for dirt and foreign objects. Also check for cleanliness of the hoses and see that they are not pinched, or cracked.

PART 16-3 SPEED CONTROL

1 DESCRIPTION AND OPERATION

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

The speed control automatically holds the car speed at any selected setting. It has an operating range of approximately 25 mph to 80 mph. It operates effectively on hills as well as on the level.

When the speed control switch button in the control head on the console is pulled to energize the control, it is held in this position magnetically. It will return to the OFF position only if pushed in manually, or if the ignition is turned off. The large speed adjusting wheel control, also located at the control head, should be turned to the extreme forward position. This provides a controlled speed of approximately 25 mph.

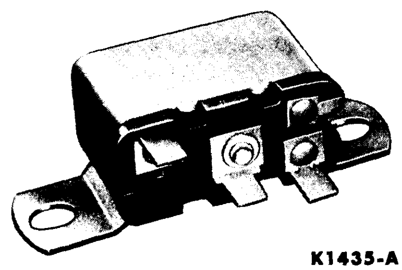

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FIG. 1–Engagement Relay

When the car is accelerated to slightly over the speed setting, a click will he heard at the engagement relay (Fig. 1).

When the foot is removed from the accelerator the car will go on automatic speed control. The large speed adjusting wheel control also can be used as a throttle and can be turned until the desired cruising speed is reached. Turning this wheel, rotates a cam in the metering valve (Fig. 2) which varies the spring pressure exerted on a pilot valve.

A low friction sensor pump (Fig. 3), driven by the speedometer cable, converts road speed to pressure which applies a balancing force to the pilot valve.

The sensor pump operates whenever the car is in motion, whether or not the speed control is energized and in operation. Because of the car motion, the sensor pump is a sealed unit containing a non-volatile lubri-

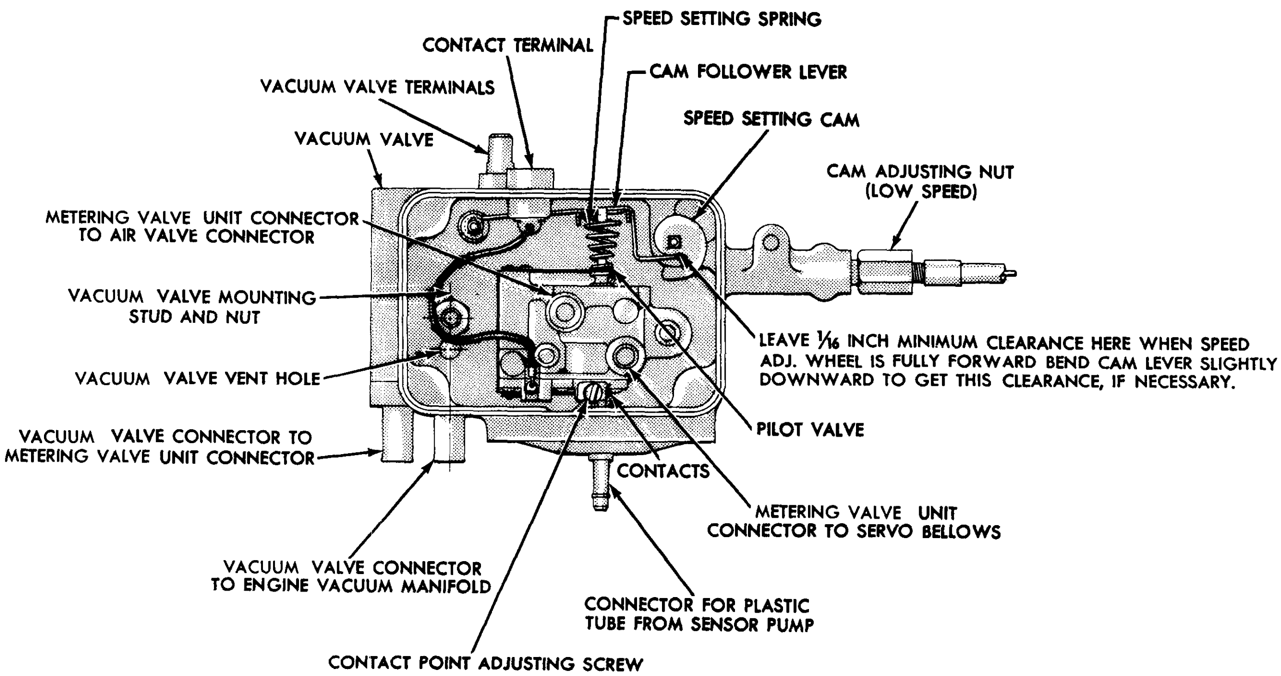

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FIG. 2–Metering Valve Unit Detail

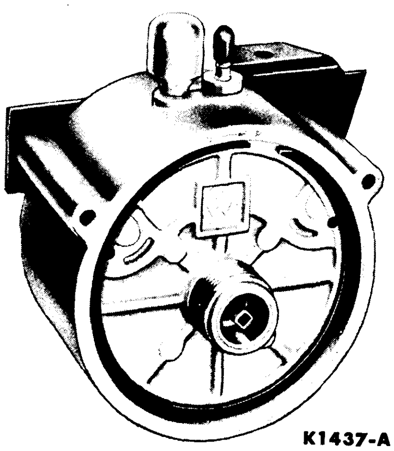

FIG. 3—Sensor Pump

cant of high viscosity stability. When the car is accelerated to the set speed, pressure from the sensor pump increases to balance the spring pressure exerted on the pilot valve. This causes the vacuum valve to snap open (Fig. 4), and the points in the metering valve unit to close. Manifold vacuum is thus available to the pilot valve which meters vacuum to the servo attached to the throttle linkage (Fig. 5). As the pilot valve is now in equilibrium position, the servo does not move the throttle. If for any reason the sensor pump is removed from the car, it must be kept in its normal vertical position or lubricant will leak out.

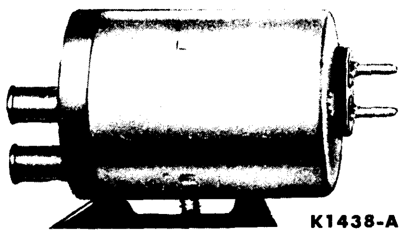

FIG. 4—Vacuum Valve

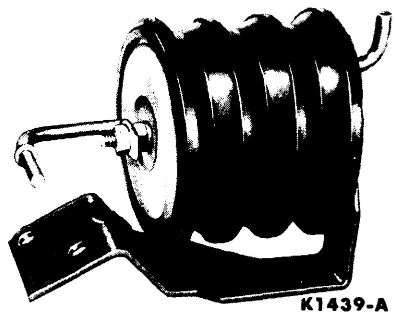

FIG. 5—Servo

When climbing a hill the car speed and the sensor pump pressure are reduced. This reduces the pressure on the pilot valve. The spring force, which is constant for the set speed, moves the valve which meters more vacuum to the servo. This opens the throttle, accelerating the car until equilibrium force is again reached.

On a downgrade the same principle applies, reversing the action. As the speed rises, so does the pressure of the sensor pump, causing the pilot valve to overpower the set speed spring force. Less vacuum is therefore available to the servo and the throttle closes slightly until the pilot valve forces are again equalized.

If the brake pedal is applied even slightly, the speed control is immediately disconnected. This is done with a small push button switch which remains closed until the pedal is depressed (Fig. 6). The speed control will resume control of the vehicle as soon as it is again accelerated to the set speed. The driver also can turn the control on or off at any speed with the switch in the control head.

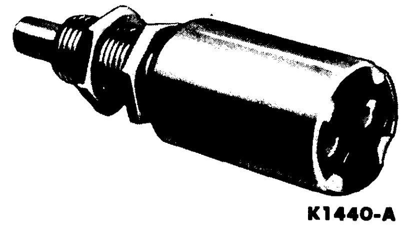

FIG. 6—Brake Switch

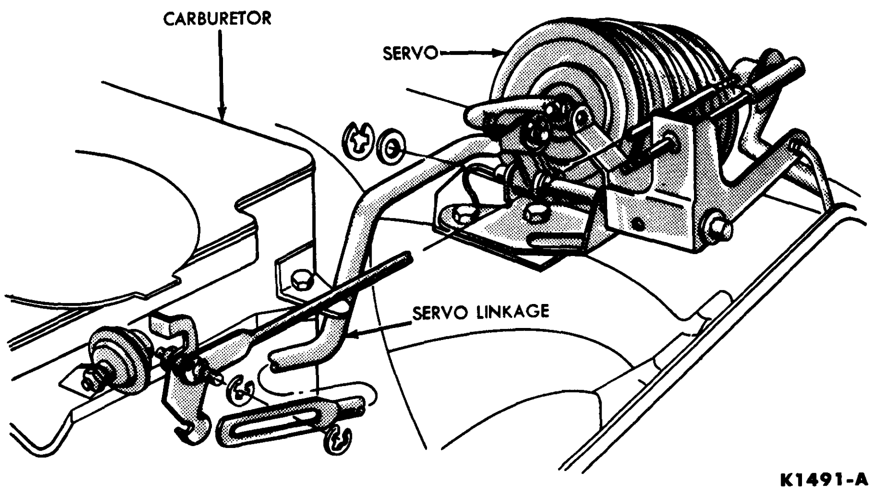

FIG. 7—Servo Linkage

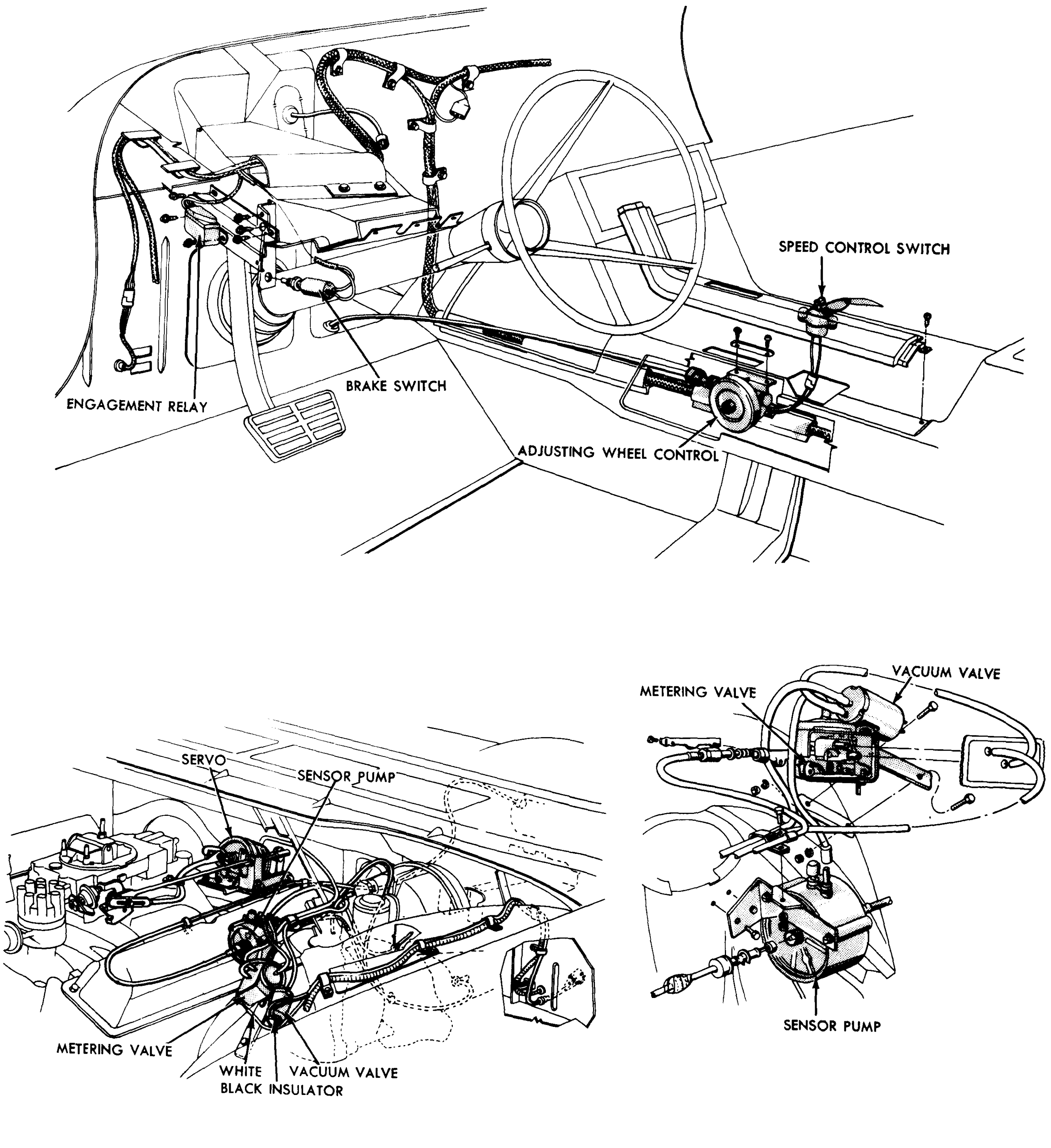

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FIG. 8—Speed Control Installation

2 DIAGNOSIS AND TESTING

SPEED CONTROL DIAGNOSIS GUIDE

SPEED CONTROL SWITCH BUTTON WON'T STAY OUT, SYSTEM IS INOPERATIVE	1. Fuse blown. 2. Wire off back of speed control switch, or ignition switch or wire(s) defective. 3. Speed control switch burned out.
SPEED CONTROL SWITCH BUTTON STAYS OUT BUT SYSTEM IS INOPERATIVE	1. Plastic tube between the sensor pump and metering valve unit off or leaking. 2. Fluid low or gone from the sensor pump due to leaks. 3. Vacuum tubes from the metering valve unit off or leaking. 4. Brake switch out of adjustment. 5. Speed setting knob set too high. 6. Wire off of the speed control switch, brake switch, engagement relay, vacuum valve or metering valve unit, or defective wire(s). 7. Contacts in metering valve unit dirty. 8. Brake switch, engagement relay, vacuum valve or metering valve unit defective. 9. Ruptured servo bellows. 10. Servo disconnected from carburetor linkage. 11. Speedometer cable broken between the transmission and sensor pump.
ENGAGEMENT RELAY IS HEARD, BUT SYSTEM IS INOPERATIVE	1. Vacuum hose off or split between manifold and vacuum valve, or between vacuum valve and metering valve unit; or, plastic tube off or split between metering valve unit and sensor pump. 2. Ruptured servo bellows. 3. Servo disconnected from carburetor linkage. 4. Defective vacuum valve. 5. Wire off vacuum valve, or wire defective.
SYSTEM HUNTS (SPEED CONTINUOUSLY CHANGES UP AND DOWN)	1. Vacuum hose split between manifold and vacuum valve, vacuum valve and metering valve unit, metering valve unit and servo. 2. Ruptured servo bellows. 3. Defective metering valve unit. 4. Sticky carburetor or accelerator linkage.
LOW SPEED SETTING TOO HIGH	1. Defective sensor pump. 2. Defective metering valve unit. 3. Cam not properly adjusted (Section 2, Part 16-8).
SYSTEM SLUGGISH, WILL NOT HOLD SPEED ON HILLS	1. Defective sensor pump. 2. Sticky carburetor or accelerator linkage. 3. Vacuum leak in hoses or servo.
SPEED CONTROL REGULATES, BUT SPEEDOMETER DOES NOT REGISTER	1. Broken speedometer cable between sensor pump and speedometer. 2. Inoperative speedometer mechanism.
WHILE OPERATING, VEHICLE OVERSPEEDS SPEED SETTING	1. Plastic tube between sensor pump and metering valve unit leaking. 2. Defective metering valve unit diaphragm. 3. Hoses to metering valve unit reversed.
SLOW RESPONSE WHEN ADJUSTING SPEED AND SPEED DROPS EXCESSIVELY ON HILLS	1. Kinked or leaking vacuum hoses between manifold and vacuum valve, vacuum valve and metering unit, or metering valve unit and servo. 2. Small leak in servo bellows.

TESTING

SYSTEM FAILS TO OPERATE

If Speed Control Switch Button Won't Stay Out. Replace the fuse. If this fails to correct the problem, examine the back of the speed control switch, and the ignition switch, for disconnected or defective wires. Finally, if the trouble still exists, replace the speed control switch.

If Speed Control Switch Button Stays Out

1. Check the brake switch for correct adjustment.

2. Be sure that the speed setting knob has not been set too high.

3. In the following order, examine the speed control switch, brake switch, engagement relay, vacuum valve and metering valve unit for disconnected, damaged, or missing wires. Make necessary corrections.

4. Examine the plastic tube between the sensor pump and the metering valve unit, and the vacuum tubes connected to the metering valve unit for improper connection or leaks.

5. Check the servo bellows for

ruptures or other leak causing damage, and for proper connection and adjustment to the throttle linkage. Make any necessary corrections or replacements.

6. If the trouble still exists, it could be caused by an internal defect in the brake switch, engagement relay, vacuum valve, or metering valve unit. To determine which is at fault use the following procedure:

1. Turn the ignition switch to ACC.

2. Pull out the knob of the speed control switch (it should remain out).

3. Ground one wire of a 12-volt trouble light to the engine.

4. Remove the red wire from the vacuum valve.

5. Touch this wire to the ungrounded wire of the trouble light.

If the light comes on, the brake switch and the associated wiring are satisfactory to put the system into operation. If the light does not come on, the brake switch may be out of adjustment or defective, or the associated wiring from the speed control switch may be loose or defective. Repair or replace the defective items. Connect the red wire to the vacuum valve and disconnect the test light.

6. Remove the white wire from the metering valve unit and ground it. A thump should be heard in the vacuum valve. This indicates that the vacuum valve is satisfactory. Immediately repeat this test. No thump should be heard. If no thump is heard on this second test, the engagement relay is satisfactory. If a thump is heard, either the engagement relay is defective, or it is not properly grounded. Connect the white wire to the metering valve unit.

7. Push in the knob of the speed control switch. **This must be done to unground the system for this test.** Pull out the knob of the speed control switch. Remove the air filter screen of the metering valve unit. **Carefully** close the contact points. If a thump is heard at the vacuum valve, the metering valve unit is satisfactory electrically. If not, clean the points. (See Cleaning and Inspection in this part.)

It should be noted that this is a one time test. Subsequent attempts to get this thump will result in no thump which is as it should be. Should there be any doubt as to whether a thump was heard, push in the knob of the speed control switch, then pull it out again before repeating the point closing test.

8. If the above tests all were satisfactory, the pressure diaphragm could be at fault. To test the diaphragm, raise the car from the floor and set the speed control at the low speed setting. Operate the car in drive range. Raise, then lower the engine speed several times, noting whether the points in the metering valve unit close and open consistently in relation to the rise and fall of the engine speed.

If the points do not close and open consistently in relation to the rise and fall of the car speed, or if the points fail to operate at all, the pressure diaphragm could be defective, in which case replace the entire metering valve unit.

It is normal during this test for the car speed to hunt, or raise and lower slightly, as the car will not be under load. **Before making any decision that the metering valve unit should be replaced, it should be determined whether the sensor pump has lost its fluid. Check for leaks into the speedometer cable. If the fluid is low, or gone, replace the pump.**

ENGAGEMENT RELAY OPERATES

1. A careful examination should be made of the vacuum hose for fractures or splits and for a secure connection at the manifold, the vacuum valve and the metering valve unit. Replace any defective sections.

2. If the servo bellows is fractured, cracked, or porous, it should be replaced.

3. Make sure that the servo connection and the adjustment to the throttle linkage are to specifications.

4. Make a trouble light check, as outlined above to determine whether the vacuum valve is operating. If all wiring and connections are satisfactory, and the trouble light will not light, replace the vacuum valve.

SYSTEM OPERATES ERRATICALLY—CAR SPEED VARIES FROM WHEEL SETTING

If the system hunts (speed continuously changes up and down), check for slight leaks in the vacuum lines or the servo bellows. Check also for restricted or sticky action of the carburetor or accelerator linkage. Take necessary corrective action.

If the low speed setting is too high, reset it by turning the cam adjusting nut of the metering valve unit (Fig. 2). If this does not stabilize the speed, any of the above listed defects which cause hunting could make this trouble.

SPEED CONTROL OPERATES BUT SPEEDOMETER DOES NOT REGISTER

A broken speedometer cable between the sensor pump and the speedometer, or an inoperative speedometer mechanism, would account for this. Replace the defective unit.

3 COMMON ADJUSTMENTS AND REPAIRS

Make all adjustments with the engine stopped.

BRAKE SWITCH

Adjust the brake switch so that the plunger is depressed 1/4 inch (Fig. 6) with the brake pedal in the normal released position (See Description and Operation in this part).

SERVO LINKAGE ADJUSTMENT

Make this adjustment with the engine stopped. Be sure that the fast idle cam does not hold the throttle open even slightly. Adjust the length of the connecting cable, or rod, between the servo and the throttle linkage so that from 1/8 inch to 1/4 inch movement of the servo bellows is allowed before it moves the throttle linkage.

METERING VALVE UNIT ADJUSTMENT FOR SET SPEED

Adjustments can be made without removing the metering valve unit (Fig. 2) from the car. The system should be adjusted to engage at approximately two mph above the set speed.

1. Remove the two vacuum hoses from the front face (screen side) of the metering valve unit.

2. Carefully remove the air filter screen from the face of the metering valve unit using a small screwdriver.

3. If the system engages at less than the set speed, rotate the small plastic cam screw slightly clockwise (Fig. 2) to open the contacts. If the system engages at more than the set speed, rotate the small plastic cam screw slightly counterclockwise to close the contacts.

4. Install the air filter screen.

5. Road test the car by driving it on a level road at some definite speed; 35 mph is suggested. Depress the brake pedal lightly to disengage the speed control. Accelerate very gradually until a click is heard. If the adjustment is correct, the speed should be approximately 37 mph. If not repeat steps 1 to 5 above.

4 REMOVAL AND INSTALLATION

VACUUM SERVO

The vacuum servo is mounted on a bracket which is bolted to the engine (Fig. 7). The servo is linked to the carburetor throttle shaft as shown. The links are held on by the use of snap rings.

METERING VALVE

The metering valve is mounted on the left hand fender well. It is connected to the sensor pump, vacuum valve and servo with vacuum hoses (Fig. 8).

VACUUM VALVE

The vacuum valve is mounted on the left hand fender well. It is connected to the metering valve and the car vacuum system with vacuum hoses (Fig. 8).

SENSOR PUMP

The sensor pump is attached to a bracket mounted on the left wheel suspension tower. It is connected by flexible cables to the speedometer and the transmission. It is connected to the metering valve by a hose (Fig. 8).

ENGAGEMENT RELAY AND BRAKE SWITCH

The engagement relay and brake switch are attached to a bracket above the brake pedal (Fig. 8).

SPEED CONTROL SWITCH

The speed control switch is mounted on the tunnel directly behind the adjusting wheel control (Fig. 8).

ADJUSTING WHEEL CONTROL

The adjusting wheel control is mounted on the left side of the tunnel beside the driver's seat (Fig. 8). It is connected by a flexible cable to the metering valve.

5 CLEANING AND INSPECTION

METERING VALVE UNIT CONTACT POINTS

1. Carefully remove the hoses and the air filter screen.

2. Insert a piece of paper approximately ¼ inch wide by 2 inches long between the contact points. Use typewriter bond paper for this. **Do not, under any condition, use emery paper, sandpaper, or a point file between these gold contact points.**

3. Lift up the pilot valve **gently** with a small screwdriver or a similar tool. To do this, insert the tool under the leaf spring just below the small end of the speed setting spring (Fig. 2). This will close the contacts and hold the paper between them.

4. Pull the paper through to wipe both of the contacts.

5. Repeat steps 2, 3, and 4 until the paper shows no markings or dirt from the contacts.

6. To complete this operation, repeat steps 2, 3, and 4, again, but before the paper is pulled all the way through, allow the contacts to open slightly to prevent any possibility of paper fragments being left between them.

7. Use all possible caution not to bend the contacts, as this will affect the speed at which the speed control will go into operation.

PART 16-4 RADIO

1 DESCRIPTION AND OPERATION

Refer to Wiring Diagram Manual Form 7795P-65 for locations of wiring harnesses.

An AM and an AM/FM radio are available. The AM radio is a Motorola, model number 5TMS. The AM/FM radio is a Bendix, model TOB5TBS. Both radios have push button tuning as well as manual tuning. The antenna is mounted on the right fender. On the manual antenna the antenna wand can be removed from the base without removing the base from the fender. A rear seat speaker and a front speaker are used.

2 DIAGNOSIS AND TESTING

RADIO DIAGNOSIS GUIDE

NO RECEPTION	1. Burned out fuse. 2. Reversed battery polarity. 3. Defective antenna or lead. 4. Shorted speaker lead or defective speaker. Be sure that proper voltage is available at the set then substitute the known good antenna and speaker.
NOISY OR ERRATIC RECEPTION	**NOISY RECEPTION—ENGINE NOT RUNNING** 1. Loose connections. **NOISY RECEPTION—ENGINE RUNNING** 1. Defective suppression equipment. 2. Suppression condensers not properly grounded. 3. Receiver not properly grounded to the instrument panel. **NOISY RECEPTION—CAR IN MOTION** 1. Loose or broken lead-in cable. 2. Loose or defective radio antenna. 3. Defective wheel static collectors.
DISTORTED OR GARBLED SOUND	1. Voice coil rubbing on center pole piece of speaker magnet (either front or rear speaker). 2. Torn speaker cone. 3. Foreign material on speaker cone. 4. Bent or twisted speaker mounting.
WEAK RECEPTION	1. Beyond normal reception distance from station (FM only). 2. Defective antenna. If FM reception is poor be sure that the antenna is at 30-32 inch height before trying a new antenna.

TESTING

Tests for any of the components in the radio system may be made by substituting known good parts. In the case of an antenna or speaker, it will not be necessary to remove the suspected antenna or speaker. Disconnect the antenna or speaker at the radio and plug in the known good unit. Check the antenna with the car outside of the garage. Plug the antenna lead into the antenna socket in the radio, and extend the antenna wand through the open window of the car.

3 COMMON ADJUSTMENTS AND REPAIRS

PUSH BUTTON ADJUSTMENT—AM RADIO

Turn the radio on and allow it to warm up for 15 minutes. Pull out the desired push button and reduce the volume to a low value. Tune in the desired station with the manual tuning knob. The station is correctly tuned in when the clearest tone is heard. Carefully push the button in all the way, then release it.

Adjust the remaining buttons and check all the positions for repeat accuracy. Repeat the procedure for any buttons that shift from the correct tuning point.

On the AM/FM radio push one AM button all the way in before adjusting the AM buttons. Push one FM button all the way in before adjusting the FM buttons.

PUSH BUTTON ADJUSTMENT—AM-FM RADIO

AM PUSH BUTTONS

Press in firmly any one of the push buttons which has been pre-set to the AM position. Pull out the push button to be set to unlock the push button mechanism. If the red bar on the push button face is down, pull out the push button approximately 1/10 inch further until the button is free to rotate and rotate the button 180° to the bar up position. Carefully tune in the desired AM station with the manual tuning knob. After the station is clearly tuned in push the button straight in until it stops and then release it. Repeat this procedure for the remaining buttons.

FM PUSH BUTTONS

Press in firmly any one of the push buttons which has been pre-set to the FM position. Pull out the push button to be set to unlock the push button mechanism. If the red bar on the push button face is up, pull out the push button approximately 1/10 inch further until the button is free to rotate and rotate the button 180° to the bar down position. Carefully tune in the desired FM station with the manual tuning knob. After the station is clearly tuned in, push the button straight in until it stops and then release it. Repeat this procedure for the remaining buttons.

4 REMOVAL AND INSTALLATION

RADIO CHASSIS

REMOVAL

1. Pry off the right and left side console mouldings. Remove the right and left side console moulding retainers.

2. Pry off the right and left side instrument panel chrome mouldings.

3. Remove the six screws and two bolts retaining the lower right and left side finish panels to the instrument panel and pull the finish panels away from the instrument panel.

4. Remove the screws retaining the right and left side console finish panels and remove the finish panels.

5. Remove the two screws attaching the lower end of the radio to the support brackets.

6. Remove the radio knobs and the bezel mounting nuts and washers.

7. Disconnect the antenna and speaker connectors and remove the radio.

INSTALLATION

1. Position the radio in the console, and install the antenna and speaker leads.

2. Position the control shafts into the console openings and install the bezel lock washers, nuts and knobs.

3. Install the two screws securing the radio to the support brackets.

4. Install the right and left side console finish panels.

5. Install the right and left side lower finish panels to the instrument panel.

6. Install the chrome mouldings between the instrument panel and the lower finish panels.

7. Position the carpeting and moulding retainer to the right and left side of the console and install the retaining screws and the console moulding.

STANDARD ANTENNA

REMOVAL

1. Pry off the right side console moulding. Remove the right side console moulding retainer.

2. Pry off the right side instrument panel chrome moulding.

3. Remove the three screws and one bolt retaining the lower right side finish panel to the instrument panel and pull the finish panel away from the instrument panel.

4. Remove the screws retaining the right side console finish panel and remove the finish panel.

5. Reach through this opening, and from behind the radio, remove the antenna lead-in wire.

6. Attach a piece of strong string to the lead-in wire to save time on installation.

7. Remove the fender splash shield and remove the antenna nut and stanchion assembly from the top of the fender, then remove the antenna.

INSTALLATION

1. Attach the string to the antenna lead-in wire.

2. Reach through the console finish panel opening and pulling the string, draw the lead-in wire through to the rear of the radio.

3. Plug the lead-in wire into the radio. Install the antenna nut and stanchion assembly, then install the fender splash shield.

4. Install the console finish panel, and the retaining screws.

5. Position the lower right side finish panel to the instrument panel and install the three screws and one bolt.

6. Install the chrome moulding carefully, on the right side instrument panel.

7. Position the carpeting and moulding retainer to the right side of the console, and install the retaining screws and the console moulding.

POWER ANTENNA

REMOVAL

1. Raise the car part way on a hoist.

2. Remove the retaining screws and one nut, and remove the right fender splash shield.

3. Disconnect the antenna lead and the electrical plug.

4. At the lower end of the antenna remove the bracket to wheel housing mounting screw, then remove the screws retaining the antenna to the ground support collar.

5. Remove the antenna from under the fender.

6. Remove the retaining nut and washer beneath the fender and remove the ground support collar stanchion assembly.

INSTALLATION

1. Transfer the mounting bracket from the old antenna to the new antenna.

2. Position the stanchion assembly and ground support collar, and install the retaining washer and nut.

3. Position the antenna under the

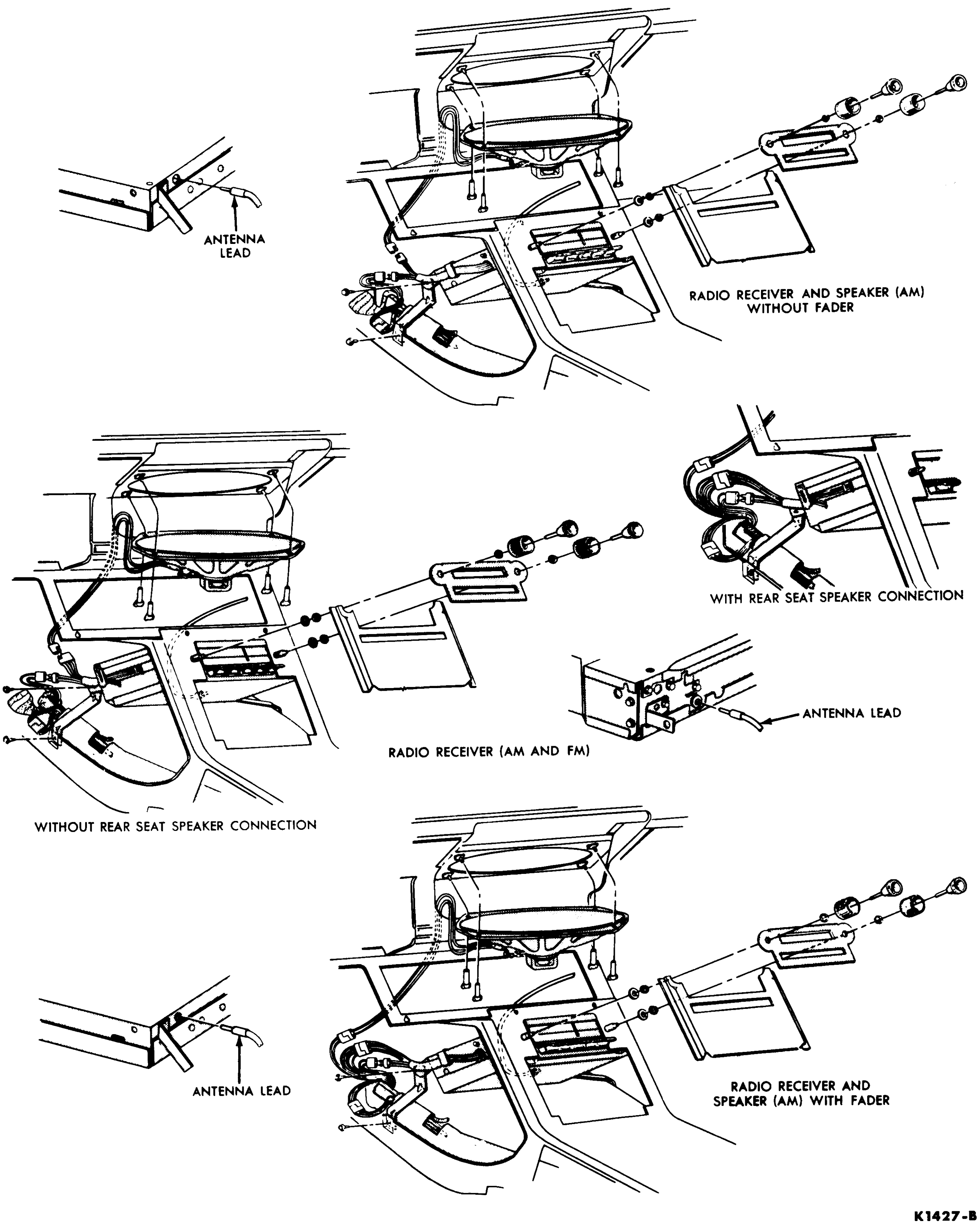


FIG. 1—Speaker Lead Connections

fender and install the retaining screws in the ground collar and at the mounting bracket to wheel housing.

4. Connect the antenna lead and the electrical plug.
5. Check the antenna operation.
6. Position the splash shield and install the retaining screws and nut.
7. Lower the car to the floor.

POWER ANTENNA SWITCH

REMOVAL

1. Remove the battery ground cable.
2. Apply tape below the clock housing to prevent paint damage.
3. Remove the retaining screws, then remove the knobs from the wiper, the washer, the right air and the left air control knobs.
4. Remove the clock housing retaining screws, then pull back the clock housing.
5. From the power antenna switch disconnect the connector plug, then remove the retaining screws and remove the switch.

INSTALLATION

1. Transfer the control arm and the knob to the new switch.
2. Position the switch to the clock housing, install the retaining screws and install the connector plug.
3. Position the clock housing and install the retaining screws.
4. Check the operation of the switch.
5. Position the knobs on the wiper and washer, the left air and the right air control levers and install the retaining screws.
6. Remove the protective tape and connect the battery ground cable.

FRONT SPEAKER

1. Remove the four knobs and four screws from the clock housing and position the clock housing down out of the way.
2. Disconnect the speaker lead. Remove the speaker mounting wing nuts, and remove the speaker.
3. Place the new speaker in position and install the mounting wing nuts.
4. Connect the speaker lead (Fig. 1).
5. Install the clock housing and install the four knobs.

PART 16-5 SPECIFICATIONS

BLOWER MOTOR CURRENT DRAW

At Low Speed	2-4	Amperes at 12 volts
At Medium Speed	4-5	Amperes at 12 volts
At High Speed	6.3-7.5	Amperes at 12 volts*

*When in A/C position 13.2 Amperes at 12 volts.

RADIO

Radio Current Draw ....1 ampere max. @ 12 volts

AIR CONDITIONING COMPRESSOR

Location	Torque (Ft-lbs)
Cylinder Head	20-24
Front Seal Plate	6-10
Service Valve (Rotolock)	35 Max.
Mounting Bolt	14-17
Oil Filler Plug	18-22
Clutch Mounting	15-22

Oil capacity: ⅞ inch Minimum. Use Suniso No. 5 or Capella E.

SPEED CONTROL

BRAKE PEDAL RELEASE SWITCH Adjustment Nut Torque ....48-60 in-lbs

CIRCUIT PROTECTION

Heater	20 Amp C.B.
Air Conditioner	20 Amp C.B.

DRIVEN BELT TENSION

Between Fan Pulley and Air Conditioner Compressor All Engines ....New 120-150 Used* 90-120

*Belt operated for a minimum of 10 minutes is considered a used belt.

BODY, DOORS, AND WINDOWS

GROUP 17

PART 17-1 GENERAL BODY SERVICE

1 DIAGNOSIS AND TESTING

LEAKS

The forward motion of the car creates a slight vacuum within the body, particularly if a window or ventilator is partially open. Any unsealed crevice or small opening in the lower section of the body will permit air to be drawn into the body. If dust is present in the air, it will follow any path taken by the air from the point of entry into the passenger and luggage compartments. Opening the fresh air outlets will equalize these pressures. Dust may work its way into the hollow, box-type, rocker panel which extends along the edge of the floor below the doors. Dust accumulates in the rocker panel, and may eventually work its way to the rear body pillar or kick-up, and follow the contour of the wheelhouse into the luggage compartment.

To eliminate dust leakage, determine the exact point at which the dust enters. As explained previously, the point of entry is often deceptive in that the dust may enter at one point and then follow the passages formed by interior trim.

Under certain conditions, water can enter the body at any point where dirt or dust can enter. Any consideration of water leakage must take into account all points covered under dust leaks.

Dust and/or water leaks may result from missing or improperly installed plugs and grommets. These are used in the underbody and the dash panel.

LOCATING DUST LEAKS

To determine the exact location of a dust leak, remove the following trim from the car:

1. Cowl trim panel.
2. Quarter trim panel.
3. Rear seat back and seat cushion.
4. Luggage compartment floor mats, side trim panel, and spare wheel.
5. Scuff plates.

After removing the trim, the location of most leaks will be readily evident. Seal these leaks, and road test the car on a dusty road to make sure that all leaks are sealed. The entrance of dust is usually indicated by a pointed shaft of dust or silt at the point of entrance.

After the road test, check for indications of a dust pattern around the door openings, cowl panel, lower part of the quarter panel, and in the luggage compartment.

The locations of sealed body joints which can be involved are shown in Fig. 1 thru 4. Roof side rail weatherstrips are shown in Fig. 5 for hardtop models and in Group 18, Part 3 for convertible models.

TYPES OF SEALERS AND APPLICATION

Since many sealers are used in manufacturing assembly, the all purpose sealers described below have been selected for service use. The method and points of application are given under each sealer type.

CAULKING CORD – AB-19560-A

This sealer has a plastic base with an asbestos filler, is heavy bodied, and is commonly known as permagnum. 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.

TRIM CEMENT – C2AZ-19C525-A

This cement is specially recommended for instrument panel safety pad and body panel plastic water shield installation. It is also useful for repair or replacement of other vinyl and rubber trim.

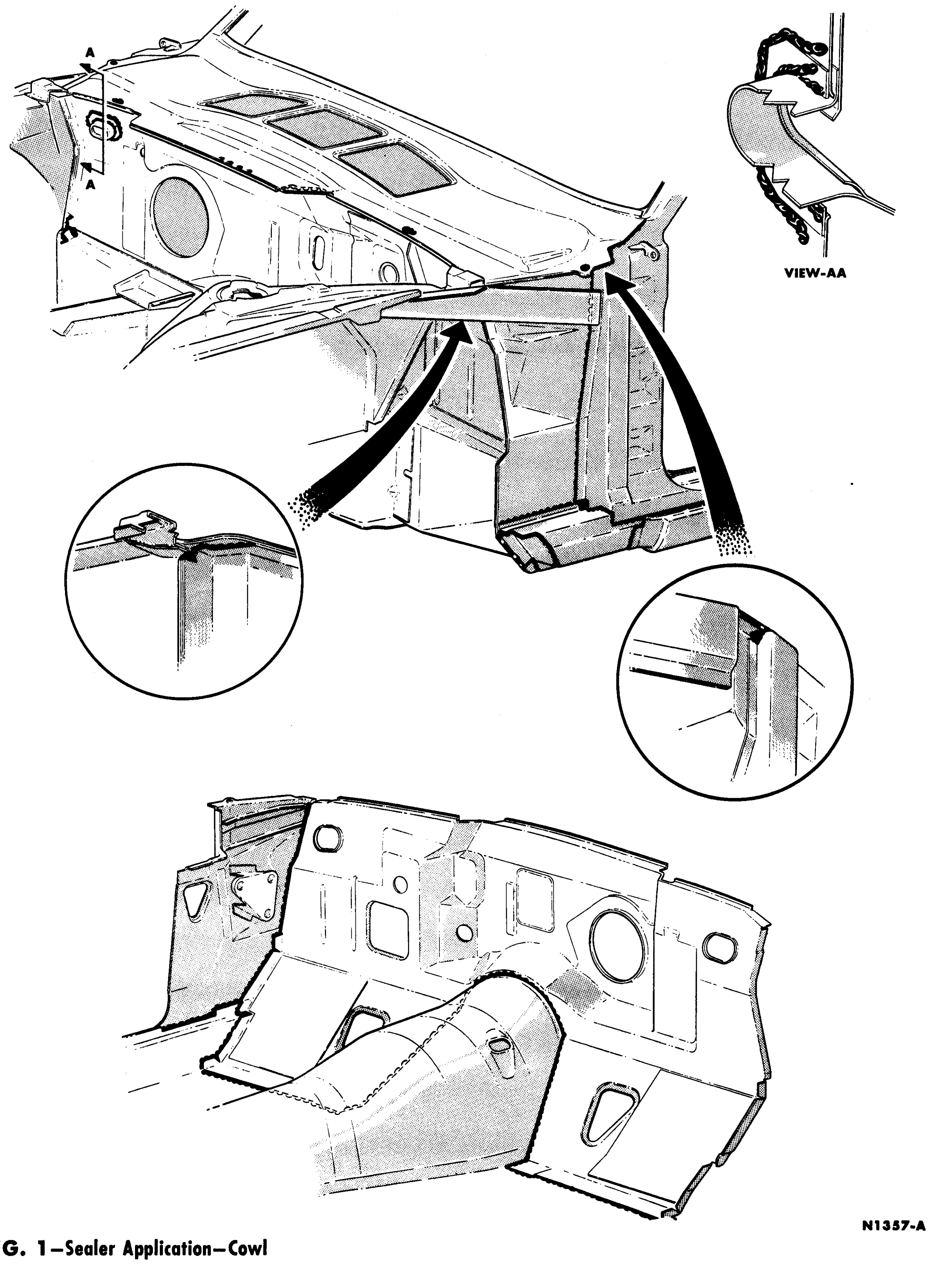


FIG. 1—Sealer Application—Cowl

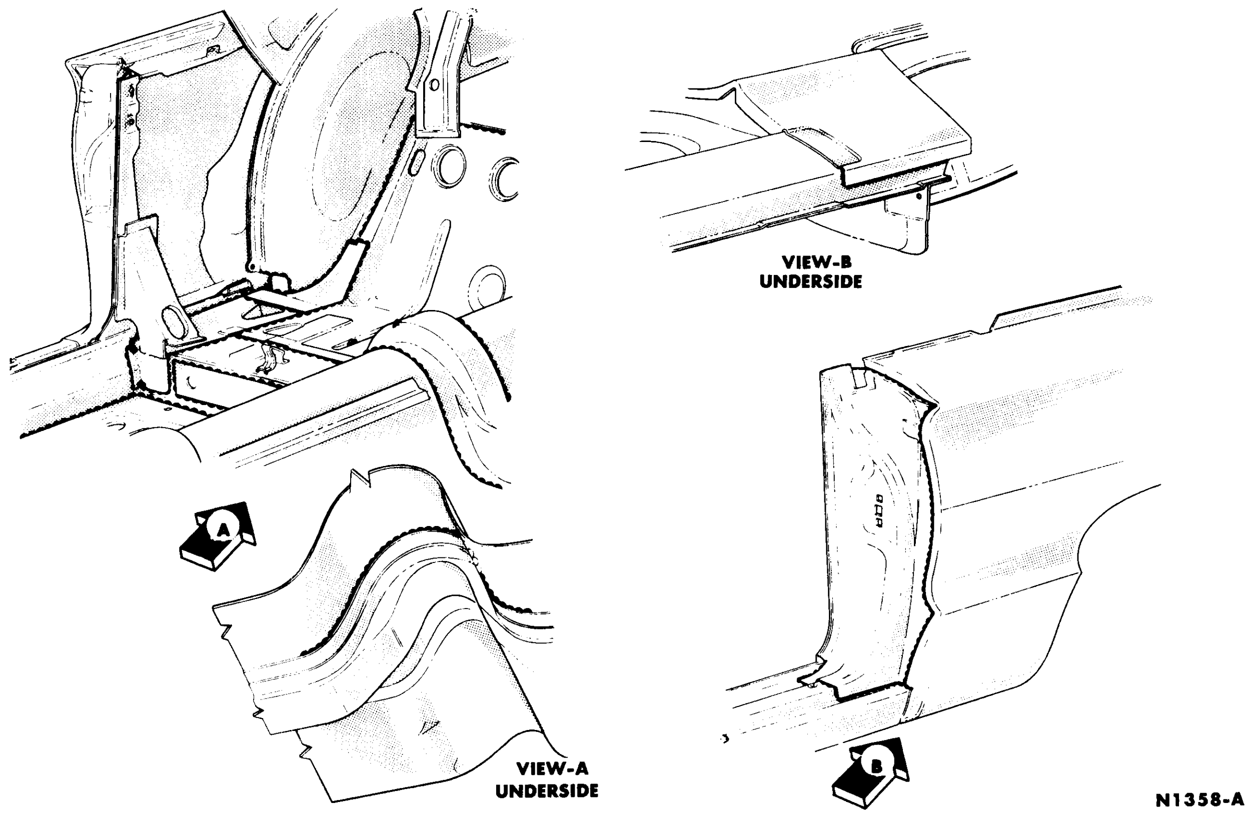


FIG. 2—Sealer Application—Rear Floor

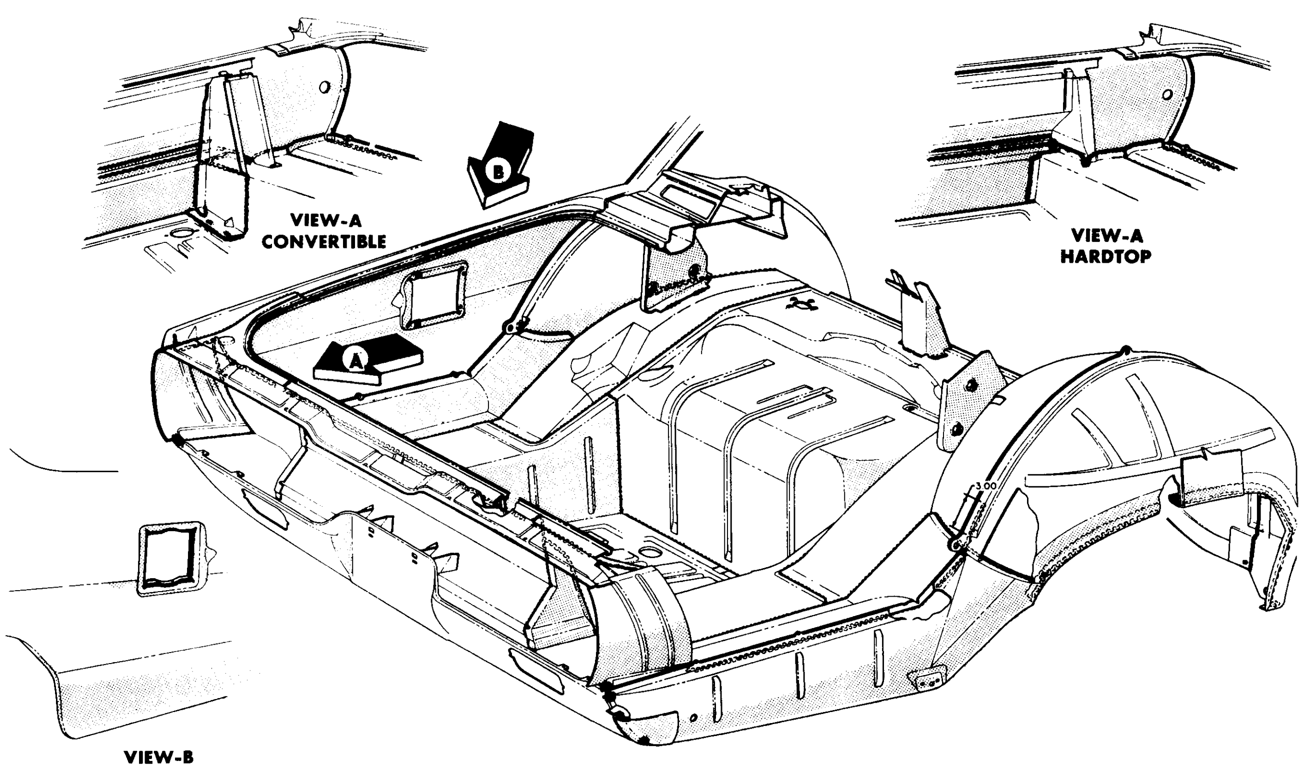


FIG. 3—Sealer Application—Body Rear

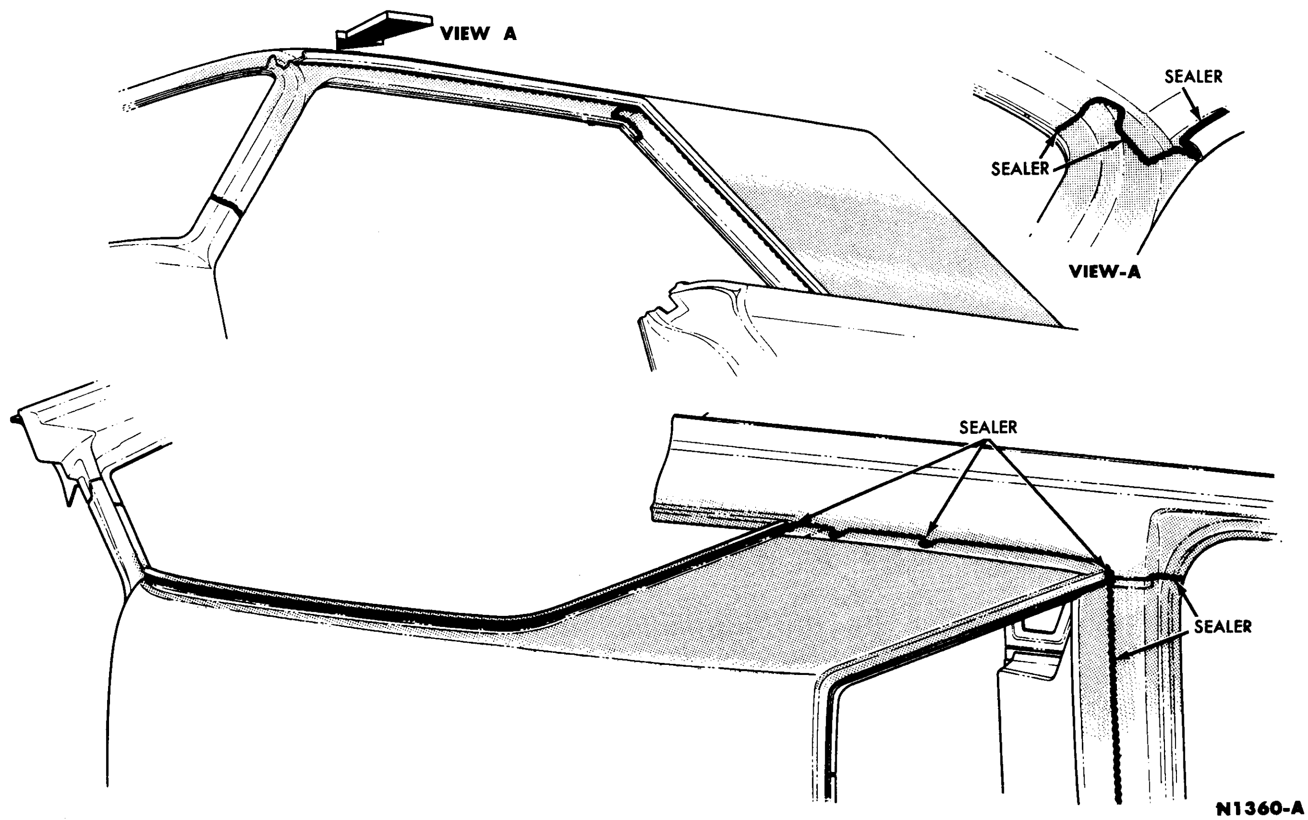


FIG. 4—Sealer Application—Roof

RUBBER CEMENT — 8A-19552-B

This quick-drying, strong, adhesive cement is designed to hold weatherstripping on doors, bodies, deck lids, cowl ventilators, and the surrounding metal. Windows and windshields that 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 surfaces thoroughly with a rag moistened with clean gasoline or cleaners naphtha. For best results, apply a medium coat of cement to both surfaces, allow it to dry until tacky, and then press both surfaces firmly together.

CLEANING SOLVENT B7A-19520-A OR B7A-19521-A

Prevent either of these cleaners from contacting either vinyl or leather.

This general clean-up solvent cleans off cement smears, wax, tars, oils, grease, caulk and sealer. It can also be used to thin caulk and sealer. It is harmless to cured paint, and is useful in new car pre-delivery.

SILICONE LUBRICANT— COAZ-19533-A (JELLY) OR COAZ-19533-B (SPRAY)

This lubricant can be used on the door upper weatherstrips of convertible and hardtop models. Its use makes the doors easier to close, avoids weatherstrip squeaks, retards

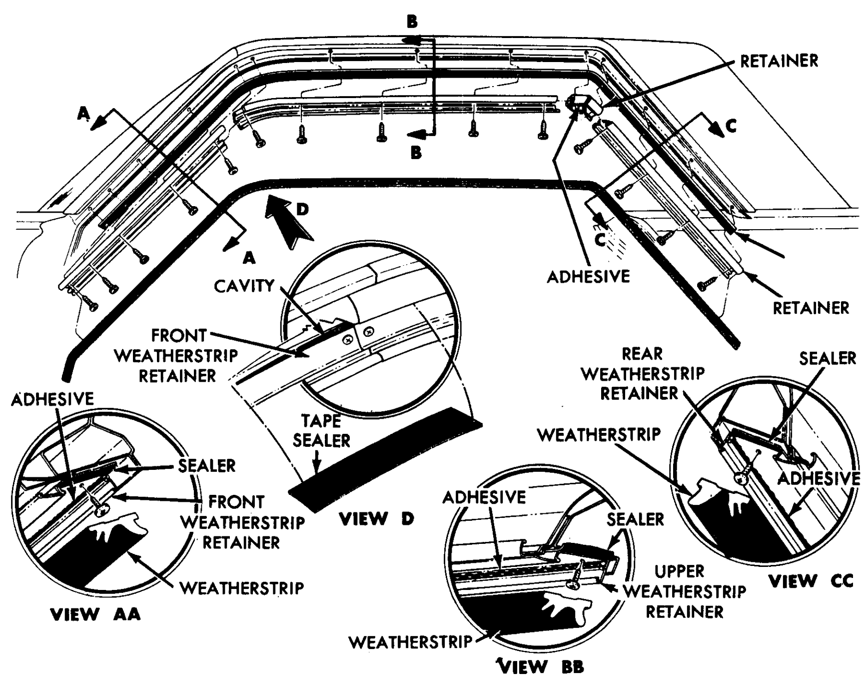


FIG. 5—Roof Side Rail Weatherstrips (Hardtop)

excess weatherstrip wear 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 weathershrip.

2 COMMON ADJUSTMENTS AND REPAIRS

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.

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. **Do not allow the hoist adapter to contact the steering stop.**

Rear. The hoist adapters must be positioned carefully under the rear axle to prevent damage to the shock absorbers and brake lines 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 lower suspension arms.

Rear. To prevent damage to the shock absorbers, the rear forks must contact the axle at points not farther outboard than one 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 24 square inches of underbody area. Figure 7 shows recommended contact points.

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 either lower control arm. **Raise the car by contacting a lower arm**

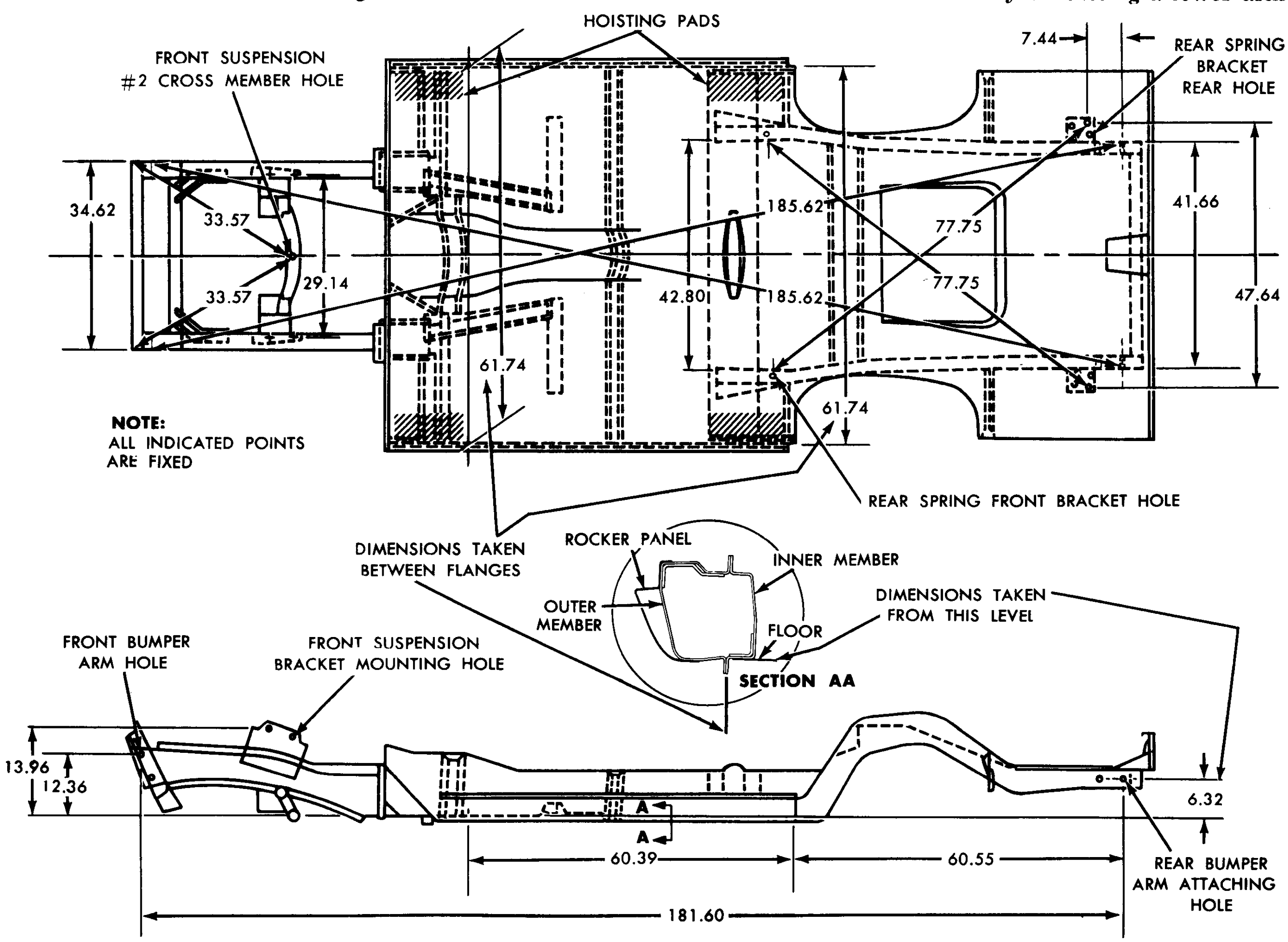


FIG. 6—Underbody Dimensions N1000-C

only when the jack saddle is large enough to accommodate the control arm securely. Either side of the front end of the car may also be raised by jack pressure on the front cross member, or on the cross member to which the stabilizer is connected.

Either side of the rear end of the car may be raised by jack pressure on the rear cross member. Do not put pressure on the fuel tank.

To raise the car with a bumper jack, position the jack hook on the bumper so that the lip of the hook engages the notch in the lower edge of the bumper.

The convertible deck lid must be closed to properly position the jack on the rear bumper.

BODY REPAIRS

BODY ALIGNMENT

Servicing the unitized body should not present any unusual difficulties or necessitate additional equipment other than that required for the conventional frame and body repair. The application of heat and the use of heavy-duty jacks must be carefully controlled because of the difference in the gauge of the metal in the sub-frame of a unitized body and the stress points developed in a single welded unit construction. It is possible to pull damaged areas back into alignment with the use of light-weight jacks and hydraulic equipment without heating the metal.

Rough out badly damaged areas before taking measurements for squaring up a body. If necessary, remove the glass from the damaged area to prevent damage. In severe cases, reinforcement brackets and other inner construction may have to be removed or cut to permit restoration of the outer shell and pillars without excessive strain on the parts. Straighten, install, and secure all such parts in place before attempting to align the body.

In cases of severe or sharp bends, it may be necessary to use heat. Any attempt to cold-straighten a severely bent bracket may cause ruptures of the welds and may also cause cracks in the bent part. Never heat the area more than a dull red.

Checking Body for Misalignment. To align or square up a body, take two opposite diagonal measurements between pillars. Use a measuring tram for these measurements. Take the measurements between reference points such as crease lines or weld joints which are diagonally opposite each other on the two pillars being measured. Since all measurements should be made from the bare metal, remove all interior trim from the checking points.

Do not attempt to correct any serious misalignment with one jacking operation. This is particularly true if other sections of the body also require aligning. Align each section proportionately until the proper dimensions are obtained.

Door openings are checked in the same manner as the body. Horizontal, vertical, and diagonal checking points are established on all four sides of the door opening that is being measured.

The dimensions of the sub-frame must be restored in the repair of major body damage, to provide correct front and rear wheel geometry. Fig. 6 shows the dimensions for aligning the underbody assembly. All the dimensions are detailed to the center line of existing holes in the underbody assembly. Once the frame and suspension members are properly aligned, the balance of the repair can be performed.

PANEL REPAIR

With proper equipment, an experienced body repair man can repair a damaged area in a body panel by one of three methods:

1. External or surface damage that can be bumped out or refinished.
2. External damage that can be repaired by removing a complete panel and installing a service panel.
3. Extensive damage necessitating the removal of the outer panels and the realignment or replacement of sections of the sub-frame. **When performing repairs of this type, measure sufficient overlap to assure an adequate area for a strong welded surface.**

In cases where only a portion of a panel requires replacement, a section of a service panel can be used. Complete service panels are available if the area is extensively damaged. Refer to the Master Parts Catalog for panel identification.

If a complete panel requires replacement, refer to Figs. 1 thru 4 which show some of the hidden weld joints and sealer locations.

Repairing Undercoated Sheet Metal. When repairing undercoated sheet metal, rough out the damaged portion, and apply moderate heat to the outside of the panel. This will soften the undercoating so that it can be scraped off with a putty knife. Remove any remaining material with a solvent.

Apply undercoating to the repaired metal with a putty knife or paint brush. Do not apply heat on freshly applied undercoating.

Panel Repair Procedure. The following procedure is one of several methods that can be used for cutting out and replacing a portion of the quarter panel. Although this procedure is used here for quarter panel repairs, it 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. This measurement should be taken from a definite point, such as a moulding or bead.

Make the corresponding measurements on the service panel. Be sure that measurements are taken from the same points. Scribe a line around the area to be cut from the service panel (preferably straight-line cuts).

Drill a ¼-inch hole at any one corner of the scribed lines 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 spotwelded to other parts of the body, such as the body side reinforcement lower edge or wheel-housing assembly, the damaged piece should be split at the weld if possible. To split a spotweld, drive a sharp chisel between the two pieces of metal at the weld. In difficult cases, a spotweld 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 panels do not overlap. Tack-weld at intervals, let the metal cool, and make a continuous weld around the two pieces. Wet asbestos putty may be used to prevent the heat from traveling. Weld about six inches at a time. Stagger the welds to prevent excessive distortion.

Hammer the weld below the contours of the surface not more than 1/16-inch with a grooving dolly.

Metal-finish the repair area and file it smooth, taking care to produce the correct contour.

Grind the welded area clean, and tin.

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.

FRONT END BODY STRUCTURE

The front end structure is welded on and the following procedure should be used to repair the necessary body area.

Lower Side Member

1. Position the front side member assembly against the torque box in the lower dash panel area (Fig. 7). Locate the front side member assembly by inserting a 5/8-inch pin through the 5/8-inch locating holes in the front side member assembly and dash panel (Fig. 7).

2. Apply arc or gas weld along both sides of the front side member as shown in (Fig. 7).

3. Position the dash panel lower reinforcement to the front side member gusset over the front side lower member to obtain flush contact with the dash panel and the lower member (Fig. 7).

4. Clamp the gusset to the lower member and tack-weld the gusset in place. Remove the clamp and weld the gusset as shown in Fig. 7.

Upper Side Member

1. Position the front fender apron to cowl side member assembly in place at the wheel housing area in alignment with the cowl side panel. Clamp the member assembly into weld position.

2. To prevent warpage and heat fracture of the thin gauge metal, apply wet asbestos packs against the inboard surface of the cowl panel.

3. Tack-weld the member assembly in place, remove the clamp and complete the weld pattern as shown in Fig. 7—View B.

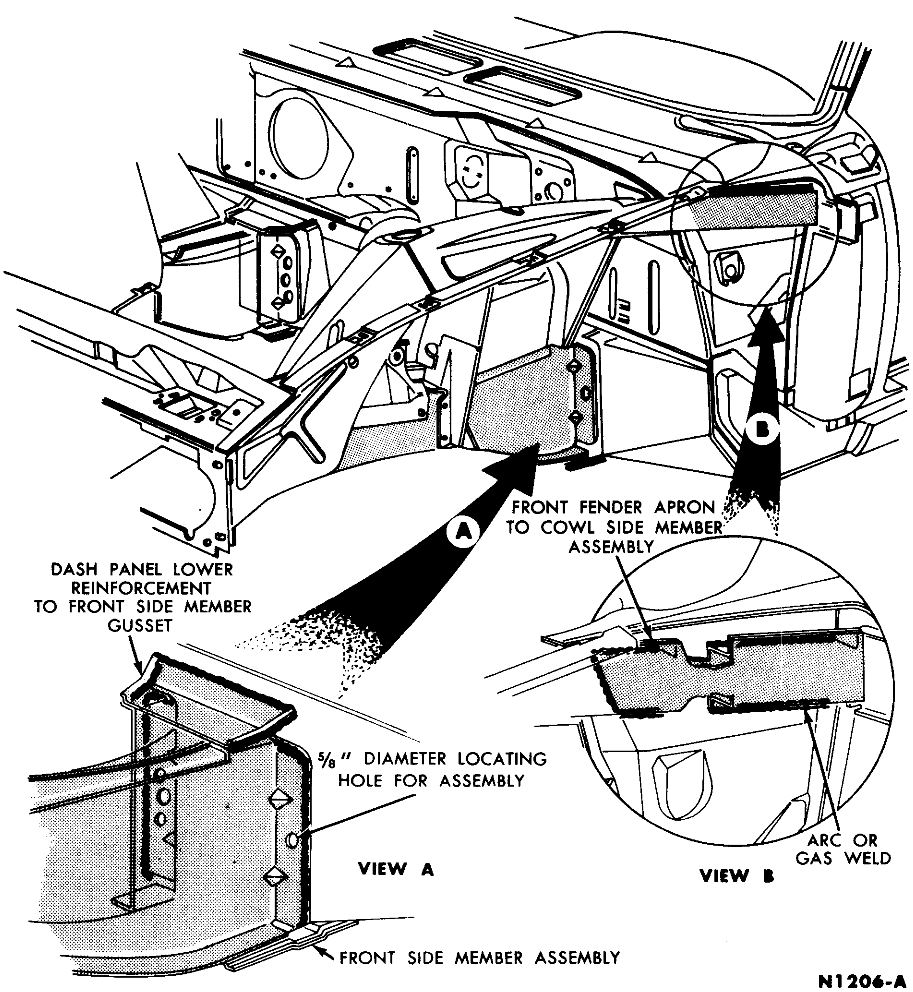


FIG. 7—Welded Front End Structure

PAINT REFINISHING

PAINT DAMAGES AND PROCEDURES FOR REPAIR

Paint Repairs on Galvanized Metals. If for any reason it becomes necessary to perform paint repairs on galvanized rocker panels or any other galvanized steel surfaces, care must be exercised in preparing the bare galvanized surface to properly accept paint, and the best possible paint products must be employed to insure satisfactory adhesion to the metal and to give a good color match with acceptable durability. Most of the approved paint suppliers for refinishing materials agree on the procedure for metal preparation but use different primer recommendations. The methods involving the use of Du-Pont Preparakote and Ditzler Zinc Dust Primer are indicated here and it is important that either one be employed exactly as directed. No short cuts nor any inter-mixing should be attempted.

METAL PREPARATION FOR GALVANIZED STEEL.

1. Strip, sand-off or otherwise remove all paint from the affected galvanized steel panel.

2. Wire-brush or steel-wool the entire metal surface and remove all grease or oil by wiping with a clean solvent.

3. Wipe the panel using a clean cloth or sponge with Lithoform No. 2 (Distributed by the Neilson Chemical Division of Amchem Products, Inc.) or Bonderite No. 34 (distributed by Parker Rustproof). The work should be kept completely wet for at least three minutes and the metal should be thoroughly etched. If any bright metal remains, the treatment should be repeated.

4. Rinse the area with clean water and blow off with compressed air.

5. The dried surface must be primed immediately. Then succeeding coats and color as required must be applied according to the vendor's directions. Examples such as the Du-Pont and Ditzler systems are given as follows:

SYSTEM FOR USING DuPONT PREPARAKOTE

1. Spray Preparakote over properly prepared metal. Force-dry with radiant heat or air-dry overnight. This primer must be dried hard enough to sand wet or dry.

2. Sand the Preparakote very carefully, preferably with 400 paper so as to avoid cutting through to bare metal. Blow off and tack clean.

3. Spray two coats of No. 22 clear sealer and allow it to air-dry for thirty minutes.

4. Spray on matching Acrylic Lacquer as directed. Then air-dry or force-dry until the lacquer is hard enough to be polished.

5. Polish the lacquer as recommended by the supplier.

SYSTEM FOR USING DITZLER ZINC DUST PRIMER.

1. Prime the galvanized area with DPE659 Zinc Dust Primer. This is a two-component product and the zinc must be carefully mixed with the vehicle as directed. A recommended film thickness of one mil may be recoated with a lacquer base primer surfacer such as DZL3200 in about twenty minutes. Do not sand DPE659.

2. Spray primer surfacer DZL3200 reduced as directed to a film thickness of about two mils.

3. After drying the primer surfacer about thirty minutes, carefully sand with No. 360 or No. 400 silicon carbide paper, wet or dry, so as not to cut through the zinc dust primer coat. Blow off and tack clean.

4. Spray matching Duracryl lacquers as directed and after drying rub and polish as required.

All material coatings may be force-dried. Careful manipulation is recommended.

Acrylic Enamels. Acrylic enamels exhibit better hardness, mar resistance and gloss retention in metallic colors than the ordinary enamels. Acrylic enamels also possess the property of good polishability.

Following are recommended repair procedures for acrylic enamels:

REPAIR BY POLISHING. Repair of minor dirt or fallout, sags, mars, scratches, dry spray, overspray, and orange peel can be accomplished by machine or hand polishing or by both sanding and polishing without the necessity of repainting. Repairs of this type should apply to an entire panel while spot repairs should be attempted only in isolated areas.

The suggested polish repair procedure consists of:

1. Remove the defect by oil sanding with 600 grit paper, using water or mineral spirits as a lubricant.

2. Apply a white or light colored medium grit machine polishing compound (Sno-Flake No. 16 or equivalent) to the painted surface with a brush.

3. Polish the entire panel surface using an 1850 rpm wheel and a carpet pad approximately (⅝-inch nap) or lambswool pad.

4. Buff the surface with a clean lambswool pad.

Normally, acrylic enamels do not need polishing to improve their gloss; however, the foregoing procedure can be used to restore the original luster to the film after weathering, or to improve the surface smoothness of the finish on the entire car.

Repair By Repainting. Acrylic enamels can be repaired by repainting with either conventional air drying or low bake enamels, or with acrylic lacquers. When repainting metallic colors, it is recommended that acrylic lacquer be used since a better color match can be obtained; both the original finish and the repair can be polished to provide the same luster, and the air dry acrylic repair lacquer will provide better durability in service than air dry enamels. **Do not use Nitrocellulose lacquers for exterior repairs.**

When using any one of the three types of repair materials over acrylic enamel, remove all traces of wax, polish or grease with a good silicone remover such as DL-60-3721-A. It is extremely important that a thorough sanding of the original finish be accomplished using No. 400 grit paper. Care should be exercised to insure that all surfaces, including edges and areas adjacent to applied mouldings, are thoroughly sanded in order to provide adhesion of the repair top coat. Areas sanded to the base metal (cut through) should be treated with an acid cleaner such as Metalprep (distributed by Amchem Products Inc.). Follow the directions of the supplier as stated on the container.

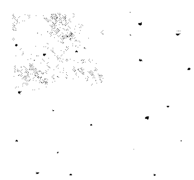
After sanding, proceed with the application of a primer surfacer reduced according to the supplier's recommendations to any bare metal spots that have been exposed. After the recommended air dry time, sand the primer surfacer with No. 400 grit paper before application of the repair material. The lacquer or enamel used should be reduced as recommended by its supplier.

PAINT DEFECTS AND REPAIR PROCEDURES

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. 8 and 9). 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.



M1004-A

FIG. 8 Random Blisters

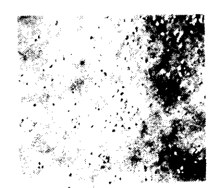


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FIG. 9 Pattern Blisters

Acrylic Enamel. Repair by repainting (color coat). Priming procedure must first be followed if defect is due to poor metal preparation.

CHECKING

Line checking has the appearance of thin, straight lines criss-crossing each other (Fig. 10). These lines may be from one-half inch to four inches or longer, increasing in length as the finish ages.

Acrylic Enamels. Refinish panel. (Color coat—primer if damaged.)

CHIPPING AND STONE BRUISES

Chipping occurs when the surface of the finish coat of paint has been

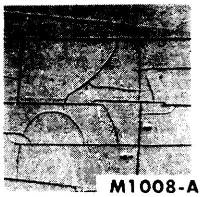


FIG. 10
Line Checking

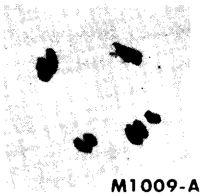


FIG. 11
Chipping

broken by a sharp blow, and small particles of paint have flaked off (Fig. 11). Frequently, stone bruises result in chipping (Fig. 12).

Acrylic Enamel. Refinish panel. Paint may be spotted if in **isolated** areas. (Prime it to bare metal.)

CRACKING

Cracking is evidenced by the paint curling. Frequently, cracking starts at the edge of the panel (Fig. 13). This is caused by poor mixing of paint or by temperature changes during the various painting stages.

Acrylic Enamel. Refinish panel. (Prime if both color and primer cracking.)

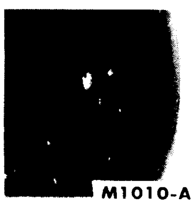


FIG. 12
Bruises

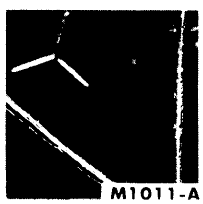


FIG. 13
Cracking

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. 14). 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.

Acrylic Enamel. Refinish panel. (Color coat.)

DIRT IN PAINT

Patches where dirt appears (Fig. 15) are sometimes confused with blistering. To verify the condition, prick the suspected areas, and note whether there is foreign material under the surface.

Acrylic Enamel. Polish repair procedure will be effective in most cases. (Color coat.)

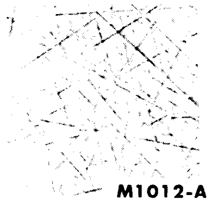


FIG. 14
Crow Footing

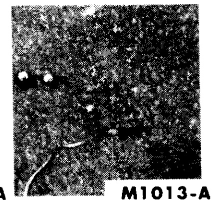


FIG. 15
Dirt in Paint

MILDEW

Mildew growth, which occurs along radial lines (Fig. 16) is most commonly found in a very dark gray or black color.

Acrylic Enamel. Repair by polishing.

OFF-COLOR

The term off-color is applied to adjacent areas on which the colors do not match (Fig. 17). It may also appear when making spot repairs.

Acrylic Enamel. Refinish panel if polishing does not correct condition. (Color coat.)

FIG. 16
Mildew

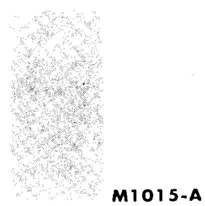


FIG. 17
Off Color

ORANGE PEEL

Orange peel is a term used to describe an uneven, mottled appearance on the paint surface (Fig. 18). This is usually caused by improper thinning of the paint.

Acrylic Enamel. Refinish panel if polishing does not correct condition. (Color coat.)

OVERSPRAY

Overspray is evidenced by a rough, dull finish in the area surrounding the paint repair (Fig. 19).

PEELING

Peeling ocurs when large areas of the finish or primer coat separate from the metal or prime coat (Fig. 20). This is usually caused by wax, grease, rust, or oil under the paint. Do not confuse with orange peel.

PITS AND POP-UPS

Pits and craters may be identified by the appearance of small round

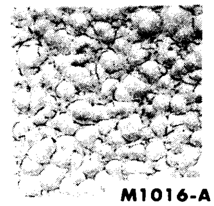


FIG. 18
Orange Peel

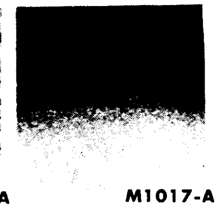


FIG. 19
Overspray

depressions in the paint (Figs. 21 and 22). 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.

Acrylic Enamel. First use polish repair procedure, refinish panel if necessary. (Color coat.)

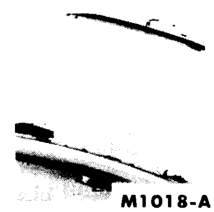


FIG. 20
Peeling

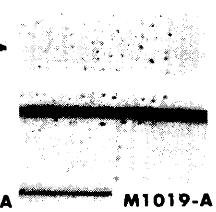


FIG. 21
Pits

THIN PAINT

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. 23).

Acrylic Enamel. Refinish panel. (Color coat.)

RUNS AND SAGS

The uneven collections of paint on the finish surface are referred to as runs or sags (Fig. 24). 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. 25). This is usually caused by overapplication of paint or hesitation in the stroke of the gun.

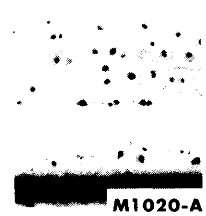


FIG. 22
Craters

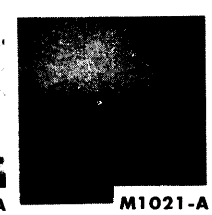


FIG. 23
Thin Paint

FIG. 24 Runs and Sags

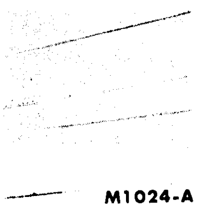
FIG. 25 Wrinkles

Acrylic Enamel. Use polish repair procedure.

SCRATCHES

Scratches are thin marks or tears that may partially or completely penetrate the surface of the finish coat of paint (Fig. 26).

Acrylic Enamel. Use polish repair procedure for shallow penetration. Refinish panels to correct conditions of deep penetration.



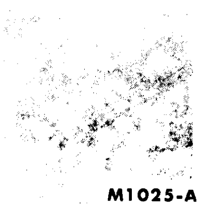


FIG. 26 Scratches

FIG. 27 Water Spotting

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.

Acrylic Enamel. Use polish repair procedure.

WATER SPOTTING

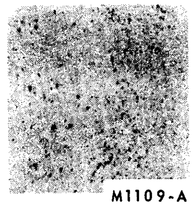
Water spotting is evidenced by a milky pattern where water drops have fallen (Fig. 27).

Acrylic Enamel. Use polish repair procedure.

INDUSTRIAL FALL-OUT

Industrial fall-out is the result of particles being exhausted into the air by the various processes of heavy industry, or in areas where there is a concentration of industry.

Industrial fall-out particles appear to the eye as tiny rust-colored dots on the paint film and the surface will feel rough to the touch (Fig. 28). Some of the particles have excellent adhesion and are difficult to remove. However, the following pro-



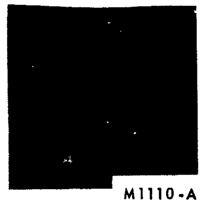


FIG. 28 Industrial Fall-Out

FIG. 29 Organic Fall-Out

cedure has proven effective in the removal of this fall-out:

1. Wash the car with car wash compound (C0AA-19B521-A) to remove loose dirt. Rinse well and examine painted surfaces for iron base fall-out particles. If there is a significant quantity of fall-out not removed by ordinary washing, the oxalic treatment should then be used. All cracks, ledges, grooves, etc., where fall-out has accumulated, should be cleaned by wiping or by air blow-off.

2. Dissolve six to eight ounces of oxalic acid (dry) in one gallon of warm water and add one to two tablespoonsful of a non-alkaline detergent such as car wash compound (C0AA-19B521-A). This acid detergent solution must be prepared and kept in a clean non-metallic container.

Apply this solution liberally to all affected surfaces of the car with a large sponge. Use a broad wiping stroke and keep the work completely wet for about 15 minutes, or until the operator can no longer feel any surface roughness or even isolated gritty particles with bare or gloved finger tips. If this is not done thoroughly, rust staining may soon redevelop. Be sure that the entire acid cleaning procedure is performed in a sheltered area so that the work will be kept as cool as possible to prevent rapid evaporation of water and consequent surface drying. **Do not work in the sun.**

3. Rinse with clear water. This must be done very thoroughly to prevent possible corrosion.

No traces of acid should be left on any surface. Bright trim parts, particularly anodized aluminum and stainless steel, may be stained by prolonged contact with the cleaning solution. Painted areas also can be spotted by prolonged exposure. It is also important to keep the oxalic acid cleaner solution from leaking to the inside of the car because some fabrics might be bleached or discolored by the solution.

If the fall-out is not completely removed or is deeply imbedded in the paint film, cleaning with the acid detergent mixture must be repeated. This may be aided by using a fine scrub brush, possibly a nylon bristle type. Make sure that the light scrubbing required does not scratch the paint. It is sometimes helpful to briskly rub the work with a mixture of equal parts of oxalic acid cleaner and FoMoCo cleaner wax polish (8A-19519-A) using a piece of heavy toweling. Again, a thorough water rinsing is extremely important.

Sometimes small black spots remain after the oxalic cleaning has removed all iron based fall-out. Such deposits might be asphaltic or they might be over-spray. These usually can be removed by rubbing vigorously with a cloth saturated with a mixture of kerosene and Actusol (about five parts of kerosene to one part of Actusol). Any residue of this solvent mixture may be readily flushed off with water.

ORGANIC FALL-OUT

Organic fall-out may result from parking cars under trees or from the air under certain atmospheric conditions (Fig. 29).

Acrylic Enamel. Refinish damaged panels. (Color coat and primer.)

INTERIOR PAINT REPAIRS

The proper matching of colors can be obtained if the following procedures are carefully adhered to:

1. Clean the surface to be painted with wax and silicone remover.

2. Feather-edge the damaged area with 400 grit wet or dry sandpaper. (Prime all areas of bare metal with M-6J-12S Primer.)

3. Mix the paint per instructions on the can and spray several light coats.

Allow the paint to become tacky between coats.

4 Spray the entire area sparingly with B7A-645-S Lacquer Leveler which will blend the repaired area with existing painted surfaces.

3 CLEANING AND INSPECTION

BODY MAINTENANCE

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.

All bolts and screws should be tightened periodically. 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 anti-squeak 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, located on the underside of each rocker panel and quarter panel, should be cleared periodically.

Regular body maintenance 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.

EXTERIOR AND INTERIOR CLEANING

Exterior Cleaning. The outside finish should be frequently washed. Never wipe the painted surfaces with a dry cloth. Dusting the finish when it is dry tends to rub the dust and dirt into the baked enamel, and leaves a sandpaper effect on the surface. To keep finish bright and attractive, and eliminate the necessity of using polish, wash the car whenever it has accumulated a moderate amount of dirt and road salt.

The bright metal parts of the car require no special care. Periodic cleaning will preserve the beauty and life of these finishes. Wash with clear water or if the parts are very dirty use a mild soap. Using a clean soft cloth or a sponge and water, rinse and wipe the parts dry. FoMoCo Chrome Cleaner may be used sparingly to remove rust or salt corrosion from chrome plated parts. Do not scour chrome finished parts with steel wool or polish them with products containing abrasives. A FoMoCo Polish will provide excellent protection for all bright metal parts.

Interior Cleaning. Use a broom or a vacuum cleaner to remove dust and dirt from the upholstery or floor covering. Vinyl and woven plastic trim that is dusty can usually be cleaned with a damp cloth.

Dirty or stained upholstery can be cleaned with FoMoCo Interior Trim Cleaner. This cleaner may be used on leather, plastic, vinyl, imitation leather, fabric upholsteries, rubber mats, and carpeting. Be sure to follow the directions on the cleaner container.

PART 17-2 FRONT END SHEET METAL, BUMPERS AND EXTERIOR MOULDINGS

1 COMMON ADJUSTMENTS AND REPAIRS

HOOD AND HOOD LOCK

Adjustment points are provided at the hood hinges (for alignment of the rear and sides of the hood with the adjacent sheet metal). The rubber bumpers (for height of the front edge of the hood), the lock striker and dowel (for proper latching of the hood) and the safety latch (for proper retention of the hood in the unlocked position) (Figs. 1 through 4).

Any adjustment of the hood panel height to the cowl or fenders can be made at the hinge-to-body bolts (Fig. 2). Side-to-side and fore-and-aft movement of the hood to obtain equalization of the rear and side edge clearance can be made at the hinge-to-hood bolts (Fig. 2).

Adjustable rubber bumpers at the forward corners of the hood permit adjustment of the front edge for height (Fig. 1).

The hood lock striker assembly (Fig. 3) is adjustable fore-and-aft and side-to-side to provide correct alignment to the dowel on the hood. The lock dowel is adjustable up-and-down so that tension is maintained to keep the hood tightly seated on the front rubber bumpers and firmly closed (Fig. 4).

The safety latch can be adjusted fore-and-aft to obtain positive engagement with the lock striker.

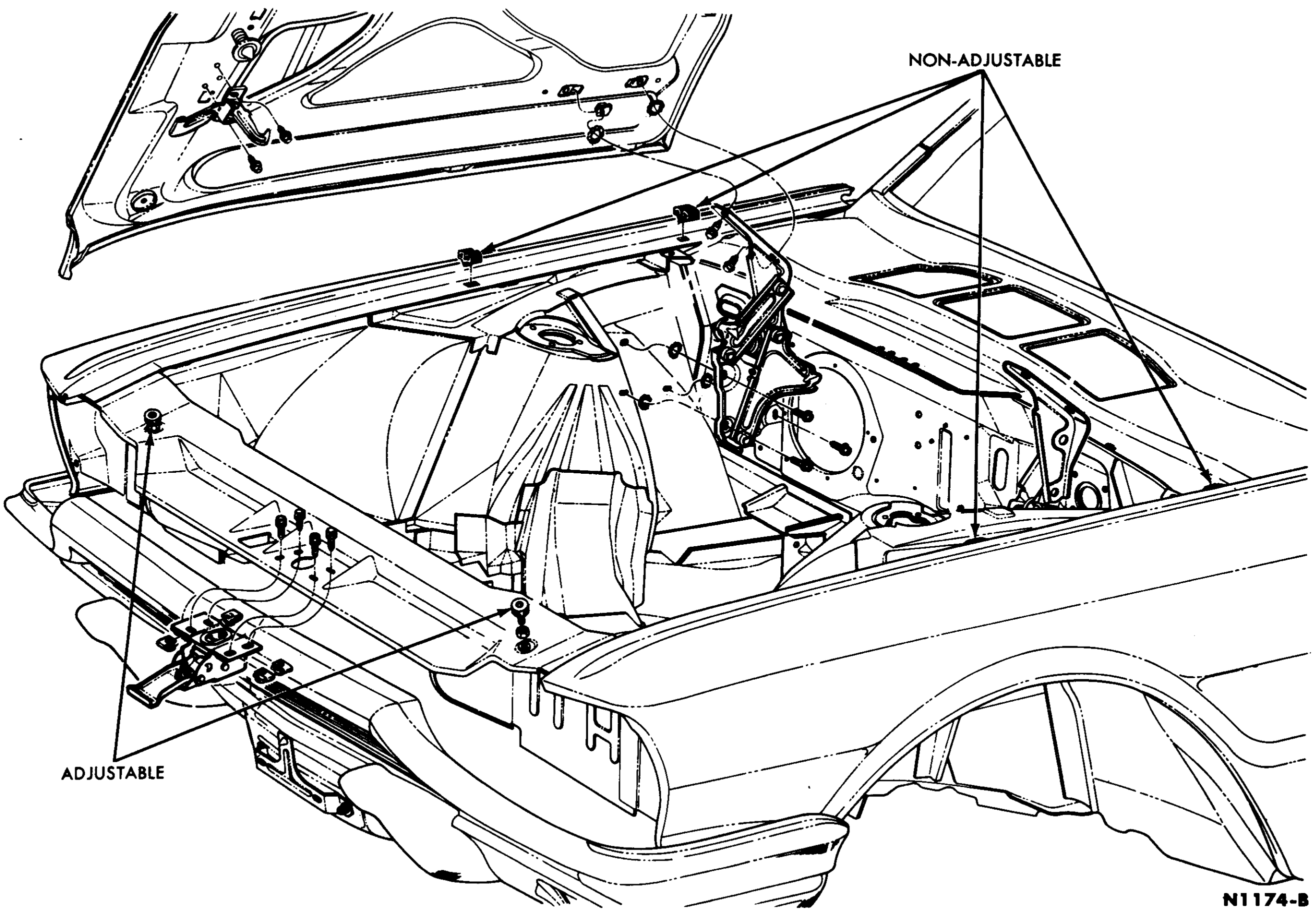


FIG. 1—Hood Adjustments

2 REMOVAL AND INSTALLATION

HOOD

1. Protect the body with covers to avoid scratches. Then obtain assistance to remove the hood. Remove the hood hinge-to-hood bolts (Fig. 2).

2. With the help of an assistant, position the hood on the hinges and install the hood hinge-to-hood bolts.

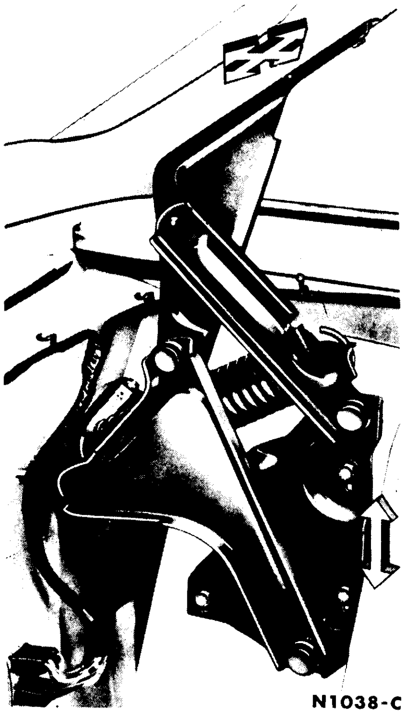


FIG. 2—Hood Alignment

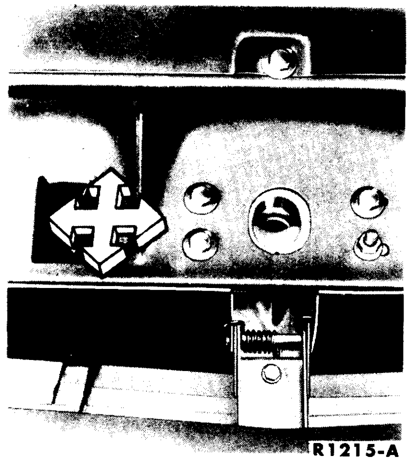


FIG. 3—Hood Lock Adjustment

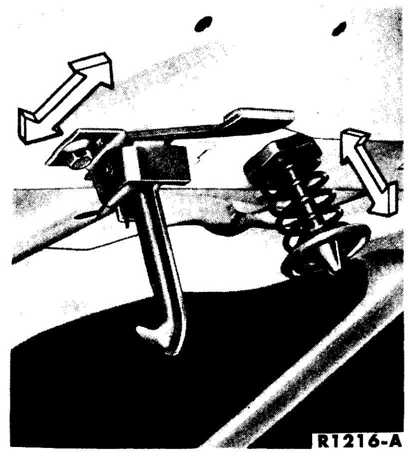


FIG. 4—Hood Lock Dowel and Safety Latch Adjustment

Check the hood alignment and correct as necessary. Check the hood height at the front and adjust the front rubber bumpers if necessary. Check the hood lock dowel for proper entry into the striker and for dowel height and adjust as necessary.

HOOD HINGE

1. Support the hood in the open position, and cover the fender and cowl panel.

2. Remove the hinge-to-hood re-

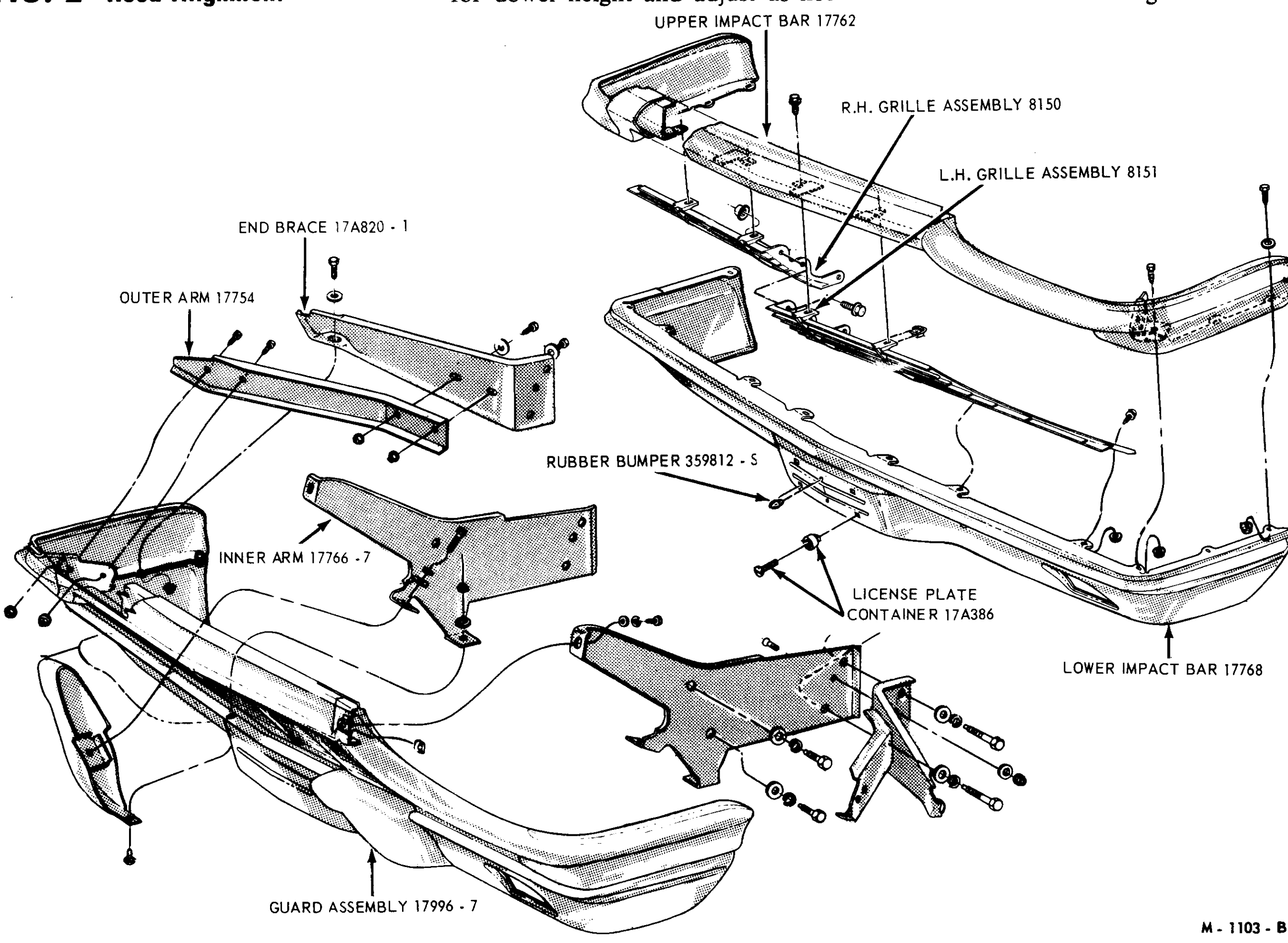


FIG. 5—Front Bumper

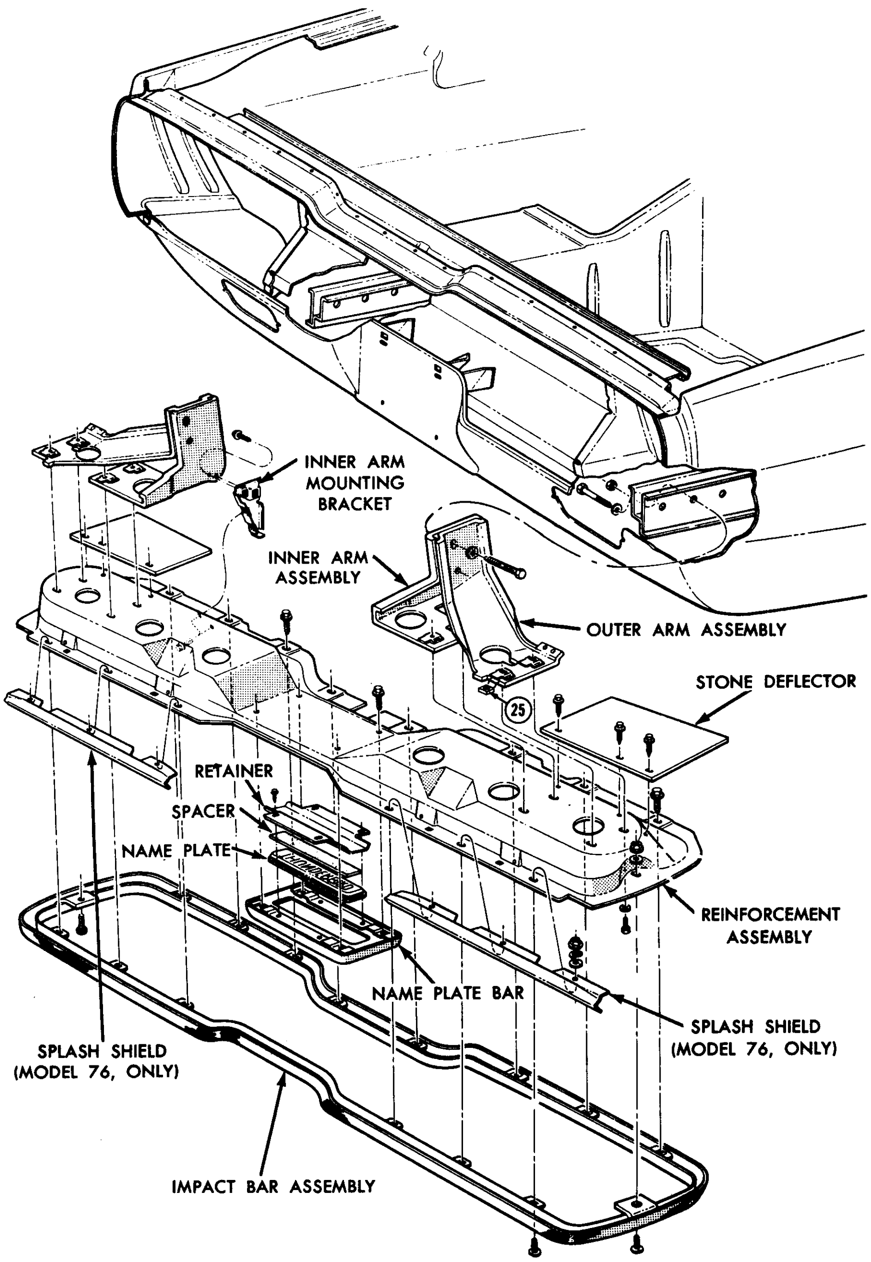


FIG. 6—Rear Bumper Installation

taining bolts, the hinge to body bolts (Fig. 2), and remove the hinge.

3. Position the hood hinge on the body and loosely install the hinge retaining bolts.

4. Align the hood and tighten the retaining bolts.

HOOD LOCK

1. Remove the hood lock retaining bolts (Fig. 3) and remove the lock assembly.

2. Position the lock and loosely install the retaining bolts.

3. Align the hood lock to the dowel (Fig. 3) and tighten all lock retaining bolts. Apply Lubriplate to the locks.

FRONT BUMPER

1. Disconnect the left and right hand parking light wires.

2. Remove the bolts and nuts retaining the bumper assembly to the underbody side rails (Fig. 5). With an assistant, remove the bumper and grille assembly with attaching brackets.

3. Remove the grille-to-bumper impact bar retaining bolts (Fig. 5) for the upper or lower bar being replaced.

4. Remove the upper impact bar-to-lower impact bar and bracket retaining nuts and bolts (Fig. 5) and remove the impact bar being replaced.

5. Remove the left and right hand parking light assemblies if replacing the lower bar.

6. Remove the license plate bracket retaining bolts and nuts and remove the license plate bracket if replacing the lower bar.

7. Position the license plate bracket on the lower impact bar and install the retaining bolts and nuts.

8. Apply sealer around the parking light housing assemblies, position the assemblies in the lower impact bar and install the retaining rings and nuts.

9. Position the upper impact bar on the lower impact bar and grille assembly. Position the bumper arms and braces on the bumper assembly and install the retaining nuts and bolts (Fig. 5).

10. Install the grille-to-upper impact bar retaining bolts.

11. With an assistant, position the bumper and grille assembly on the car. Install the bolts and nuts retaining the bumper assembly to the underbody side rails.

12. Connect the parking light wiring connectors.

GRILLE

1. Remove the bumper guard to lower impact bar retaining nuts and bolts and remove one bumper guard to allow room for grille removal.

2. Remove the grille-to-bumper assembly retaining bolts and nuts.

3. Remove the grille assembly.

4. Position the grille assembly in the bumper assembly and install the grille retaining bolts and nuts.

5. Position the bumper guard on the lower impact bar and install the retaining nuts and bolts.

REAR BUMPER

1. Disconnect the rear lamp wiring connectors.

2. Remove the right and left rear lamp lens retaining screws and remove the rear lens.

3. Remove the inner and outer

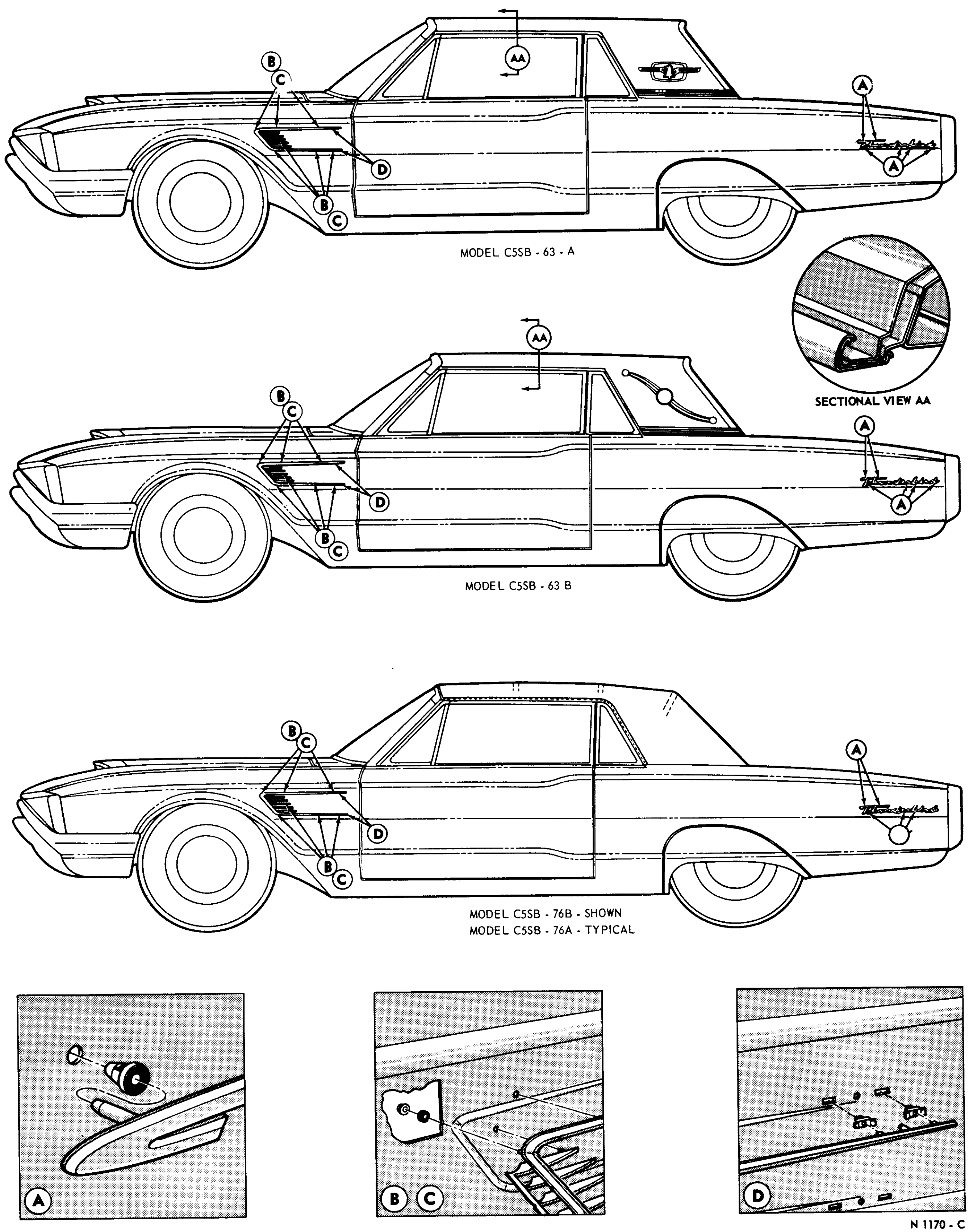


FIG. 7—Body Exterior Mouldings

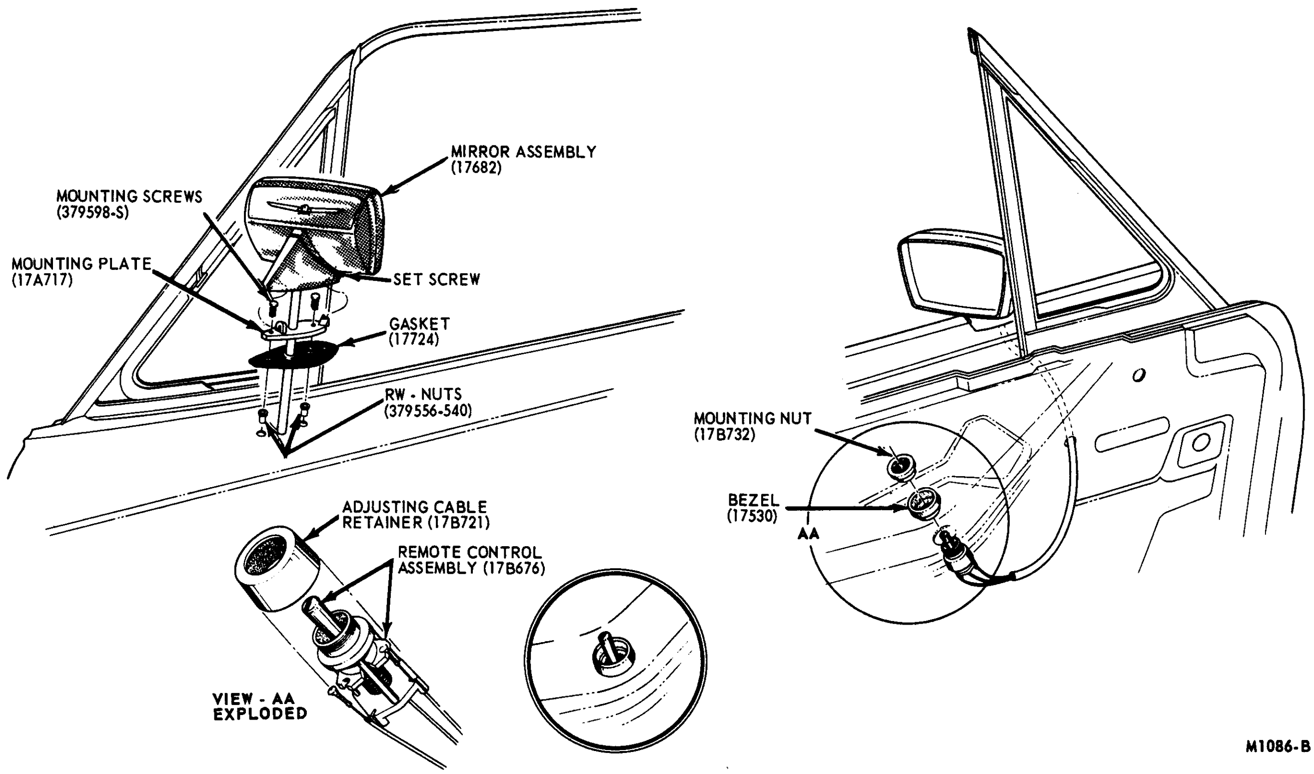


FIG. 8—Remote Control Rear View Mirror

arm-to-rear side rail retaining bolts and remove the bumper assembly (Fig. 6).

4. Remove the name plate-to-reinforcement bar retaining screws. Remove the name plate (Fig. 6) and name plate spacer.

REMOTE CONTROL REAR VIEW MIRROR

The remote control rear view mirror is controlled from inside the car. Adjustment is made with the control knob which is located on the left front door trim panel.

Movement of the control knob operates three cables which control the movement of the mirror. The cables are securely attached to the mirror and no attempt should be made to remove or replace the cables.

1. Remove the mirror control retaining nut and washer from the control (Fig. 8).

2. Remove the trim panel from the door.

3. Disconnect the three control cables from the control head.

4. Attach a piece of lead wire to the control cables.

5. Remove two mirror attaching screws and remove the mirror from the door, carefully pulling the control cables and attached lead wire thru the door.

6. Disconnect the lead wire from the control cables and attach the wires to the replacement mirror cables.

7. Install the mirror on the door, using the covered wire to route the control cables through the door.

8. Disconnect the lead wire from the cables and connect the cables to the control head. Be sure to install the retainer over the cables after they are installed.

9. Position the control head in the trim panel opening and install the bezel and retaining nut. **Be sure that the key on the control head is engaged into the keyway in the plastic bracket on the trim panel before installing the bezel and retaining nut.**

10. Install the door trim panel.

EXTERIOR MOULDINGS

The exterior mouldings and various methods of retaining the mouldings are shown in Fig. 7. To remove the mouldings secured with nuts, it will be necessary to remove the interior trim panels in the roof quarter area.

Removal of the windshield and back window mouldings is covered in Part 17-3.

PART 17-3 DOORS, WINDOWS AND DECK LID

1 DIAGNOSIS AND TESTING

POWER WINDOW TROUBLE CHECKS

Before making any of these checks, make sure that the battery is fully charged, the ignition switch is in the accessory position and that the master lock-out switch is in the unlocked position.

Refer to Wiring Diagram Manual Form 7795P-65 for schematics and locations of wiring harnesses.

ALL WINDOWS DO NOT OPERATE

1. Connect a voltmeter or test light from a ground to the power window circuit breaker red-blue stripe wire connected to the 20-ampere circuit breaker in the fuse panel. If no voltage is available, replace the 20-ampere circuit breaker (and/or replace the connecting black wire from the starter relay if the other common fed circuit breakers controlling the horns or seats also do not function).

2. Connect a voltmeter from a ground to the red wire terminal of the power window relay. If no voltage is available, repair or replace the ignition switch (if other ignition switch controlled accessories also do not function), the circuit breaker in the fuse panel which also controls the heater circuit (further test will isolate this breaker), the wire from the ignition switch to heater circuit breaker, or the wire from this breaker to the relay.

3. Connect a voltmeter from a ground to the remaining terminal (black wire) of the power window relay. If no voltage is available, replace the power window relay.

4. Check the black wire at the master lockout switch for voltage. If no voltage is available, repair or replace the black wire from the master control switch to the power window relay.

5. At this point the trouble causing all windows not to operate should have been found and corrected. The chances of having all of the control switches, ground circuit breakers, switch to motor wires, or motors defective at the same time are very remote.

ONE WINDOW DOES NOT OPERATE

1. Disconnect the connector at the motor. Check for voltage at either of the colored wires (other than grey ground wire) when the switch is operated. If voltage is available, check the motor by grounding the grey wire from the motor and applying a 12-volt source to the colored wires one at a time. Replace the motor if it does not function when so tested. Replace the grey ground wire if the motor functions normally.

2. In case there is no voltage at the color coded red or yellow wire terminals when the switch is operated, check for voltage at the switch black wire terminal. Replace the switch if there is voltage at the black wire terminal and none at the color coded red or yellow wire terminals. Repair or replace the black wire if no voltage is available at the switch.

WINDOW OPERATES IN ONE DIRECTION ONLY

1. Check the window operation with both switches. If the window operates properly with one switch and not the other, check the switch and the red and yellow wires for voltages. Replace the switch or the wires as necessary.

2. If both switches operate the window in only one direction, check the red and yellow wires at the motor for voltage. If voltage is available, a field coil is open and the motor must be replaced.

WINDOW OPERATES SLUGGISHLY

1. Check the regulator and window runs for binding. Adjust the runs, repair and lubricate the regulator. Lubricate the runs with silicone lubricant.

2. Check the frayed insulation where the wires may partially ground. Check for loose connections which will cause high resistance and make sure paint is not insulating the ground wires where they attach to the body.

3. Connect an ammeter between the black motor wire and a ground. Current draw for normal operation should not exceed 12 amperes maximum for door windows and 14 amperes maximum for quarter windows. Current draw when the mechanism is against a stop would be within 30-50 amperes, depending upon the motor temperature. If either check shows excessive amperage and the windows are properly adjusted, the motor should be replaced.

4. Disconnect the motor from the regulator. Connect an ammeter in series with the ground wire, and operate the switch. The motor no-load current draw should not exceed 14 amperes at 12 volts. If the current draw does not meet these specifications, the motor must be replaced.

2 IN-CAR ADJUSTMENTS AND REPAIRS

DOOR ALIGNMENT

The door hinges provide sufficient adjustment latitude to correct most misalignment conditions. The elongated holes where the hinges attach to the pillars provide fore-and-aft movement of the front door (Fig. 1).

The bolt holes where the doors attach to the hinges are enlarged.

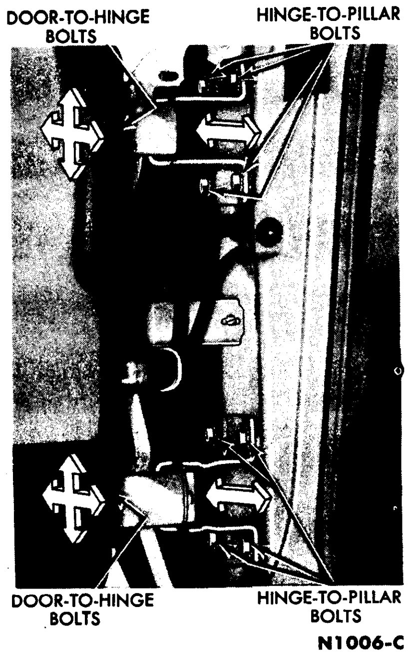


FIG. 1—Door Hinges

This permits a circular movement of the front door to obtain proper positioning of the door in its opening.

ALIGNMENT PROCEDURE

1. See Fig. 1 to determine which hinge bolts must be loosened to move the door in the desired direction.
2. Remove hinge-to-pillar access plates. Loosen the hinge bolts just enough to permit movement of the door with a padded pry bar.
3. Move the door the distance estimated to be necessary. Tighten the hinge bolts and check the door fit.
4. Repeat the operation until the desired fit is obtained, and check the striker plate alignment for proper door closing.

LOCK STRIKER ADJUSTMENT

The striker pin can be adjusted laterally and vertically (Fig. 2). **The striker should not be adjusted to correct door sag.** Move the striker laterally to provide a flush fit at the door and the quarter panel, and to tighten the fit of the weatherstrip to the body (being careful not to increase door closing effort).

The striker can be shimmed, if necessary, to obtain the clearance shown in Fig. 2 between the underside of the striker pin head and the lock jaws. To check this clearance, clean the lock jaws and the striker, then apply a thin layer of dark grease to the striker pin. As the door is closed and opened, a measurable pattern will result.

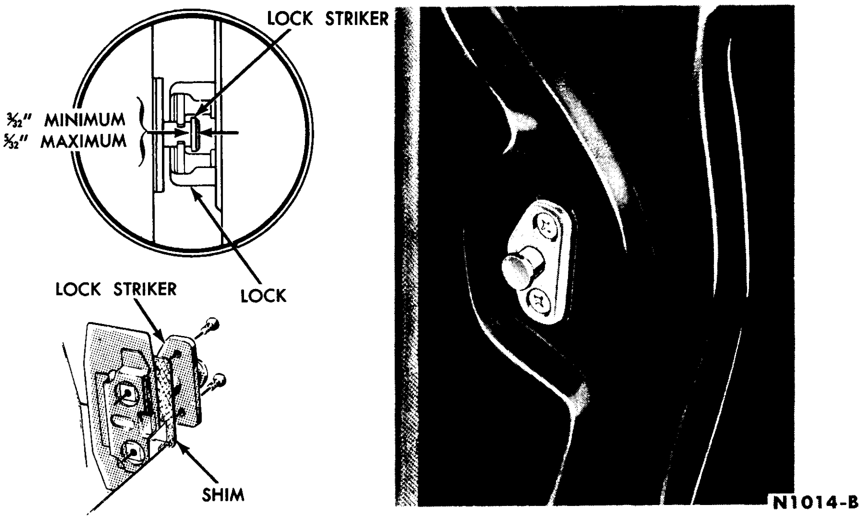


FIG. 2—Door Lock Striker Plate Adjustment

DOOR AJAR WARNING LIGHT SWITCH ADJUSTMENT

1. Remove the door trim panel. Peel back the watershield far enough to provide access to the door lock area.
2. Rotate the door lock striker teeth to the safety catch position. The warning light should be lit while the door lock is in the safety position.
3. Loosen the door lock warning light switch lock nut and screw the switch assembly into its mounting bracket until the warning light is on (Fig. 3).
4. Tighten the switch assembly locknut. Close and open the door several times to insure consistent lock assembly operation.
5. Install the door trim watershield and the door trim panel.

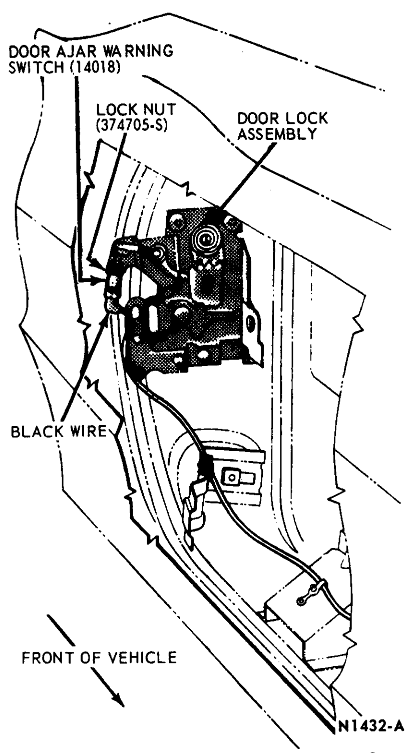


FIG. 3—Door Ajar Warning Light Switch Installed

DOOR WINDOW AND VENT ADJUSTMENT

Remove the door inside handles (Figs. 4 and 5), the door trim panel, and then carefully remove the door water shield to gain access to the vent and window adjustments.

VENT ADJUSTMENTS

To adjust the vent window assembly position in relation to the windshield pillar weatherstrip, the vent-to-outer panel screw (Fig. 6, View AA), the vent lower and front glass run lower adjusting screw lock nuts (Fig. 6, Items B and C) and the vent regulator shaft screws should be loosened. Movement of the vent assembly up-and-down can then be

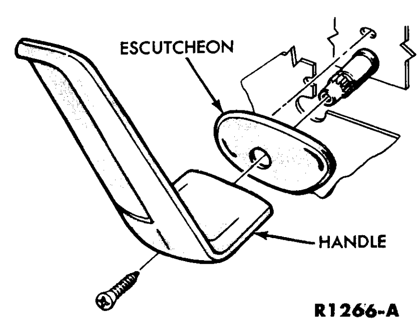


FIG. 4—Door Inside Lock Handle

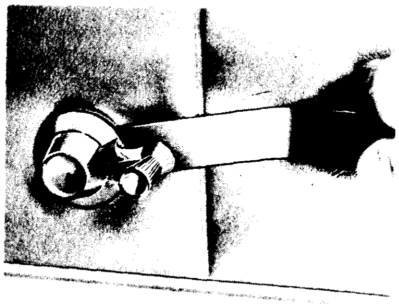


FIG. 5—Vent Handle Removal—Typical

made by loosening the vent-to-inner panel screws (Fig. 6, Item A). After tightening these screws, the in-and-out position of the top of the vent can be set to obtain correct interference with the windshield weatherstrip, correct alignment against the windshield side moulding and the top edge of the vent through tilting of the vent by adjustment of the lower screw (Fig. 6, Item B). The glass run lower screw should be set to eliminate any bind in the run. The regular handle shaft, vent-to-outer panel screw and all lock nuts and bolts should then be tightened.

DOOR WINDOW ADJUSTMENTS

Smooth operation of the door glass is adjusted by moving the vent and glass run assembly fore-and-aft as described in the preceding paragraph. To obtain the proper fit of the glass to the outer belt and roof rail weatherstrips, the tilt of the glass can be changed by adjusting the rear run (Fig. 6, Items D and F).

To hold the glass firmly in the up position, the two dovetails on the inner panel (Fig. 6, Item G) can be adjusted in-and-out. The height of the glass can be adjusted to obtain a flush fit at the vent assembly at the front dovetail retainer (Fig. 6, Item H). The rear dovetail retainer is adjusted to contact the glass and channel assembly rear dovetail at the same time as the front dovetail after the glass is adjusted to be parallel to the roof weatherstrip by adjusting the equalizer arm bracket (Fig. 6, Item F).

Install and seal the door water shield as shown in Fig. 7, then install the trim panel and inside handles.

QUARTER WINDOW ADJUSTMENT

To remove the quarter trim panel

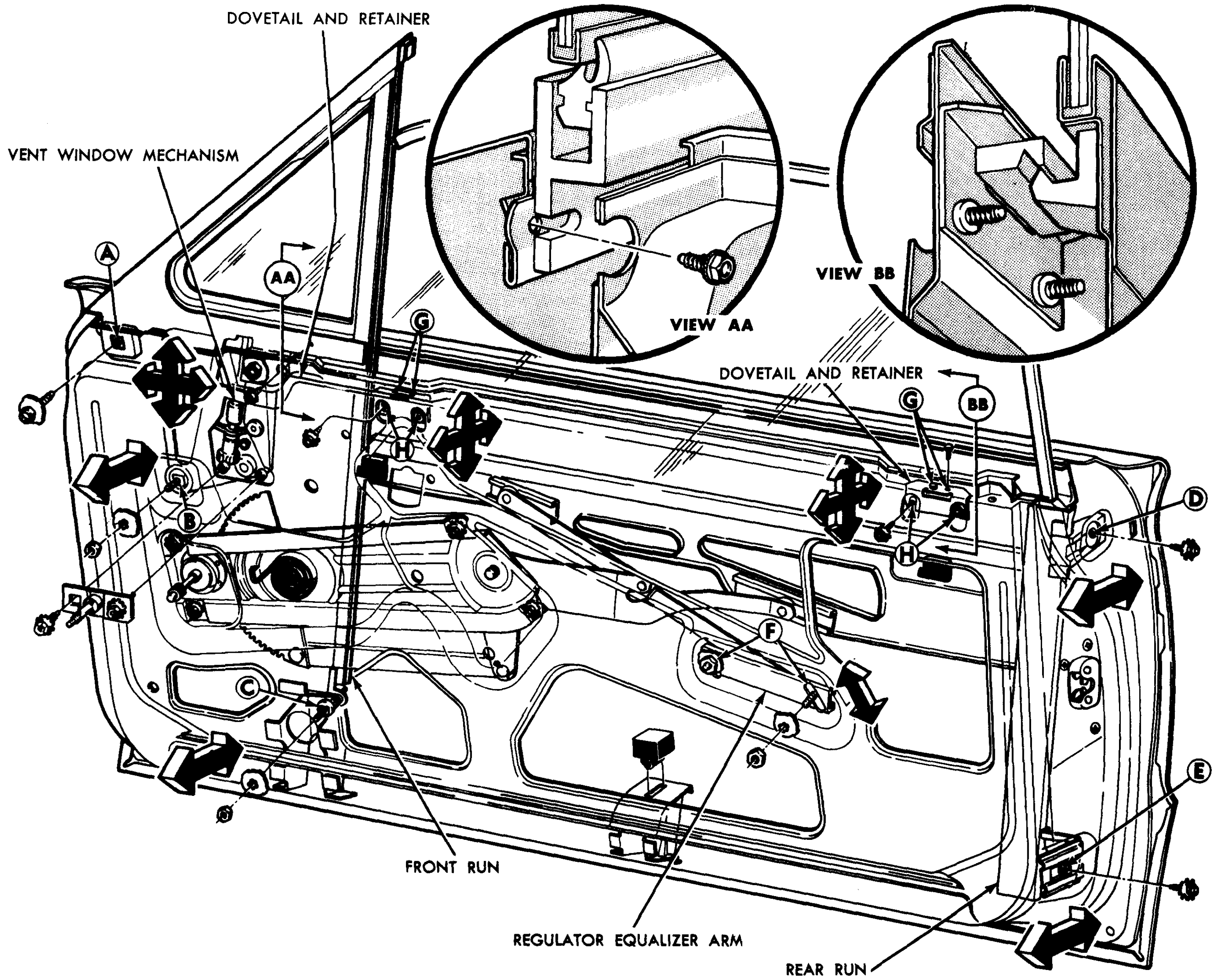


FIG. 6—Vent and Door Window Adjustment

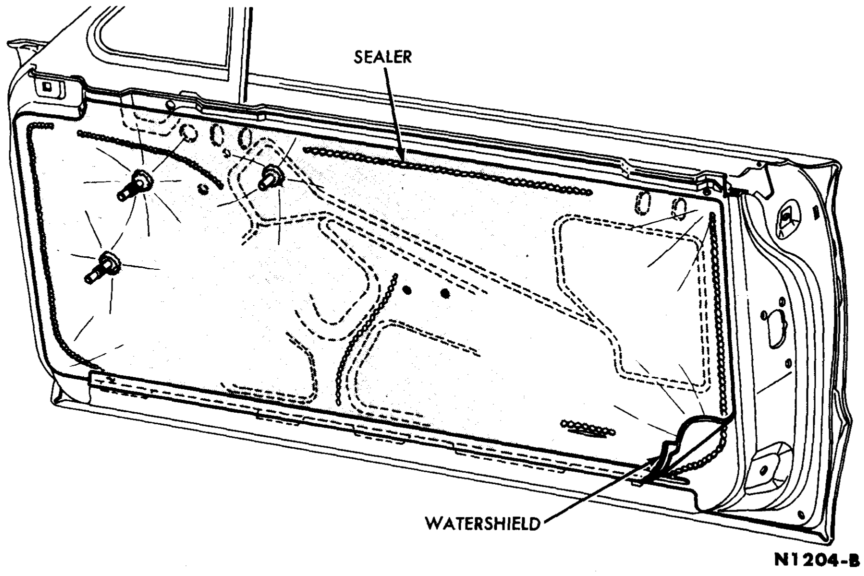


FIG. 7—Door Water Shield Installation

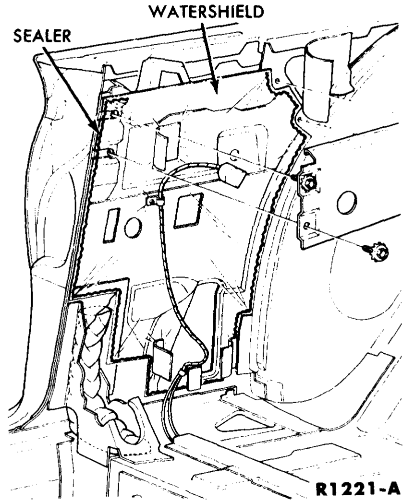


FIG. 9—Quarter Water Shield Installation

for access to the quarter window adjustments, the arm rest, rear seat cushion and rear seat back must be removed as follows:

1. Remove the arm rest screws and remove the arm rest.
2. Lift up on the front edge of the rear seat cushion and pull the cushion forward and out of the car.
3. Remove the rear seat back re-

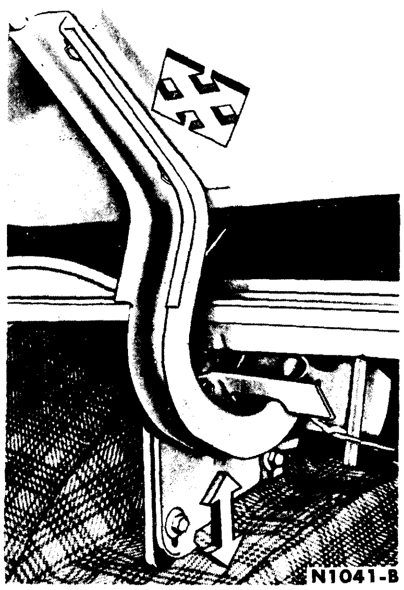


FIG. 10—Deck Lid Hinge and Adjustment

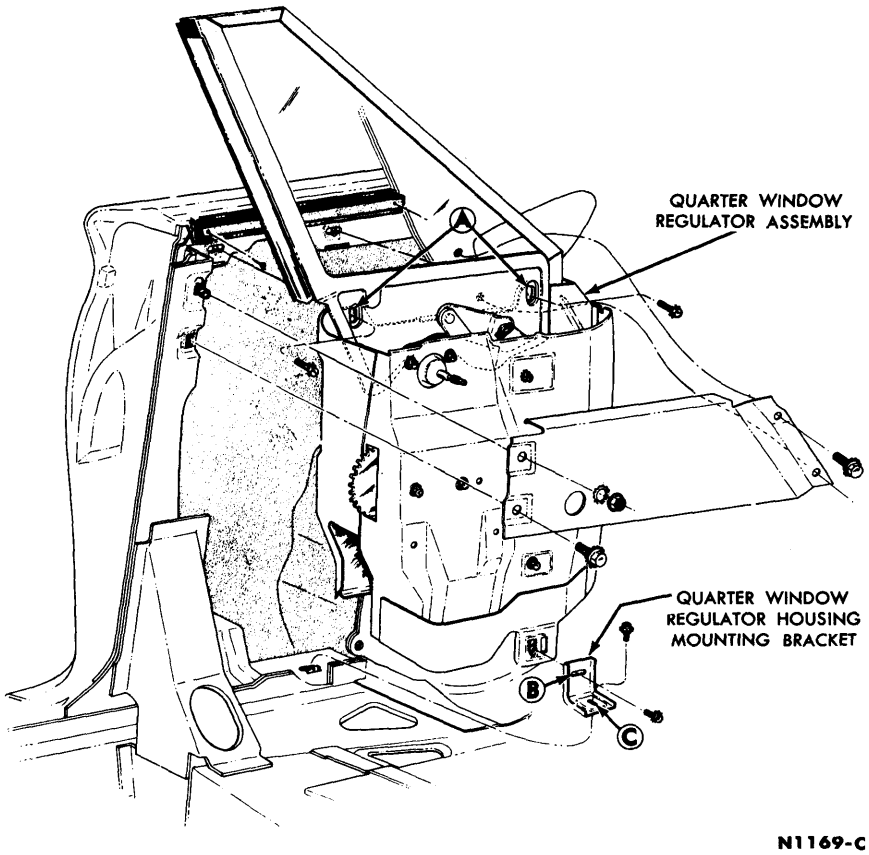


FIG. 8—Quarter Window Adjustment

FIG. 11—Deck Lid Lock Adjustment

taining screws (Fig. 9), and lift the seat back upwards off the upper retainers.

4. Remove the quarter window handle (Fig. 5), the trim screws and the trim.

5. Remove the quarter inner side belt rail, then carefully pull back the water shield at the top and bottom.

The quarter window can be adjusted up-and-down and fore-and-aft to set its position to the door window and roof rail weatherstrip by loosening the upper bolts (Fig. 8, Item A) and the lower bracket-to-window assembly bolt (Fig. 8, Item B). The window assembly can then be tilted in-and-out at the top for alignment to the roof weatherstrips by loosening the lower bracket-to-body bolt (Fig. 8, Item C). Securely tighten all bolts after adjustment.

Install and seal the quarter window water shield as shown in Figure 9, then install the quarter inner belt rail, trim panel, handle, seats and arm rest.

DECK LID ALIGNMENT

The deck lid can be shifted fore-and aft, up-and-down, and from side-to-side as shown in Fig. 10. Care should be taken not to distort or mar the deck lid or body panel so that an unsightly appearance results.

DECK LID STRIKER PLATE ADJUSTMENT

The deck lid striker plate (Fig. 11) can be adjusted up-or-down by loosening the bolts and moving it to the desired position. If lateral movement of the striker plate is required, it can be tilted slightly to obtain free operation of the lock.

3 REMOVAL AND INSTALLATION

DOORS

Replacement doors are furnished as a sheet metal shell in prime paint. They have no hinges, trim, glass or hardware. When a door is replaced, transfer all usable parts from the old door to the new one, and replace any parts which are damaged beyond repair.

Repair any dings or dents in the new door which may have occurred in handling and storage. Sand, paint, and install the weatherstrip on the new door before assembly.

1. Remove all usable hardware, the trim panel and the plastic water shield. Remove the window and lock components.

2. Slide the door off the hinges. If a hinge is damaged, remove the hinge pillar bolts, and replace the hinge (Fig. 1).

3. Position the door on the hinges, tighten the bolts finger-tight, align the door, and tighten the bolts securely.

4. Install the window and lock mechanisms, glass and vent window assemblies. It may be necessary, at this time, to perform a final door alignment to obtain a satisfactory weather seal at the windshield pillar and/or the roof rail.

5. Install the plastic water shield, and the interior trim panel.

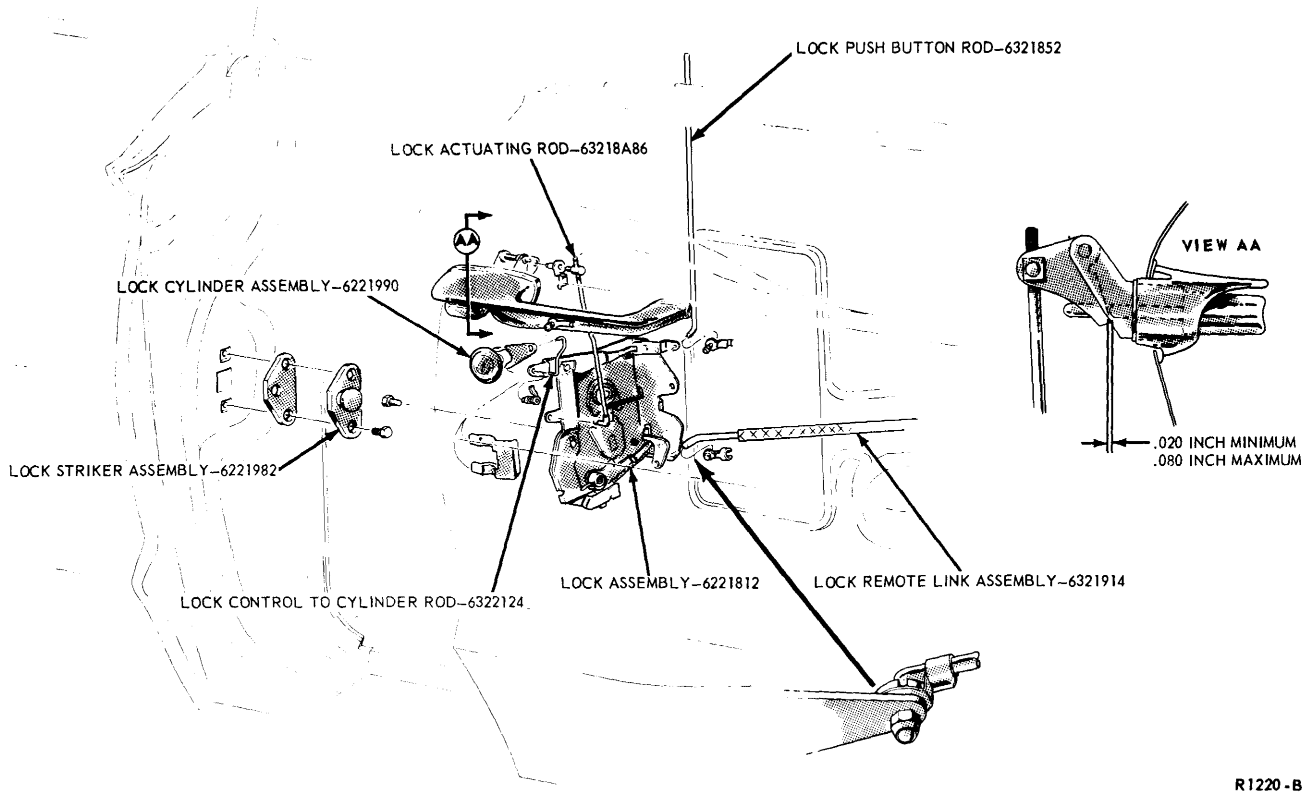


FIG. 12—Door Lock Mechanism

DOOR LOCK

Design of the door lock assembly permits keyless locking of the doors. To lock the door without the use of the key, depress the inside door lock control rod. Then, close the door while depressing the outside door handle push-button.

The door lock key has teeth cut into both sides of the blade to allow insertion into the lock cylinder either way as compared to previous design which permitted key entry with the teeth up only.

1. Raise the door glass, and remove the door trim panel. Loosen the water shield enough to reveal the door panel access holes.
2. Disconnect the remote control link at the lock (Fig. 12), the lock cylinder and at the lock and the outside handle push button at the push button.
3. Remove the screws retaining the lock to the door panel, remove the lock assembly, with the link attached, from the door.
4. Transfer the lock assembly link to the new lock assembly.
5. Install the lock assembly to the door panel. Connect the lock cylinder link to the lock assembly. Connect the remote control link to the upper bellcrank. Connect the outside handle push button to the handle.
6. Check the door lock mechanism for ease of operation and adjust the outside push button as required.
7. Install and seal the door water shield and trim panel.

LOCK CYLINDER

When a lock cylinder is replaced, both door lock cylinders and the ignition lock cylinder should be replaced in a set. This will avoid carrying an extra key which will fit only one lock.

The key code is stamped on the door and glove box lock cylinders.

1. Remove the door trim panel and pull the water shield away from the door access holes.
2. Disconnect the lock link at the cylinder, and remove the cylinder retainer and lock cylinder (Fig. 12).
3. Insert the cylinder in the door, install the cylinder retainer, and connect the lock link to the cylinder.
4. Install the door water shield and trim panel.

DOOR LOCK REMOTE CONTROL

1. Raise the window to the closed position, remove the door trim panel, and loosen the plastic water shield enough to reveal the lower access hole and the remote control rod access hole (Fig. 12).
2. Reach through the remote control rod access hole and disconnect the remote control rod at the bellcrank (Fig. 12).
3. Remove the 3 screws retaining the remote control assembly. Disconnect the remote control rod from the retaining clip and remove the remote control.
4. Transfer the remote control rod to the new remote control. Position the lock remote control in the door and loosely install the 3 retaining screws.
5. Connect the remote control rod retaining clip, and then connect the rod to the bellcrank.
6. Tighten the lock remote control retaining screws. Install and seal the plastic water shield, the door trim panel, and the hardware.

DOOR OUTSIDE HANDLE

1. Raise the door glass and remove the door trim panel. Loosen the water shield enough to gain access to the lock.
2. Disconnect the outside push button-to-lock rod at the push button.
3. Remove the door handle screws (Fig. 13) and remove the handle.
4. Position the handle to the door with the two rubber pads and install the handle retaining screws.
5. Connect the push button-to-lock rod to the handle and adjust as required.
6. Install and seal the water shield, then install the door trim panel and hardware.

VENT WINDOW

1. Remove the door trim panel, and loosen the water shield enough to reveal the door panel access holes.

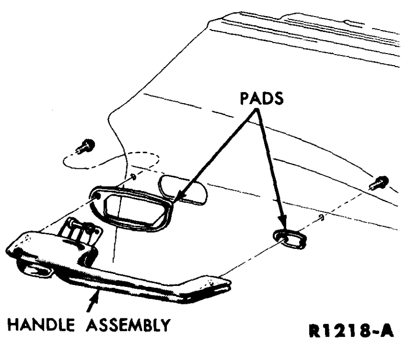


FIG. 13—Door Outside Handle

2. Remove the two bolts retaining the vent window assembly to the door inner panel (Fig. 6, Item A) and the screw retaining the vent to the outer panel (Fig. 6, View AA).
3. Remove the front run lower retaining nut and washer (Fig. 6, Item C).
4. Remove the vent window adjusting screw nut and washer (Fig. 6, Item B).
5. Turn the vent window adjusting screw and the front run adjusting screw in enough to clear the door inner panel.
6. Remove the vent window regulator shaft.
7. Remove the screw retaining the door weatherstrip to the leading edge of the vent window frame and pry the weatherstrip from the frame.
8. Remove the vent window and division bar as an assembly.
9. Transfer or replace the front run assembly to vent window and division bar assembly.
10. Remove the run and division bar assembly from the vent window.
11. Remove the vent window regulator and coupling. Then, remove the vent window upper hinge to vent glass retaining screws, and remove the vent glass and retainer.
12. To replace the vent window weatherstrip, remove the vent window frame weatherstrip retaining screws and remove the weatherstrip. Apply a rubber lubricant to the new weatherstrip. Then, position the weatherstrip to the vent window frame. Install the weatherstrip retaining screws.
13. Position the vent glass and retainer assembly with the stop washers to the vent frame. Install the vent window regulator coupling and regulator. Then, install the vent hinge retaining screws.
14. Position the vent window assembly into the door, being careful to align the front run with the leading edge of the door glass.
15. Install the vent window frame to door panel retaining bolts.
16. Install the vent frame adjusting screw washer and retaining nut, and snugly tighten the screw.
17. Loosely install the window run lower adjusting screw washer and retaining nut.
18. Install the door weatherstrip with cement and retaining screw.
19. Adjust the vent window assembly to the body opening (see Section 1), and tighten the retaining nuts and bolts.

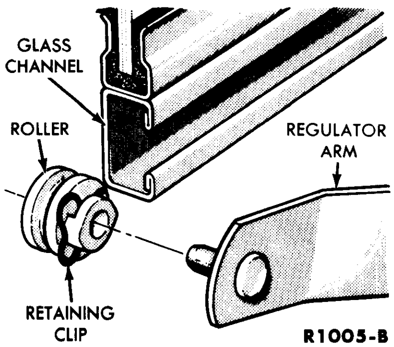


FIG. 14—Glass Channel Roller

20. Install the water shield and the trim panel.

DOOR GLASS

1. Remove the trim panel and loosen the water shield enough to reveal the access holes.
2. Remove the rear run retaining screws and position the run in the bottom of the door (Fig. 6).
3. Disconnect the regulator arms from the glass channel roller assembly by pulling the roller clip out to release the regulator arm pin (Fig. 14).
4. Remove the window upper stops (Fig. 6).
5. Remove the glass assembly, through the top opening of the door.

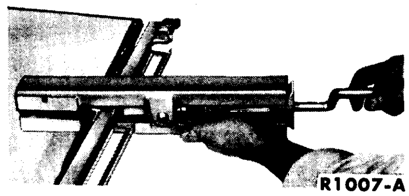


FIG. 15—Glass Channel Removal and Installation

6. Remove the glass frame retaining screws, and then remove the glass channel, glass weatherstrip, frame, and glass tape (Fig. 15).
7. Install the glass frame on the glass (Fig. 15), using new glass tape. Install the glass channel and weatherstrip. Trim the excess glass tape.
8. Position the door glass assembly in the door. Install the regulator arm pins in the roller assemblies.
9. Install the rear glass run to the glass and install the retaining screws finger-tight.
10. Install the window upper stops and adjust the window assembly (See Section 1).
11. Install and seal the water shield, and install the trim panel and hardware.

DOOR WINDOW REGULATOR

1. Remove the trim panel and loosen the water shield enough to reveal the access holes.
2. Remove the regulator arms from the glass channel rollers by pulling the roller clip out to release the regulator arm pin (Fig. 14), then prop the window in the up position.
3. Remove the regulator assembly retaining screws and remove the regulator assembly.
4. Transfer the equalizer arm roller (and regulator motor on electric window vehicles) to the new regulator.
5. Position the window regulator assembly in the door panel and install the retaining screws.
6. Remove the window block and connect the regulator arms to the glass channel rollers.
7. Install and seal the water shield. Install the trim panel and hardware.

QUARTER WINDOW AND REGULATOR

1. Remove the arm rest, seat cushion and back, and then quarter trim panel and remove the water shield (See Section 1).

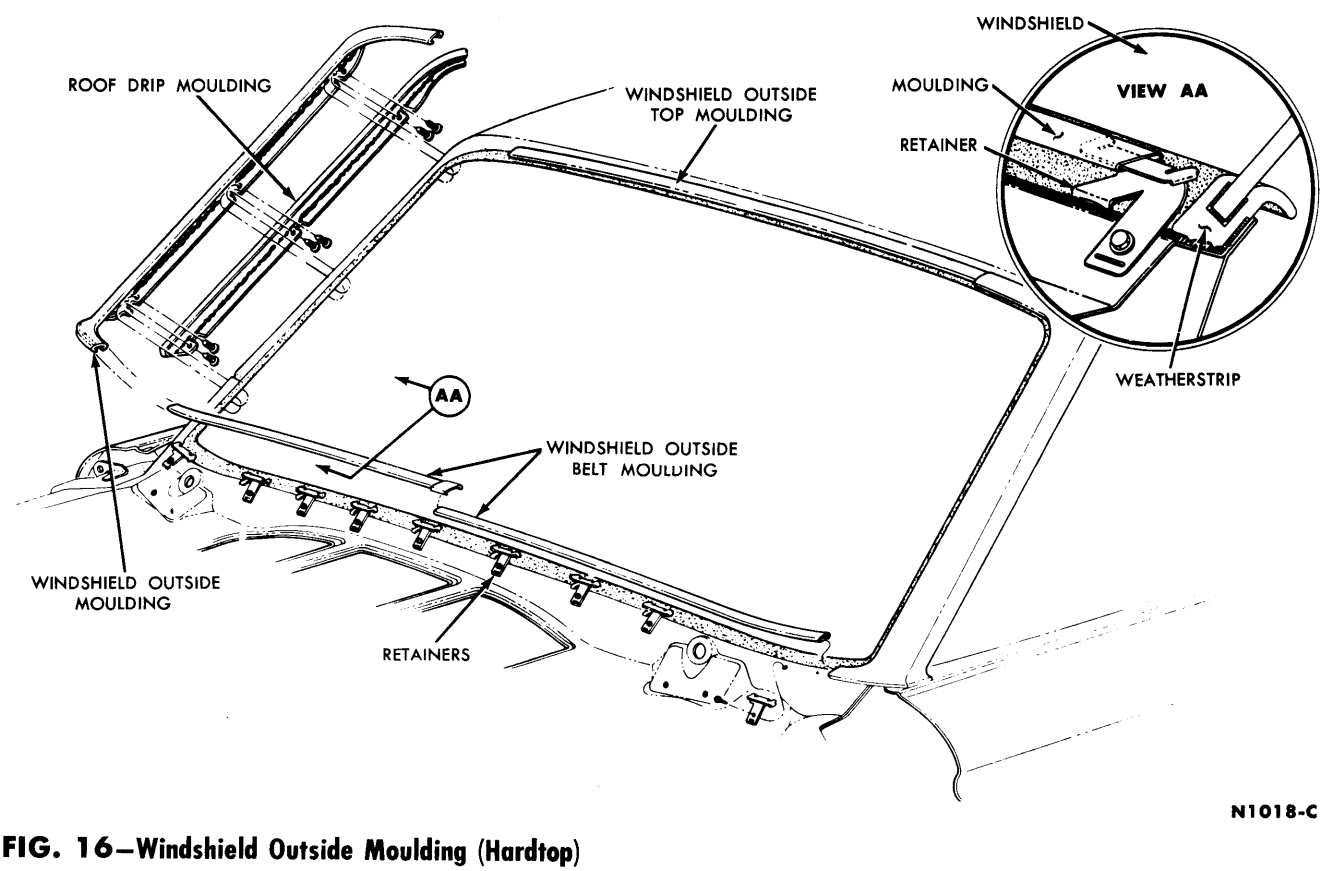


FIG. 16—Windshield Outside Moulding (Hardtop)

2. Remove the quarter window regulator housing bolts and remove the housing and window asesmbly.

3. Lower the quarter window until the equalizer roller comes out of the run and disconnect the regulator arm from the glass channel.

4. Remove the quarter window from the housing.

5. To remove the glass frame, pull down the weatherstrip from the forward edge of the glass assembly, remove the frame retaining screws, and remove the frame and glass tape. Remove the glass channel (Fig. 15).

6. Install the glass in the channel and install the glass frame, using new glass tape. Trim the excess tape. If the regulator doesn't require replacement omit steps 7 and 8.

7. Remove the window regulator retaining bolts, and remove the regulator from the housing.

8. Transfer the roller (and motor if electric windows) to the new regulator equalizer arm, position the regulator in the quarter window housing, and install the retaining bolts.

9. Install the glass assembly in the housing, and connect the regulator arm in the roller.

10. Install the quarter window and housing to the quarter panel.

11. Adjust the quarter window as required (See Section 1).

12. Install and seal the water shield. Install the quarter trim panel, seats and arm rest.

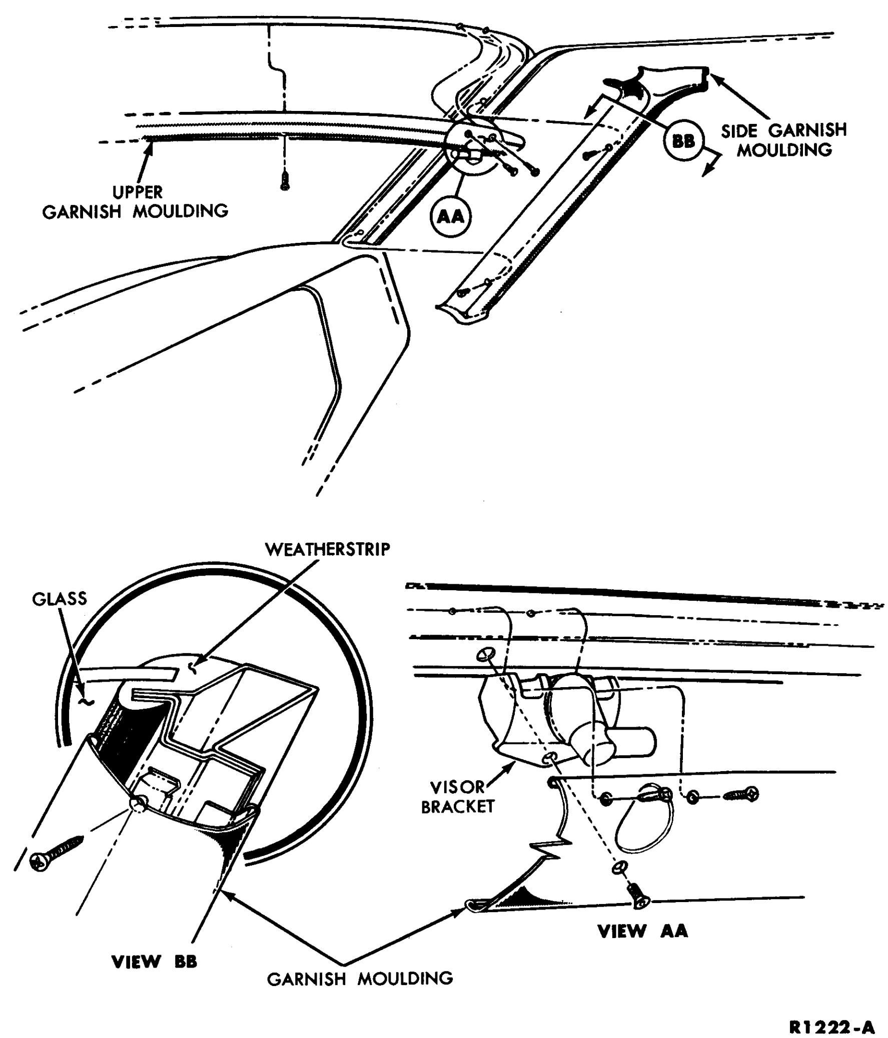


FIG. 17—Windshield Inside Mouldings

POWER REGULATOR

The power regulators are basically the same for all models, whether the regulator is installed in a door or quarter panel. In view of this, repair procedures are given for one regulator and will apply to all.

POWER REGULATOR AND/OR MOTOR

To remove and install the power regulator assembly, including the motor, follow the appropriate removal and installation procedures given for the manual regulator. Connecting the wires presents no problem because of the type of wire connectors used.

If the regulator arm tension spring requires replacement, it can be replaced after the regulator is removed. This operation should be performed with the arm at its point of maximum upward travel so that there is a minimum of spring tension to overcome.

WINDSHIELD

HARDTOP

1. Remove the windshield wiper arm and blade assemblies, the wiper pivot nuts and cowl top panel.

2. Pull the roof side rail weatherstrips from the front retainer on the windshield pillars and remove the retainers from the windshield pillars (See Fig. 5 in Part 17-1).

3. Remove the roof drip mouldings and outside side mouldings from the windshield pillars (Fig. 16).

4. Remove the windshield lower moulding by removing nine (9) retainers and the upper moulding by pulling it off the retainers (Fig. 16).

5. Loosen the sun visor set screws and remove the visors from the visor brackets, then remove the inside garnish mouldings (Fig. 17).

6. From inside the car, loosen the weatherstrip from the windshield opening flange, and push the windshield and weatherstrip assembly out of the opening.

7. Remove the weatherstrip from the glass.

8. After cleaning the old sealer from the windshield opening flange, glass, and weatherstrip, apply sealer to the weatherstrip in the groove for the glass, and install the weatherstrip on the windshield glass.

9. Apply a heavy bead of caulk and sealer all around the windshield opening flange.

10. After coating the weatherstrip mounting surfaces with RuGlyde, install a draw cord in the weatherstrip groove.

11. After positioning the windshield assembly in the opening (with a helper applying pressure from the outside), pull the weatherstrip over the flange with the draw cord.

12. With a sealer gun, apply a

bead of caulk and sealer (B6A-19563-B) between the weatherstrip and glass, and between the weatherstrip and roof across the top.

13. Install the inside garnish mouldings and sun visors.

14. Install the outside upper and lower mouldings, side mouldings, drip finish mouldings and weatherstrip retainers. Install the roof side rail weatherstrips into the retainers.

15. Apply a bead of sealer around all (3) outermost cowl panel screw holes on each side and install the cowl panel, wiper pivot nuts and wipers.

16. Test the windshield for water leaks and seal it as necessary.

CONVERTIBLE

1. Remove the windshield wiper arm and blade assemblies, the wiper pivot nuts and the cowl top panel.

2. Lower the top and remove the visor and bracket assemblies.

3. Remove the windshield side weatherstrips, weatherstrip retainers, drip rail mouldings, outside corner and side mouldings (Fig. 18).

4. Remove the top lock plates and visor brackets from the windshield top moulding and remove the top moulding.

5. Remove the inside side mouldings.

6. From inside the car, loosen the weatherstrip from the windshield opening flange, and push the windshield and weatherstrip assembly out of the opening.

7. Remove the weatherstrip from the glass.

8. After cleaning the old sealer from the windshield opening flange, glass, and weatherstrip, apply sealer to the weatherstrip in the groove for the glass, and install the weatherstrip on the windshield glass.

9. Apply a heavy bead of caulk and sealer all around the windshield opening flange.

10. After coating the weatherstrip mounting surfaces with RuGlyde, in-

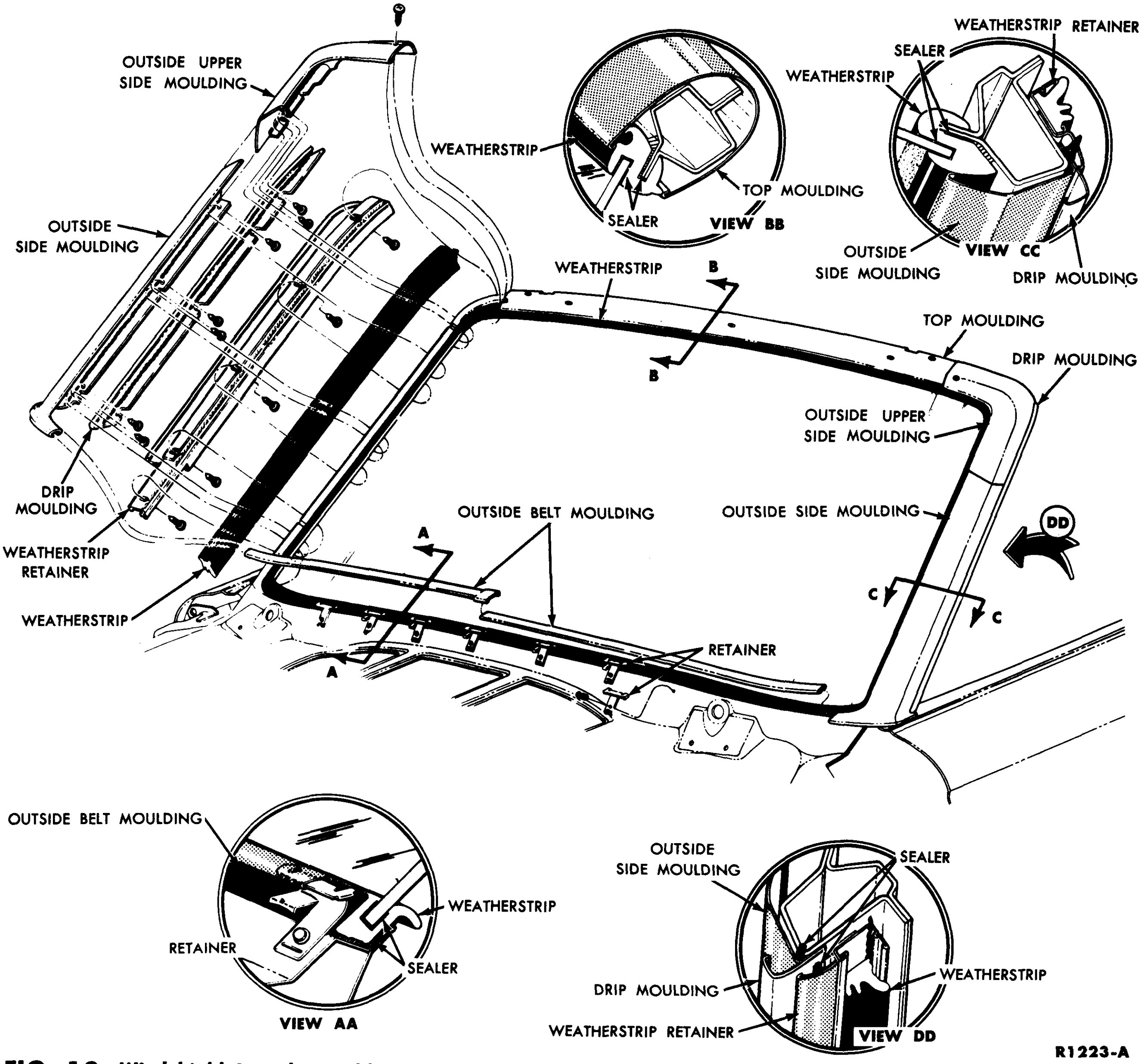


FIG. 18—Windshield Outside Mouldings (Convertible)

stall a draw cord in the weatherstrip groove.

11. After positioning the windshield assembly in the opening (with a helper applying pressure from the outside) pull the weatherstrip over the flange with the draw cord.

12. With a sealer gun, apply a bead of caulk and sealer (B6A-19563-B) between the weatherstrip and the glass.

13. Install the outside top moulding, visor brackets and lock plates to the header.

14. Install the inside side mouldings.

15. Install the outside side and upper corner mouldings, the drip rail mouldings, weatherstrip retainers and weatherstrips to the pillars.

16. Install the sun visors.

17. Apply a bead of sealer around all (3) outermost cowl panel screw holes on each side and install the cowl panel, wiper pivot nuts and wipers.

18. Test the windshield for water leaks and seal it as necessary.

INSIDE REAR VIEW MIRROR (BONDED TO WINDSHIELD)

The following procedures are used when replacing or repairing a bonded-to-windshield type rear view mirror.

REMOVAL

1. Clean both the inside and outside surfaces of the windshield in the area of the mirror mounting bracket. Inspect the windshield for stone chips and scratches.

2. Using welding putty or wet rags, insulate all chips or scratches within 12 inches of the mirror mounting bracket.

3. Apply heat to the bracket mounting area from outside the windshield with a standard 250 watt infrared bulb (heat lamp). Hold the lamp approximately 4 inches from the windshield, and rotate it in a small circle.

4. The mirror mounting bracket can be pulled off the windshield glass in approximately 8-10 minutes, using the mirror as a handle.

5. Slowly remove the heat lamp. **Do not remove the insulating materials until the windshield has cooled to room temperature.**

6. Remove the mirror and arm from the bracket.

INSTALLATION

1. Locate and mark, with a wax pencil, the bracket location on the outside surface of the windshield (Fig. 19).

2. Use a good grade of Ethyl Alcohol to thoroughly clean the inside glass surface bracket mounting area and mounting bracket face. It is important that the mounting surfaces are properly cleaned before the resin is applied.

3. To mix the resin, pour the en-

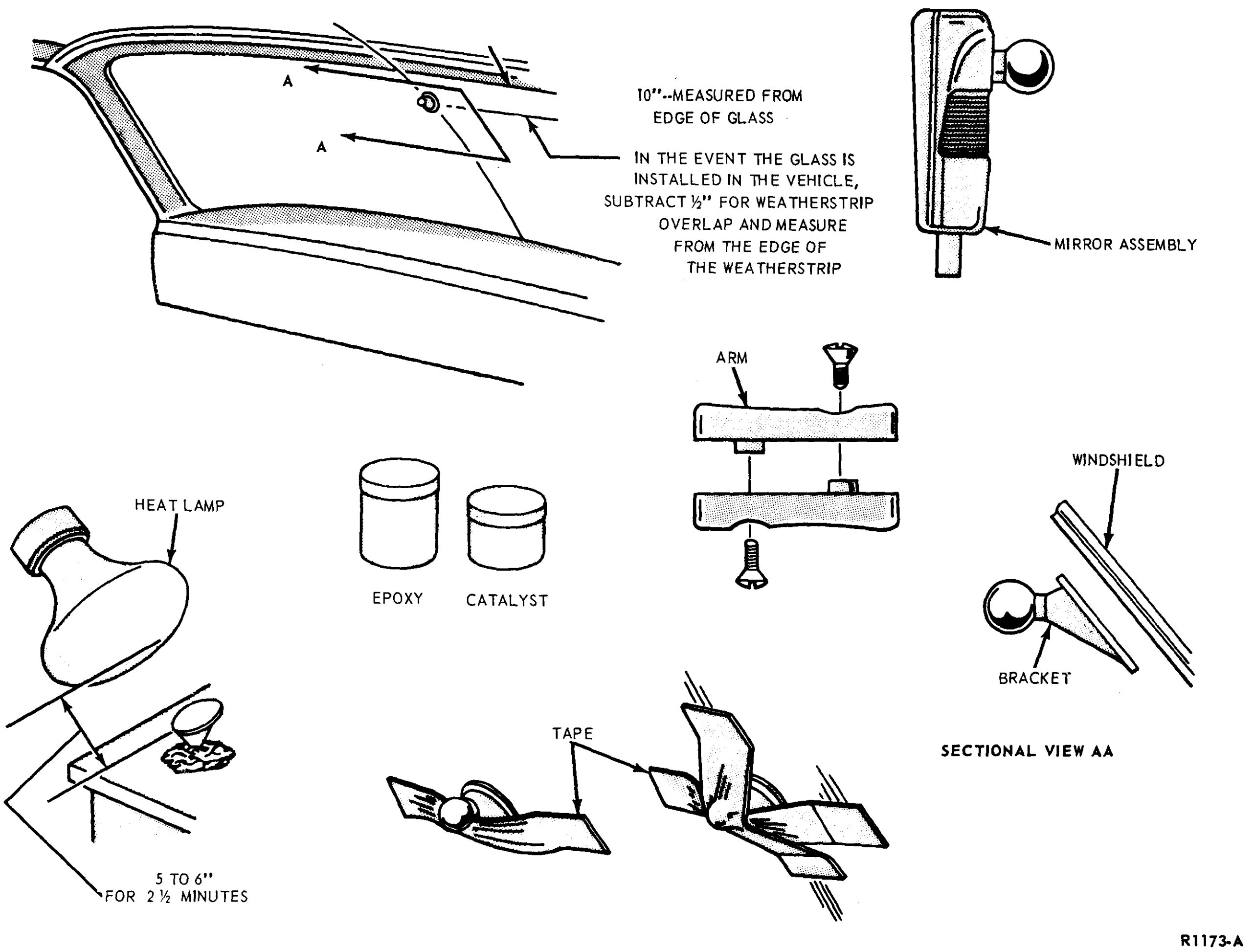


FIG. 19—Bonded Inside Rear View Mirror Replacement

tire contents of the small catalyst bottle into the large epoxy bottle (Fig. 19).

4. Stir the contents for three to five minutes. **To guarantee the correct mixing ratio and resulting bond strength, it is mandatory that the entire contents of both bottles are used and properly mixed. Under no circumstances should only portions of the epoxy or catalyst be used.**

5. Apply the mixed resin to the bracket mounting surface. Level off the resin film as smoothly as possible.

6. Place the mounting bracket surface upward in a vise or in a small mound of permagum or any suitable holding material that will support the mounting bracket (Fig. 19). Hold a standard 250 watt infrared lamp about five to six inches from the mounting surface of the bracket for two and one half minutes. (Fig. 19).

7. Allow the bracket to cool for one minute. With light hand pressure, apply the mounting surface of the bracket to the desired inside area of the windshield.

8. Secure the bracket to the windshield, using a piece of tape about five inches long located just under the knob of the bracket (Fig. 19). Apply another piece of tape in the vertical direction (Fig. 19) to firmly hold the mounting bracket in place on the windshield.

9. When the temperatures are above 67°F., the mirror and arm should not be mounted to the bracket for eight hours, to allow the resin to properly adhere the bracket to the glass. However, the car may be used with the bracket taped in place one hour after installation.

When the temperatures are below 67°F., the mirror and arm should not be mounted to the bracket for sixteen hours. However, the car can be used two hours after the bracket has been taped in place.

10. After the bracket has had time to adhere to the glass, remove the tape and install the mirror and arm to the bracket (Fig. 19).

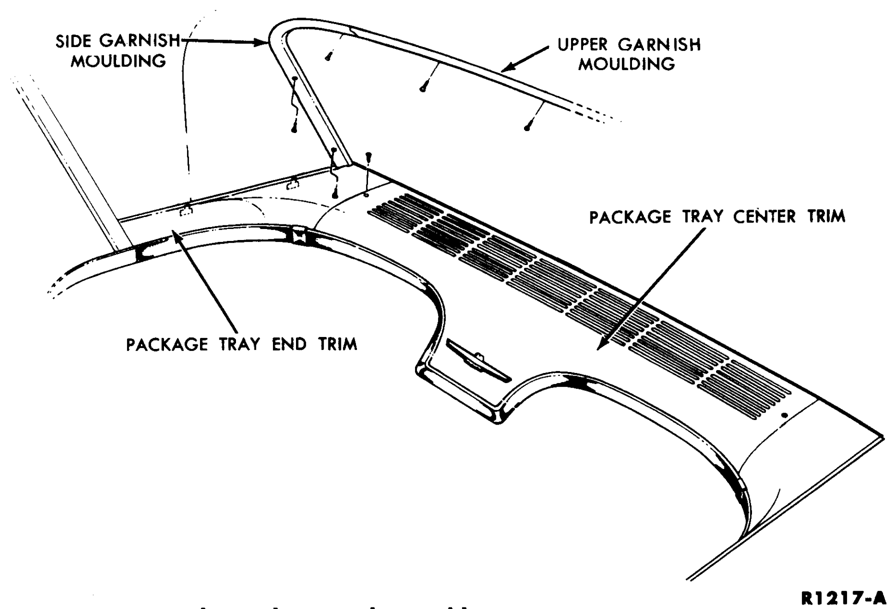


FIG. 21—Back Window Inside Mouldings

BACK WINDOW

1. Remove the back window outer side moulding retaining screws from each side moulding and remove the mouldings (Fig. 20).

2. Remove the upper outside moulding by carefully prying it off the retainers, then remove the moulding retainers.

3. Remove the back vent air grille screws and the grille.

4. Remove the back window inside side and upper garnish mouldings (Fig. 21).

5. From the inside, loosen the weatherstrip at the flange, and push the window and weatherstrip, assembly out of the opening.

6. Remove the weatherstrip from the glass. Clean the old sealer from the weatherstrip and the back window body flange.

7. Apply caulk and sealer to the back window opening flange and at the holes for the attaching clips.

8. Apply sealer to the weatherstrip in the groove for the glass, and position the weatherstrip on the glass.

9. Apply RuGlyde to the flange area of the weatherstrip, and install a draw cord in the weatherstrip flange crevice with about a 12-inch overlap at the top center.

10. Position the glass assembly in the opening, have a helper apply pressure on the outside, and pull the weatherstrip over the flange with the draw cord.

11. Install the outside upper moulding retainers and the back window upper moulding, and then install the side mouldings (Fig. 20).

12. Install the rear vent grille.

13. Install the back window center

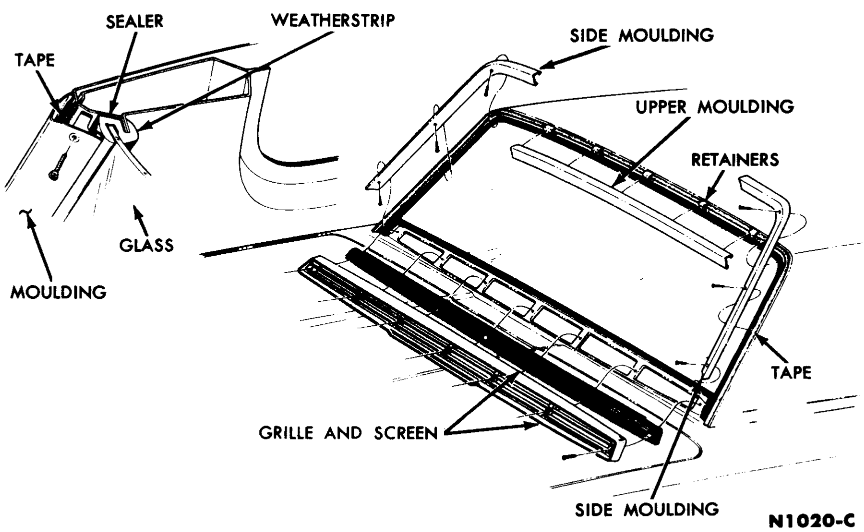


FIG. 20—Back Window Outside Mouldings

and side garnish mouldings and install the retaining screws.

14. Check the window for water leaks and seal as necessary.

DECK LID

New deck lids are furnished in prime paint without hardware. All usable hardware parts should be removed from the old deck lid so that they can be installed on the new lid.

Before the old deck lid is removed and disassembled, time will be saved if the new deck lid is prepared for installation first. Inspect the new deck lid for dings and other minor damage, repair as necessary, and sand and paint it. While it is drying, remove and disassemble the old lid. When the new lid is dry, install the hardware.

1. Remove all hardware from the deck lid.
2. Remove the hinge to deck lid bolts (Fig. 10), and remove the deck lid. Remove the deck lid lock from the deck lid. If it is necessary to remove the hinge, remove the hinge bracket bolts (Fig. 10).
3. If the hinges were removed, install the new hinges at the same approximate location as the old hinges. Position the deck lid and install the hinge to deck lid bolts finger-tight.
4. Close the deck lid gently to check the fit. Adjust the deck lid and hinges for proper fit. Adjust the striker plate.

DECK LID HINGE OR TORSION BAR

1. Prop the deck lid open.
2. Mark the hinge position on the lid and on the mounting bracket for reference when a new hinge is installed.
3. Remove each torsion bar using a long screwdriver and vise-grips, pry the anchor end of the torsion bar out of its adjustment notch (Fig. 10). **The bar must be securely held with the vise-grips.**
4. Remove the hinge attaching bolts from the deck lid and from the mounting bracket, and remove the hinge.
5. Position the hinge and partially tighten the mounting bolts.
6. Install each torsion bar, reversing the procedure in step 3.
7. Remove the prop and check the lid position. After any necessary adjustment, tighten the hinge attaching bolts. The farther rearward the anchor end is twisted, the greater the tension.

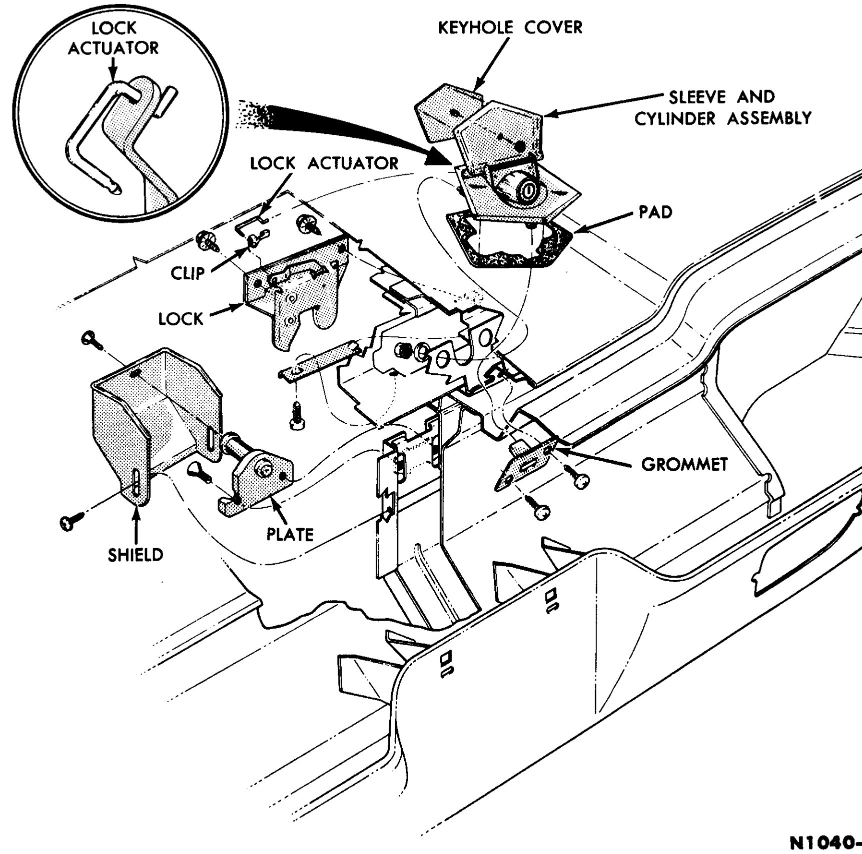


FIG. 22—Deck Lid Lock

DECK LID LOCK CYLINDER

To replace the deck lid lock cylinder and sleeve, disconnect the actuator link at the lock, remove the retaining nuts and remove the assembly (Fig. 22).

To remove the lock cylinder from the sleeve, turn the key 1/8 turn clockwise from the locked position, and push the release pin down with a small punch. Pull the key and cylinder out of the sleeve.

When installing the cylinder in the sleeve, turn the key in the cylinder 1/8 turn clockwise from the locked position and insert the cylinder in the sleeve.

DECK LID LOCK

Disconnect the actuator link at the lock, remove the lock retaining bolts and remove the lock (Fig. 22).

The lock is not adjustable in the deck lid. Positioning of the striker in relation to the lock is accomplished entirely at the striker plate.

INTERIOR TRIM, SEATS AND CONVERTIBLE TOP

GROUP 18

PART 18-1 INTERIOR TRIM

1 REMOVAL AND INSTALLATION

DOOR TRIM PANEL

REMOVAL AND INSTALLATION

1. Remove the inside lock and window regulator handles (Part 17-3).

2. Remove the lock inside push button.

3. Remove the weatherstrip retainer from the upper rear corner of the door. Remove the front and rear trim panel retainer and remove the trim. Disconnect the courtesy light wires (Fig. 1).

4. Transfer the trim panel mouldings and courtesy light to the new trim panel.

5. Install the trim panel (connecting the courtesy light wire) to the door and install the retainers and weatherstrip retainer.

6. Install the lock inside push button and inside window and lock handles.

QUARTER TRIM PANEL

REMOVAL AND INSTALLATION

1. Remove the quarter arm rest (Fig. 2).

2. Remove the rear seat cushion by lifting the front edge off the retainers and pulling forward. Remove the seat back retaining screws and pull the seat back downward off the retainers.

3. Remove the quarter trim retaining screws and the quarter trim (on manual window cars, the window handle must be removed before the trim (Part 17-3). Disconnect the window control switch wiring on cars with power windows.

4. Transfer the window switch to the new trim panel.

5. Install the quarter trim (connecting the window switch wires), and install the window handle on manual window cars.

6. Install the rear seat back, seat cushion and arm rest.

HEADLINING

REMOVAL AND INSTALLATION

1. Remove the sun visor assemblies, and the windshield side and upper garnish mouldings (Part 17-3). Pull the staples out of the windshield header tacking strip and loosen the headlining (Fig. 4).

2. Remove the back window garnish mouldings (Part 17-3). Then pull the staples out of the rear window tacking strip and loosen the headlining.

3. Remove the coat hooks and roof interior side mouldings (Fig. 3). Disconnect the battery and remove the dome light assembly and disconnect the light wires.

4. Remove the quarter arm rests, seat cushion, seat backs and package tray.

5. Pull the staples out of the roof side tacking strip and loosen the headlining.

6. Starting at the front of the car, remove the headlining supports. At the rear support, release the two rear support retainers from the roof rear rail.

7. If a new headlining is to be installed, lay both the old and new headlinings on a clean work table and transfer the supports in sequence to the new headliner listings (Fig. 4).

Roof bows are color coded at each end. When ordering new headlining supports, be sure to note the color at each end of the bow.

8. Install the rear support in the side rails, and hook the two rear support retainers to the support and the roof rear rail.

9. Install the other headlining supports workings from the rear toward the front of the car.

10. The headlining should be centered and the seams straight. Pull the headlining forward tight enough to remove all wrinkles, and staple the headlining to the windshield header tacking strip, starting at the center and working toward the sides. Cut off the excess material.

11. Staple the headlining around the rear window, starting at the center and working toward the sides. Pull the headlining just tight enough to remove the wrinkles. Cut off the excess material around the rear window.

12. Staple the headlining to the roof side tacking strip. Pull the

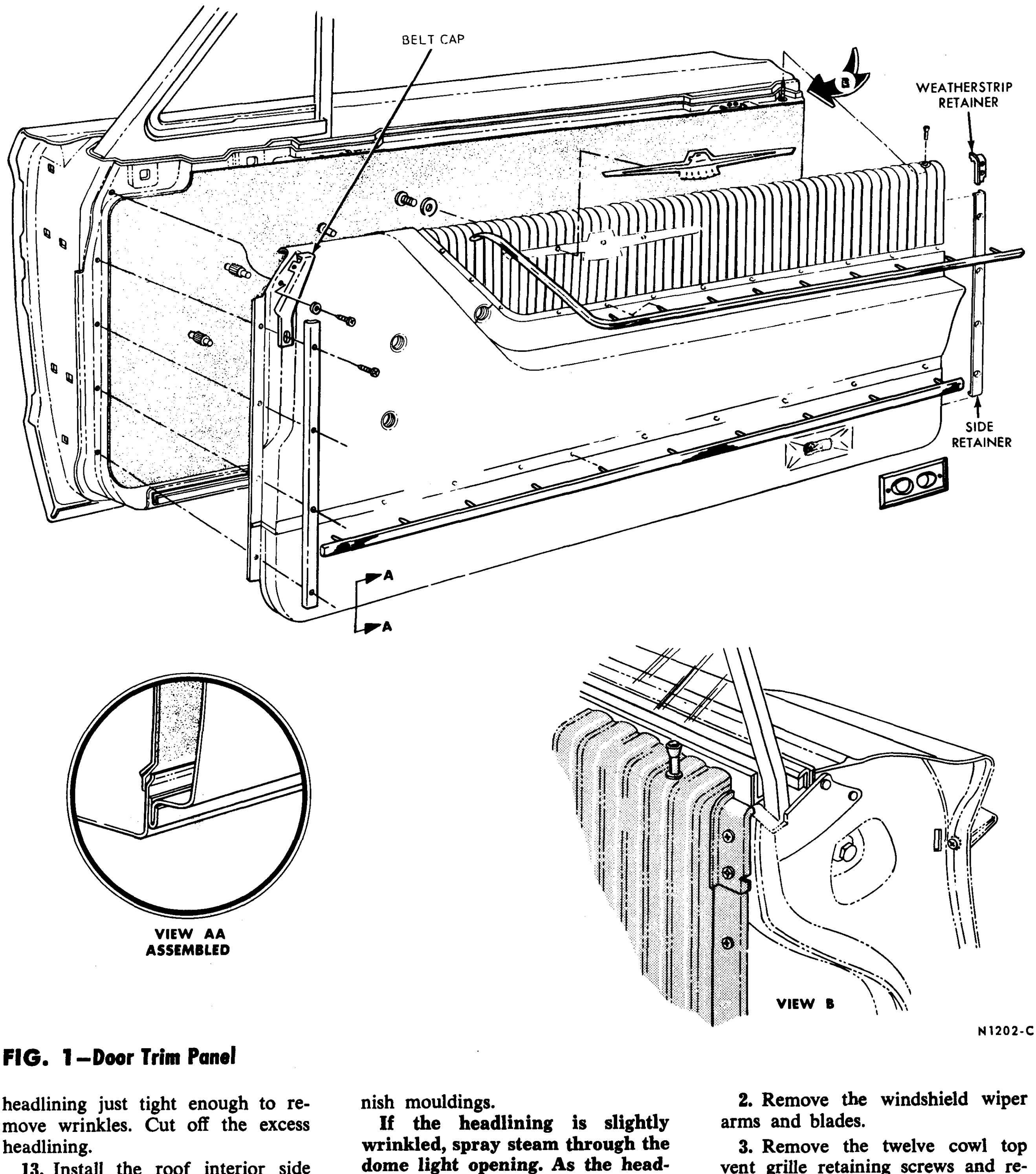


FIG. 1—Door Trim Panel

headlining just tight enough to remove wrinkles. Cut off the excess headlining.

13. Install the roof interior side mouldings, coat hooks, and garnish mouldings.

14. Install the windshield side and upper garnish mouldings, and the sun visor assemblies.

15. Install the package tray, rear seat backs, seat cushion and quarter arm rests.

16. Install the rear window garnish mouldings.

If the headlining is slightly wrinkled, spray steam through the dome light opening. As the headlining dries, it will shrink slightly, removing most wrinkles and sags.

17. Connect the wires to the dome light and install the assembly.

18. Connect the battery cable.

INSTRUMENT PANEL, SAFETY PAD

REMOVAL

1. Disconnect the battery.

2. Remove the windshield wiper arms and blades.

3. Remove the twelve cowl top vent grille retaining screws and remove the cowl top vent grille.

4. Remove the two instrument panel retaining screws from the center outer top cowl area (Fig. 5).

5. Remove the front seat track-to-floor retaining nuts from the underside of the floor and remove both front seat and track assemblies. (Disconnect power seat wiring con-

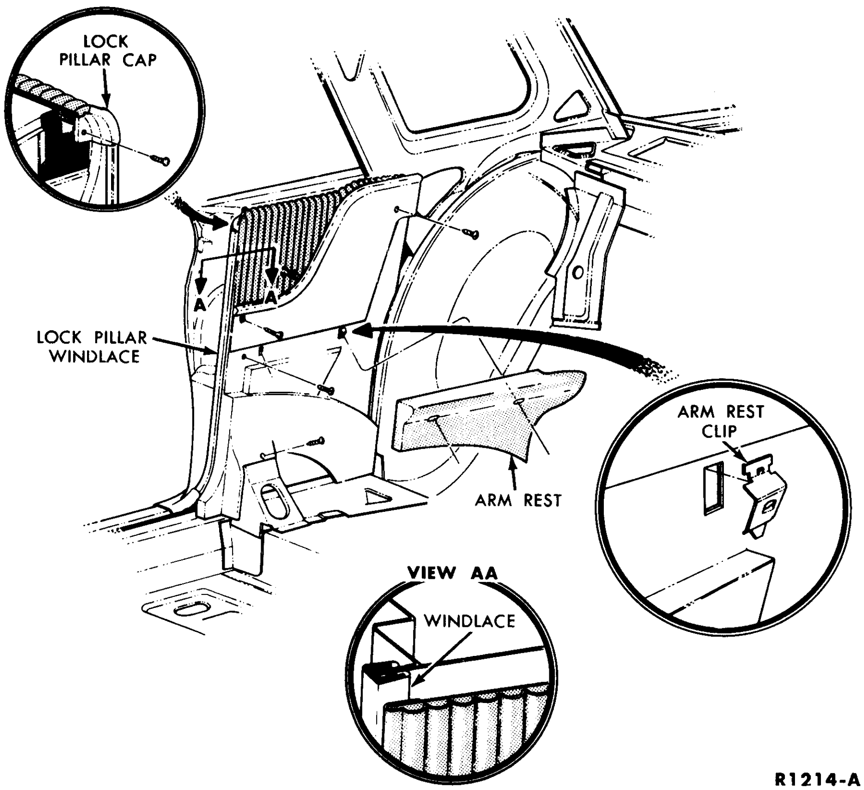


FIG. 2—Quarter Trim Panel

nectors on units so equipped).

6. Remove the two retaining screws from each console front moulding and remove the front console mouldings.

7. Remove the four retaining screws from each of the side front console moulding retainers and remove the moulding retainers (Fig. 5).

8. Remove the finish moulding cap retaining screws and remove the finish moulding cap.

9. Remove the radio knobs, bezel nuts and bezel.

10. Remove the air conditioning knobs (if so equipped) and heater control knobs.

11. Remove the six console finish panel retaining screws.

12. Disconnect the accessory switch and wiring connectors and remove the console finish panel.

13. Remove the headlight switch knob and bezel.

14. Remove the six instrument finish panel retaining screws and remove the instrument finish panel (Fig. 6).

15. Remove the five ignition switch and radio access panel retaining screws and remove the radio access panels.

16. Remove the ignition switch wiring connector retaining nut.

17. Remove the three left instrument finish panel extension retaining screws and remove the left instrument panel extension (Fig. 6).

18. Remove the console upper rear moulding retaining screws and remove the console upper rear moulding.

19. Remove the rear seat cushion.

20. Remove the three retaining screws from each lower edge moulding and remove the mouldings.

21. Remove the five retaining screws from each lower edge moulding retainer and remove the retainers.

22. Remove the right lower pad retainer moulding by pulling the moulding off its retainers.

23. Remove the two capscrews from each end of the lower lip of the right lower finish panel and three screws from the face of the right lower finish panel and remove the right lower finish panel.

24. Remove the four console-to-instrument panel retaining screws.

25. Remove the six console-to-floor retaining screws and slide the console back away from the instrument panel.

26. Remove the windshield wiper, windshield washer and the left and right air control knobs.

27. Remove the four clock hous-

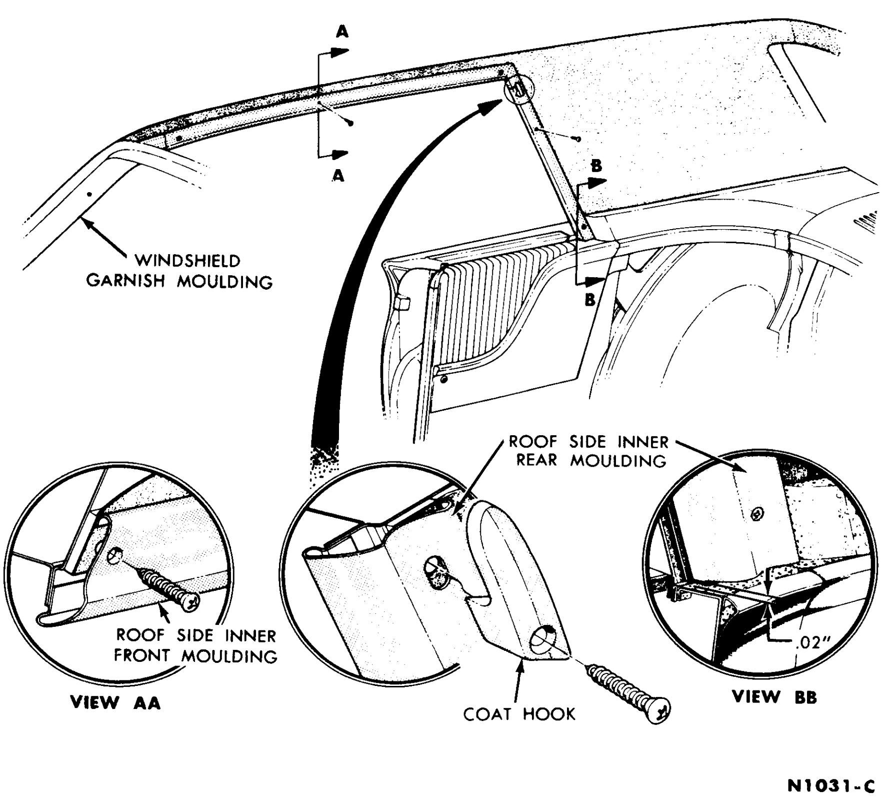


FIG. 3—Body Side Interior Mouldings

HEADLINING SUPPORT COLOR CHART		
SUPPORT NO.	COLOR	
	ONE END	OPPOSITE END
1	Green	Plain
2	Green	Green
3	Green	Blue
4	Plain	Plain
5	Red	Plain

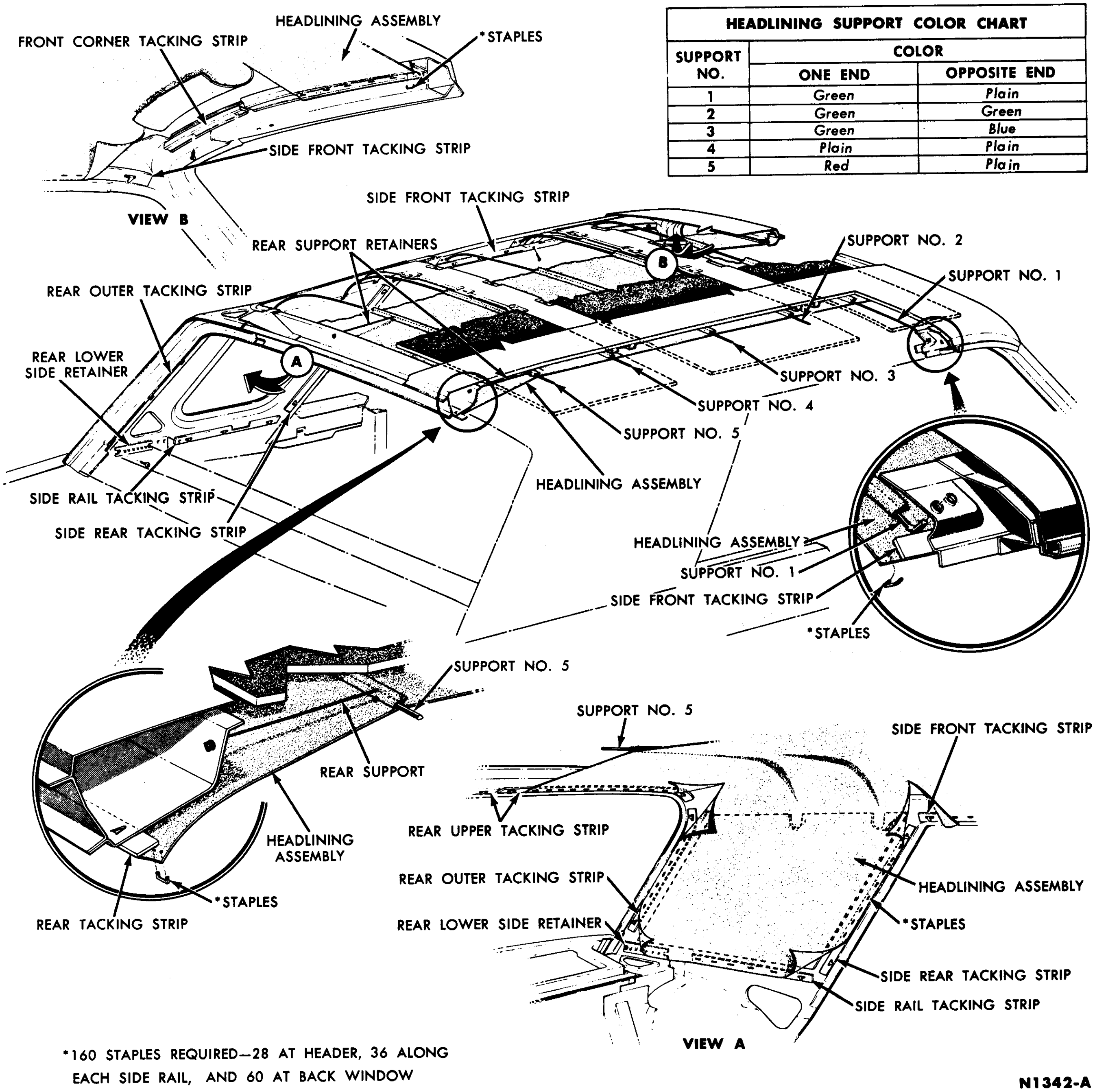


FIG. 4—Headlining Installation

ing retaining screws.

28. Disconnect the clock wiring connectors and remove the clock housing.

29. Remove the three screws retaining the instrument panel and console moulding and remove the moulding.

30. Remove the right radio access panel retaining screw and remove the access panel.

31. Remove the windshield interior moulding retainer screws and remove the windshield interior mouldings.

32. Remove the three retaining screws from each side cowl panel and remove the side cowl panels.

33. Remove two bolts from the steering column face plate support bracket and two bolts from the face plates.

34. Remove two bolts from the upper steering column support bracket.

35. Position the steering column downward and cover it to prevent scratching the finish.

36. Remove the four air conditioning unit grille retaining screws and remove the grille.

37. Remove two air conditioning duct retaining screws and position the duct towards the firewall.

38. Disconnect the speedometer cable from the speedometer.

39. Remove the two instrument panel retaining screws located at the center inside of the upper cowl.

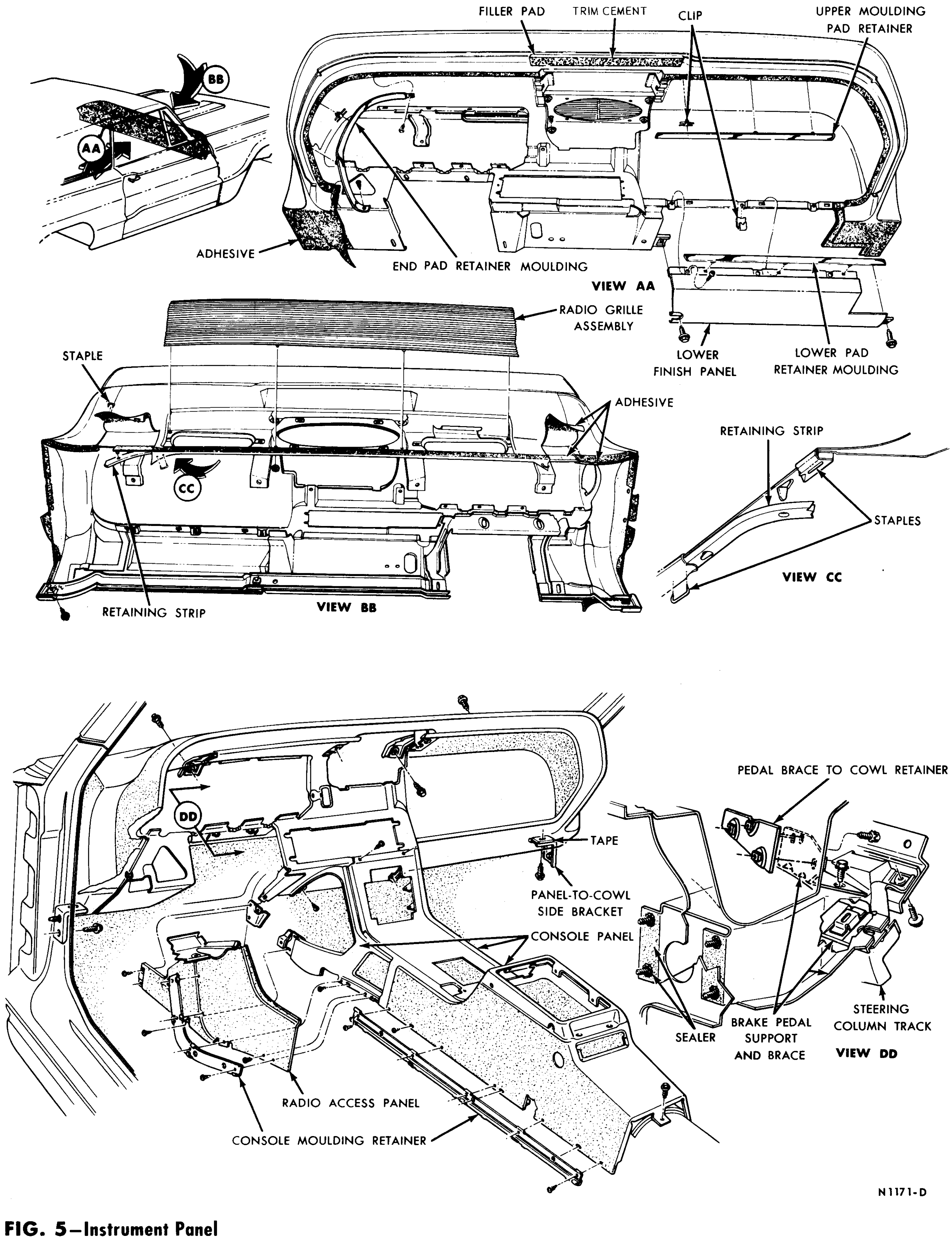


FIG. 5—Instrument Panel

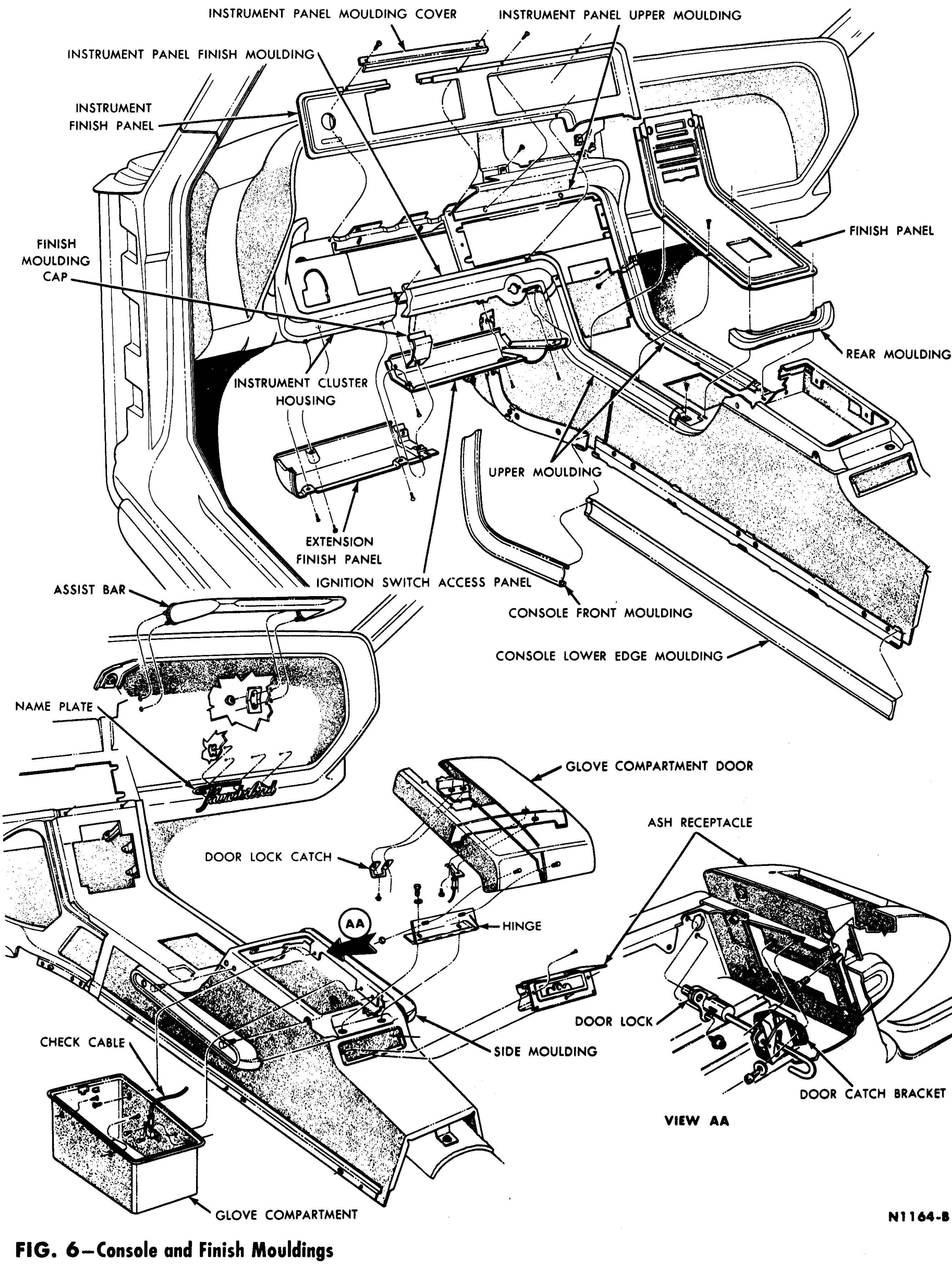


FIG. 6—Console and Finish Mouldings

40. Remove the radio speaker (four wing nuts).
41. Remove the windshield wiper, washer and left and right air control assembly bracket retaining screws.
42. Remove the one left instrument panel-to-pillar retaining bolts.
43. Disconnect the defroster hoses from their nozzles and disconnect the instrument panel wiring connectors.
44. Remove the instrument panel and place it on a bench.
45. Remove the upper right instrument panel pad retaining moulding.
46. Remove the eight instrument cluster retaining screws and position the cluster toward the center to provide access to the left end pad retainer moulding retaining screws.
47. Remove the left end pad retainer moulding.
48. Remove the six speaker grille retaining nuts and remove the speaker grille.
49. Pull the pad free from the adhesive and remove the pad.

INSTALLATION

1. Clean old adhesive from the instrument panel surface.
2. Apply adhesive to the instrument panel and position the new instrument panel pad in place.
3. Staple the pad to the pad retaining strips.
4. Install the radio speaker grille.
5. Install the left end pad retainer moulding.
6. Position the instrument cluster on the instrument panel and install the eight retaining screws.
7. Install the upper right instrument panel pad retainer moulding.
8. Carefully position the instrument panel assembly in the car.
9. Connect the wiring connectors and connect the defroster hoses to their outlet nozzles.
10. Install the two instrument panel retaining screws at the center inside upper cowl.
11. Connect the speedometer cable to the speedometer.
12. Install the radio speaker.
13. Install the windshield wiper, washer and air control assembly bracket.
14. Install the two upper instrument panel retaining screws from the upper outer cowl opening.
15. Install the left and right instrument panel to side cowl bracket retaining screws.
16. Position the console on the floor and to the instrument panel.
17. Install the console rear retainer.
18. Install the left and right console rear lower moulding retainers.
19. Install the console-to-instrument panel retaining screws.
20. Install the right lower finish panel.
21. Install the right lower pad retainer moulding.
22. Install the right radio access panel.
23. Install the right side front console moulding retainer.
24. Install the right side front console moulding.
25. Install the air conditioning duct.
26. Install the air conditioning grille and retaining screws.
27. Install the left and right side cowl panels.
28. Install the two bolts retaining the instrument panel to the steering column support bracket.
29. Install the steering column face plate support bracket four retaining bolts.
30. Install the steering column movable face plate and adjust.
31. Install the left radio access panel.
32. Install the left lower extension finish panel.
33. Install the left front console moulding retainer.
34. Install the left front console moulding.
35. Install the instrument cluster and console upper left moulding.
36. Install the ignition switch and access panel and connect the switch wiring connector.
37. Install the left lower finish moulding cap.
38. Connect the clock wiring and install the clock housing assembly.
39. Install the windshield wiper and air control knobs.
40. Install the console rear upper moulding.
41. Connect the console accessory switch wiring connectors and install the console finish panel.
42. Install the instrument finish panel.
43. Install the air conditioning and heater control knobs.
44. Install the headlight switch bezel and knob.
45. Connect the battery and check the instruments and controls for proper operation.
46. Install the outer cowl panel and windshield wiper bezels.
47. Install the windshield wiper arms and blades.
48. Install the windshield interior garnish mouldings.
49. Install the rear seat cushion.
50. Install the front seat and track assemblies and connect the seat control wiring connectors.

CARPETS

1. Remove the right and left quarter arm rests.
2. Remove the rear seat cushion from the car.
3. Remove the right and left front seat and seat track assemblies from the car.
4. Remove the seat belt anchor bolts and remove the seat belts.
5. Remove the right and left door scuff plates and remove the clips from the door sill pinch welds.
6. Remove the right and left cowl trim panels.
7. Unsnap the console right and left side mouldings (Fig. 6).
8. Remove the console right and left side moulding retainers.
9. Remove the carpet retaining screws and remove the carpet from the car (Fig. 7).
10. Position the carpet to the floor pan and cement it in place with trim cement C2AZ-19C525-A (Fig. 7).
11. Install the carpet retaining screws (Fig. 7).
12. Install the console side moulding retainers and mouldings.
13. Install the right and left cowl trim panels.
14. Install the clips on the door seal pinch weld and install the door scuff plates.
15. Install the seat belts.
16. Install the front seat and seat track assemblies.
17. Install the rear seat cushion and the right and left quarter arm rests.

LANDAU TOP

REMOVAL

1. Remove the roof side quarter ornament and belt moulding as described in Section 17-2.
2. Remove the back window side and top mouldings.
3. Remove the windshield (see Section 17-3).
4. Remove the sealer from the drip rails covering the top cover side retainers and rivets.
5. Using a 0.128-0.132 inch diameter drill, remove the pop rivets which attach the retainer strips to the right and left drip rails (Fig. 9).

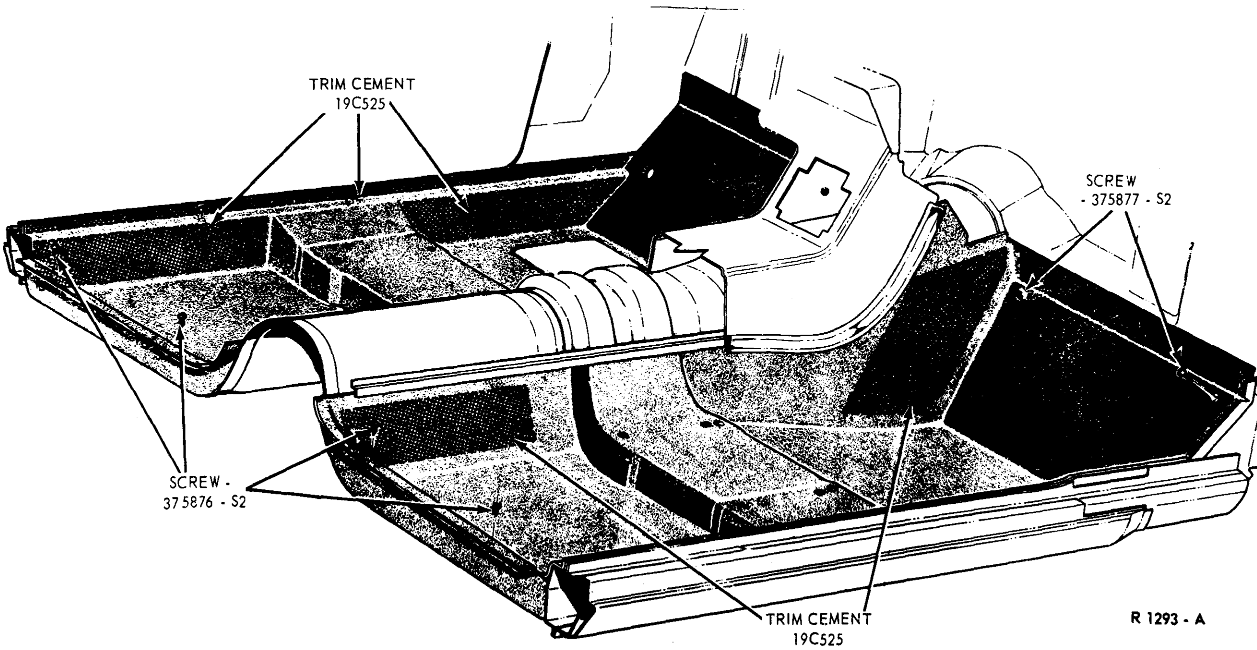


FIG. 7—Carpet Installation

Remove the retainer strips, and clean the sealer from the drip rails.

6. Remove all top cover retaining staples, screws and clips and remove the cover (Fig. 9).

7. If necessary to remove the cover pad from the roof, clean all old sealer from the roof panel.

8. Remove all old sealer and/or cement from the roof panel and drip rail areas with naphtha solvent or equivalent. **It is extremely important that the entire roof and drip rails are thoroughly cleaned. Also, use extreme safety precaution while using naphtha or equivalent.**

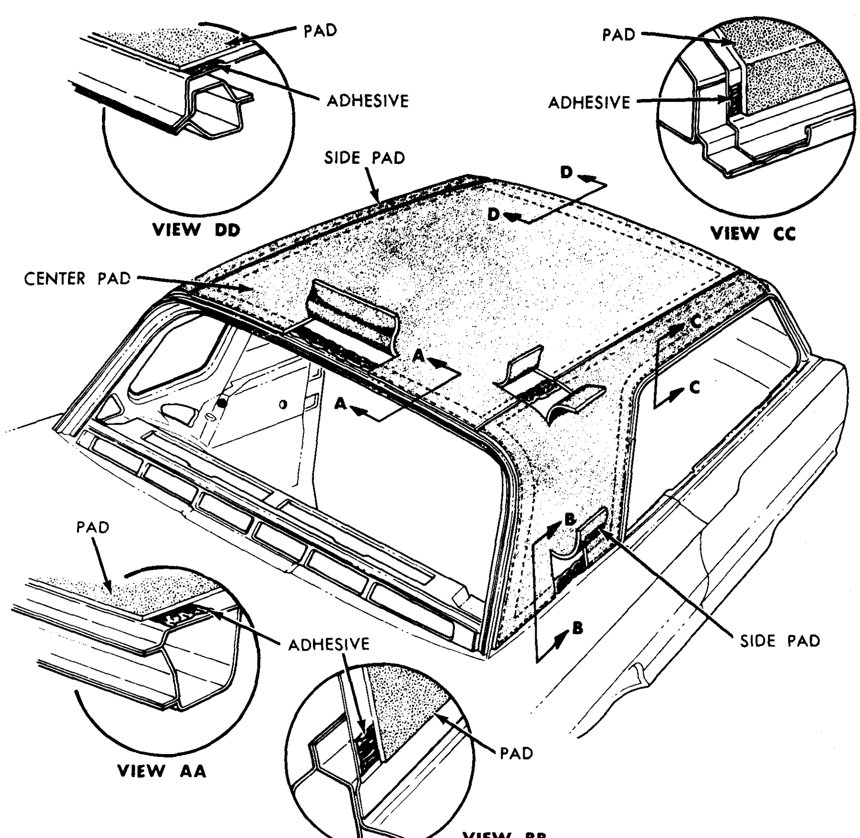


FIG. 8—Landau Top Cover Pad Installation

PAD INSTALLATION

Carefully locate and cement the center and side pads to the left panel. Adhesive should be applied to an area about ⅜-inch wide on the outside edge of the pads and to the corresponding area of the pad as shown in Fig. 8. After the pad is installed, trim off any excess material.

COVER INSTALLATION

It is recommended that the ⅛-inch oval head blind rivet Part No. 378906-S (Pop Rivet) be substituted for the staples.

The ⅛-inch oval head blind rivet Part No. 378906-S (Pop Rivet) and installing pliers (Mfg. Part No. PRP-26-A) can be procured from: Pop Rivet Division, United Shoe Machinery Corporation, Sheldon, Connecticut or from their local distributor.

Seal all unused holes with AB-19560-A Sealer. Seal staple holes with C1AZ-19627-A pressure sensitized tape.

1. Carefully position the outside cover on the pad and roof panel. Center punch marks, fore and aft, have been provided in the cover for centering purposes. Use adhesive

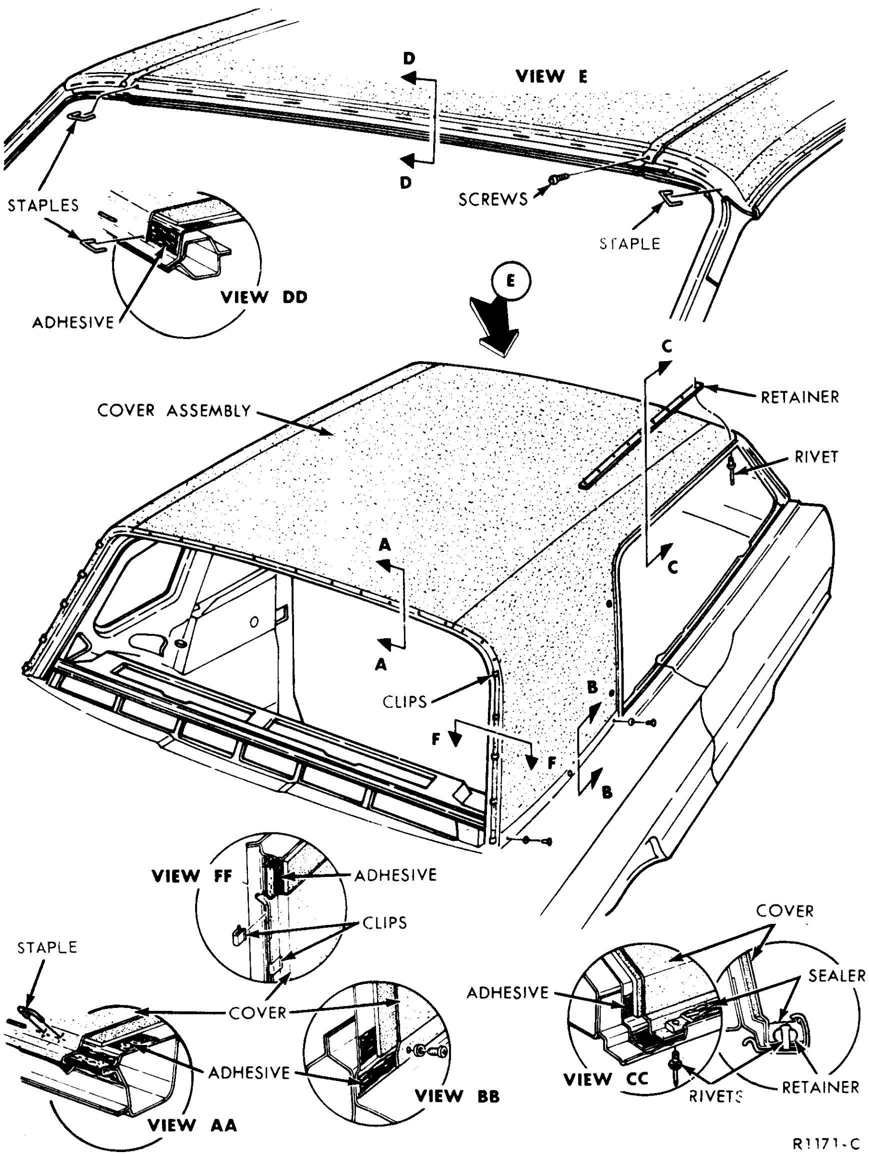


FIG. 9—Landau Top Cover Installation

C2AZ-19C525-A to cement the cover at the header and back window pinchweld flanges (Fig. 9).

The cover should be wrinkle free before installing. With the cover draping freely, a heat lamp application will remove the wrinkles. Do not overheat the cover.

2. Apply trim cement around the edges of the cover and using a 0.128-0.132 inch drill, pierce the vinyl material and drill twenty eight holes at the approximate locations of the sealed staple holes. Install pop rivets in each hole.

3. Position both drip rail retainers and, using the same drill referred to above, pierce the vinyl at each of the holes. Install the pop rivets from the underside of the drip rail.

4. Repeat the riveting at the back window and along the belt line.

5. Trim excess cover material from around the entire perimeter.

6. Apply sealer C3AZ-19562-A (for white tops) or sealer C3AZ-15962-B (for black or darker colored tops) over the entire surface of the drip rail retainers. With the drip rail properly sealed, a minimum depth of 1/8 inch should be retained for adequate water drainage. **Place masking tape on the cover assembly for the entire length of the drip rail before applying sealer. After sealer has been applied, remove the tape. (Refer to Fig. 9).**

7. Install five flange clips along each side of the rear window (Fig. 9).

8. From the underside of the roof panel, pierce the roof outside rear center moulding retainer holes. Install the roof outside mouldings, exercising care to ascertain that all holes are adequately sealed.

9. Locate and install the roof quarter outside ornaments and belt mouldings.

10. Install the windshield (see Part 17-3).

PART 18-2 SEATS

1 POWER SEATS

DESCRIPTION AND OPERATION

The power seat mechanism consists of a reversible electric motor, control switch, motor control relay, gear housing and screw shaft, and two solenoid actuated nuts.

The gear housing and screw shaft consists of a driving worm gear and a driven gear which rotates the screw shaft. The driving worm gear is connected to the motor by a rubber coupling.

The horizontal and vertical nut and solenoid assemblies are meshed to the screw shaft and connected to the seat track assembly.

The horizontal and vertical nut and solenoid assemblies are identical in construction. Each assembly consists of an internally threaded nut coupled with a locking solenoid. When the solenoid is energized, the internally threaded nut is locked by the solenoid pawl (ball) engaging a notch on the nut. As the screw shaft is rotated through the locked nut, the nut and solenoid move along the shaft and move the seat track.

2 RECLINING SEAT

DESCRIPTION AND OPERATION

The reclining seat mechanism consists of a seat actuator and control cable assembly and a seat-adjusting handle. The seat actuator is located in the seat back. It is connected to the adjusting handle, located at the seat back right side pivot, by a control cable which is routed through the seat back (Fig. 4).

The seat back reclining operation is controlled by the adjusting handle. When the handle is raised, the control cable releases a clutch in the seat actuator, allowing the seat back to recline. When the handle is released, the clutch engages and locks the actuator, thereby locking the seat back in position.

3 DIAGNOSIS AND TESTING

SEAT WILL NOT OPERATE

If both front seats are power operated and one seat is inoperative, the source of trouble is between the junction block and the inoperative seat mechanism.

1. Disconnect the red-blue stripe and the black wires, under the seat, which lead to the junction block under the console panel.

With a self-powered test light check the black wire to see if the system is properly grounded. If the black wire is not grounded, remove the console panel (see Part 17-3) and check the connections at the junction block, and repair as necessary.

2. Check the red-blue stripe wire for voltage. If voltage is not available, use a voltmeter to check both terminals of the circuit breaker located in the fuse panel. If voltage is available on both sides of the circuit breaker, remove the console panel and check the terminal of the junction block for voltage. If voltage is available at this point, repair or replace the wire between the junction block and the seat assembly. If voltage is not available at the junction block, repair or replace the wire from the circuit breaker to the junction block.

If voltage is available at only one terminal of the circuit breaker, replace the circuit breaker.

3. If voltage is available at the red-blue stripe wire, under the seat assembly, check the connections from the red-blue stripe wire to the seat relay for broken or loose wires. Repair or replace the wires as necessary. If the wires are all right, check the black wire at the motor for proper connection.

4. Separate the seat control switch wire connectors enough to insert a voltmeter test lead and still leave the wire connector functional. Check for battery voltage at the black-white stripe wire. If voltage is not available, repair or replace the black-white stripe wire.

Connect a voltmeter from each of the switch terminals to ground and operate the switch. If voltage is not available at any one of the switch terminals when the switch is operated, replace the seat control switch.

5. Separate the motor green wire at the connector. Operate the seat control switch and test the relay green wire for voltage. Repair or replace the relay, wires, or motor.

MOTOR RUNS BUT SEAT DOES NOT MOVE

Check for the following:

1. Loose or broken motor coupling.
2. Defective seat regulator worm, gear, or screw shaft.
3. Broken or loose wires from control switch to solenoid.
4. Defective solenoid and nut assembly.

SEAT MOVES IN ONE PLANE ONLY

Check for the following:

1. Connect a voltmeter from each of the switch terminals to ground, and operate the switch. If voltage is not available at any one of the switch terminals when the switch is operated, replace the switch.
2. Check the inoperative circuit solenoid and limit switches for proper operation.

4 REMOVAL AND INSTALLATION

POWER SEAT MECHANISM

REMOVAL

1. From under the car, remove the seat track retaining nuts and washers from the 4 studs. Disconnect the wires under the seat which lead to the junction block and remove the seat assembly.

2. Place the seat assembly on a clean work area and remove the front seat track shields and the four bolts retaining the seat track to the seat assembly. Disconnect the wires at the seat control switch and remove the seat track mechanism.

INSTALLATION

1. Connect the control switch wires and place the seat track mechanism in position on the seat assembly. Install the retaining bolts.

2. Install the front seat track shields.

3. Place the seat assembly in the car and install the washers and nuts on the studs which retain the seat track to the floor panel. Connect the seat wires to the junction block wiring harness. Test the seat assembly for proper operation.

MOTOR

1. Remove the two nuts and washers retaining the motor to the drive assembly and remove the motor. Remove the rubber coupling from the motor shaft. Transpose the new motor leads for the defective motor leads.

2. Install the rubber coupling on the motor. Place the motor on the drive assembly, making sure that the rubber coupling is properly installed on the drive gear shaft, and install the motor retaining nuts with washers.

SEAT TRACK

1. Working under the car, remove the seat track retaining stud nuts and washers. Then remove the seat assembly from the car and place it in a clean work area.

2. Remove the screws which retain the seat track assembly to the seat cushion, and remove the track assembly.

3. Disconnect the seat track brace and latch release rod from the track being replaced, and connect these parts to the new track.

4. Loosely install the track-to-floor retaining studs in the seat track assembly (Fig. 1).

5. Install the track assembly on the seat cushion, and tighten the screws.

6. Position the seat in the car and, working under the car, install the washers and nuts on the retaining studs.

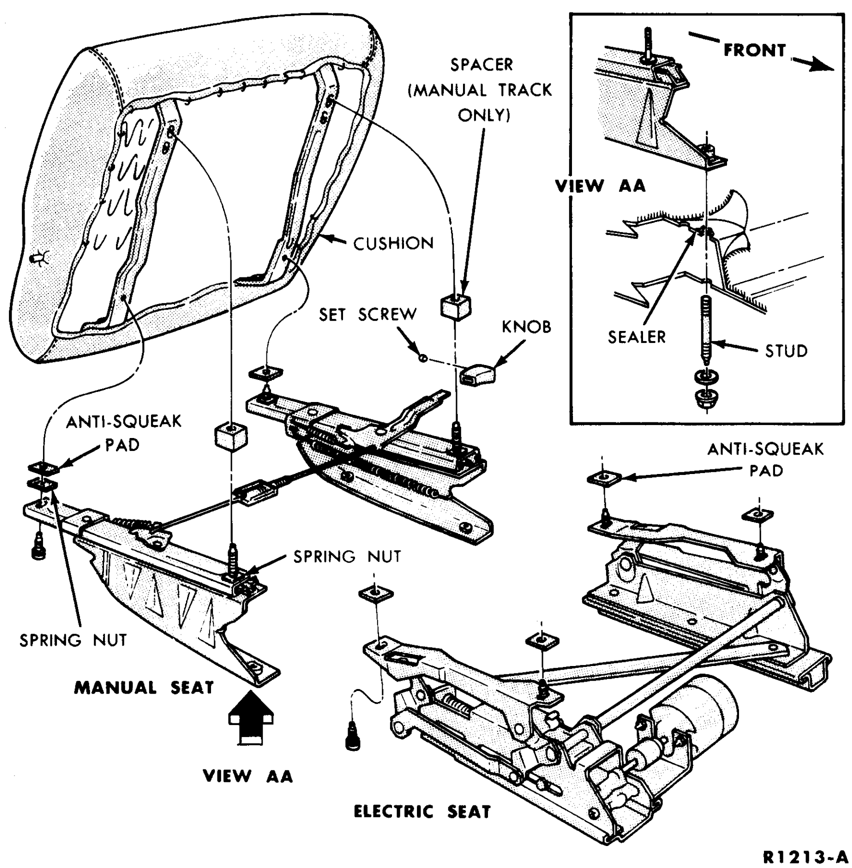


FIG. 1—Seat Track Installation

FRONT SEAT

REMOVAL

From underneath the car, remove the seat track retaining stud nuts and washers. Remove the seat assembly from the car and place it on a clean work area.

INSTALLATION

Adjust the seat stops as required. Place the seat assembly in the car and install the nuts and washers on the studs that retain the seat tracks to the floor panel.

REAR SEAT BACK

1. To remove the rear seat back, first remove the rear seat cushion. Remove the two screws that retain the bottom edge of the rear seat back to the body (Fig. 2).

2. Lift the bottom of the seat back slightly outward to allow the hanger wire to clear the retaining brackets. Remove the rear seat back.

3. Position the seat back so that the hanger wire engages the retaining brackets.

4. Install the lower retaining screws.

5. Install the rear seat cushion.

REAR SEAT BACK CENTER ARM REST

1. Lower the arm rest and remove the two screws attaching the arm rest trim flap to the package tray.

2. Remove the arm rest hinge screws and remove the arm rest.

3. Position the arm rest in place and install the hinge attaching screws.

4. Position the arm rest trim flap to the package tray and install the two attaching screws.

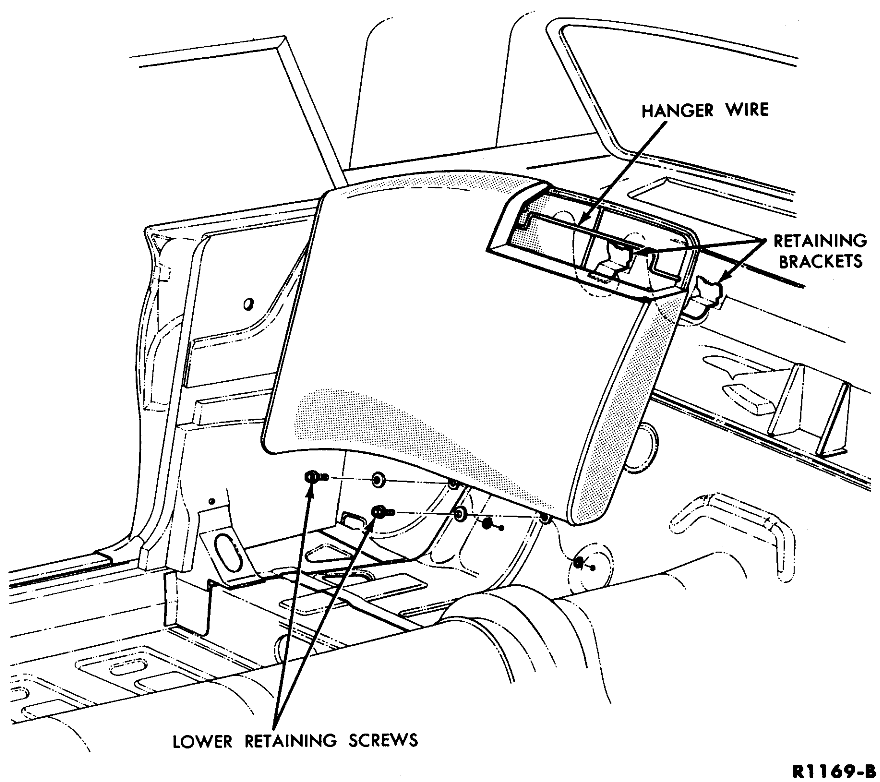


FIG. 2—Rear Seat and Arm Rest Installation

ADJUSTING ACTUATOR AND CABLE ASSEMBLY

REMOVAL

1. Remove the six seat back shield retaining screws and remove the seat back shield.

2. Remove the spring retainers from the lower ends of the headrest stabilizer rods and remove the headrest.

3. Remove the adjusting handle spring retainer and pull the handle off its shaft. Remove the speed clip which retains the control cable end to the adjusting handle (Fig. 3) and disengage the control cable end to the adjusting handle (Fig. 3) and disengage the control cable from the adjusting handle.

4. Unsnap the pivot side outer cover from the pivot side outer cover retainer (Fig. 3).

5. Remove the pivot side outer cover retainer attaching nuts (Fig. 3) and rotate the retainer clockwise sufficiently to gain access to the cable retaining clips.

6. Loosen the two retainer clip screws and disengage the control cable from the seat back pivot (Fig. 3).

7. Remove the headrest stabilizer rod upper right guide plate retaining screws (Fig. 4) and remove the guide plate.

8. Remove the seat back stops (Fig. 4).

9. Cut the hog rings from the seat back lower flap.

10. Remove the cotter pin and remove the hinge retaining pins from the seat back hinges.

11. Remove the roll pin from the actuator cylinder assembly at the hinge and remove the seat back assembly from the car.

12. Place the seat back assembly on a bench. Straighten the trim retaining tabs. Cut the hog rings at the top of the seat back trim and pull the trim cover away far enough to expose the actuator cylinder.

13. Remove the clevis pin from the upper actuator rod. Remove the hog rings which retain the cable assembly to the springs and remove the actuator assembly from the seat back.

INSTALLATION

1. Position the actuator assembly on the seat back spring assembly mounting brackets and insert the clevis pin in the upper actuator assembly rod. Install the self locking pin on the clevis pin. The metal spacer located between the control cable mounting bracket and the actuator lower mounting hole extends the over-all length of the actuator to provide for ease of installation. The spacer must remain intact during installation of the actuator.

2. With the actuator lower hole properly aligned with the mounting bracket, insert the retaining pin from the open side of the hole. If a new actuator assembly is being installed, the metal spacer will be driven out of the hole.

3. Position the cable assembly to the springs and install the two retaining hog rings.

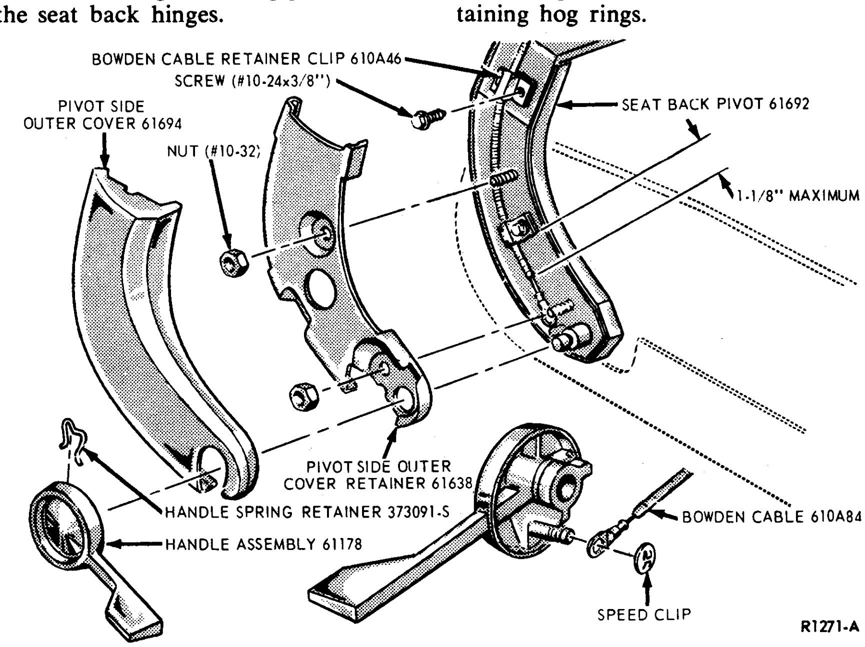


FIG. 3—Seat Adjusting Handle and Side Pivot—Disassembled

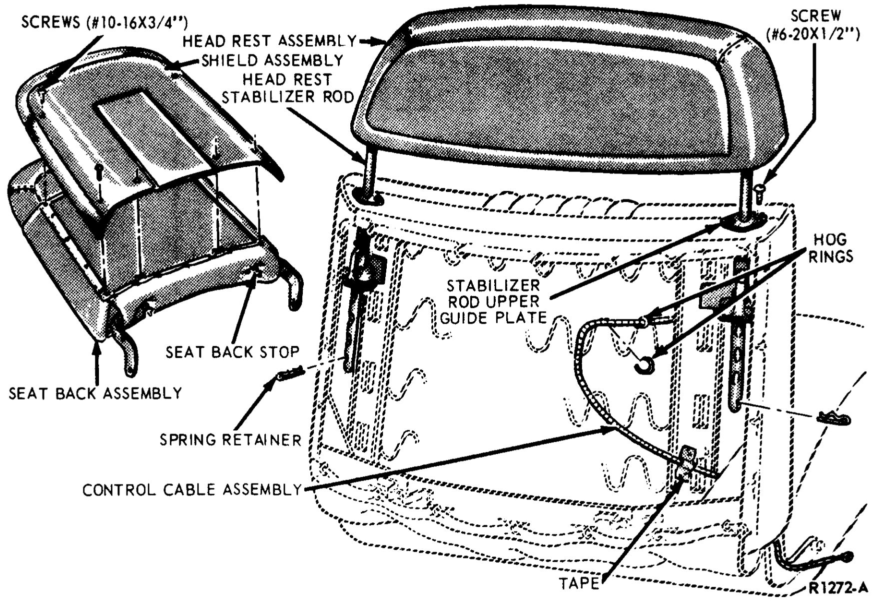


FIG. 4—Seat Back Shield and Headrest Assembly

4. Position the seat back trim over the tabs. Bend the tabs down and install new trim retaining hog rings.
5. Install the headrest stabilizer rod upper guide plate.
6. Position the seat back assembly to the seat cushion hinge assembly and install the roll pin which retains the lower actuator rod to the seat hinge.
7. Install the seat back hinge retaining pins and cotter pins.
8. Install new hog rings to retain the trim cover bottom flap.
9. Install the seat back stops.
10. Install the control cable under the two retaining clamps on the seat back pivot.
11. Position the control cable end on the adjusting handle and install the speed clip cable retainer.
12. Install the pivot side outer cover retainer.
13. Install the adjusting handle on the adjusting handle shaft.
14. Adjust the control cable, if necessary, and tighten the cable clamps.
15. Install the pivot side outer cover.
16. Position the headrest on the seat back assembly and install the headrest stabilizer rod lower spring retainers.
17. Position the seat back shield on the seat back and install the seat back shield retaining screws.

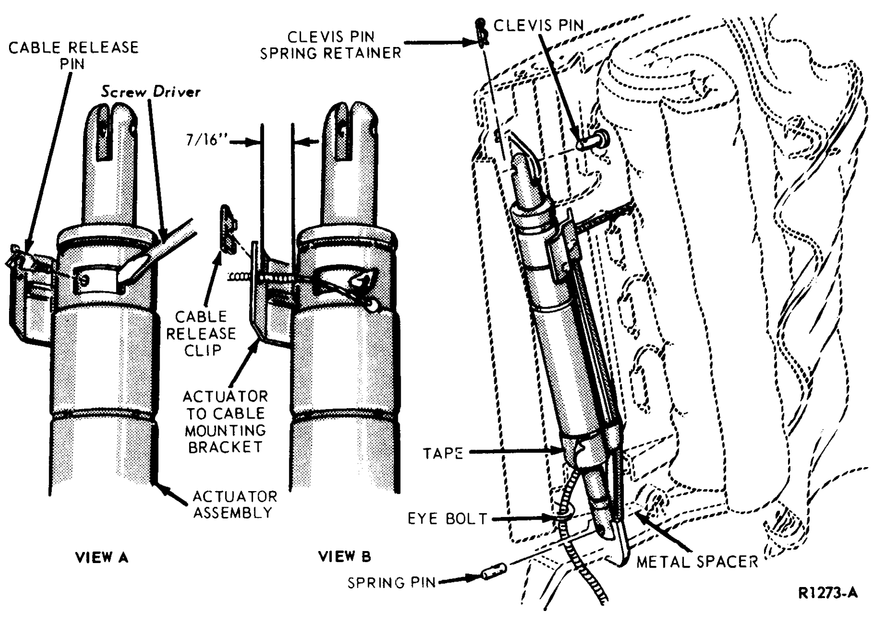


FIG. 5—Seat Actuator and Control Cable Assembly

ADJUSTING ACTUATOR CABLE

REMOVAL

1. Remove the six seat back shield retaining screws and remove the seat back shield.
2. Remove the spring retainers from the lower ends of the headrest stabilizer rods and remove the headrest.
3. Remove the adjusting handle spring retainer and pull the handle off its shaft. Remove the speed clip which retains the control cable end to the adjusting handle (Fig. 3) and disengage the control cable from the adjusting handle.
4. Unsnap the pivot side outer cover from the pivot side outer cover retainer (Fig. 3).
5. Remove the pivot side outer cover retainer attaching nuts (Fig. 3) and rotate the retainer clockwise sufficiently to gain access to the cable retaining clips.
6. Loosen the two retainer clip screws and disengage the control cable from the seat back pivot (Fig. 3).
7. Remove the headrest stabilizer rod upper right guide plate retaining screws (Fig. 4) and remove the guide plate.
8. Remove the seat back stops (Fig. 4).
9. Cut the hog rings from the seat back lower flap.
10. Remove the cotter pins and remove the hinge retaining pins from seat back hinges.
11. Remove the roll pin from the actuator cylinder assembly at the hinge and remove the seat back assembly from the car.
12. Place the seat back assembly on a bench. Straighten the trim retaining tabs. Cut the hog rings at the top of the seat back trim and pull the trim cover away far enough to expose the actuator cylinder.
13. Remove the hog rings which retain the cable assembly to the springs.
14. Remove the actuator-to-cable release clip (Fig. 5).
15. Open the split end of the cable release pin and remove the cable (Fig. 5).
16. Manually disengage the actuator clutch by forcing the release pin from right to left and retain the

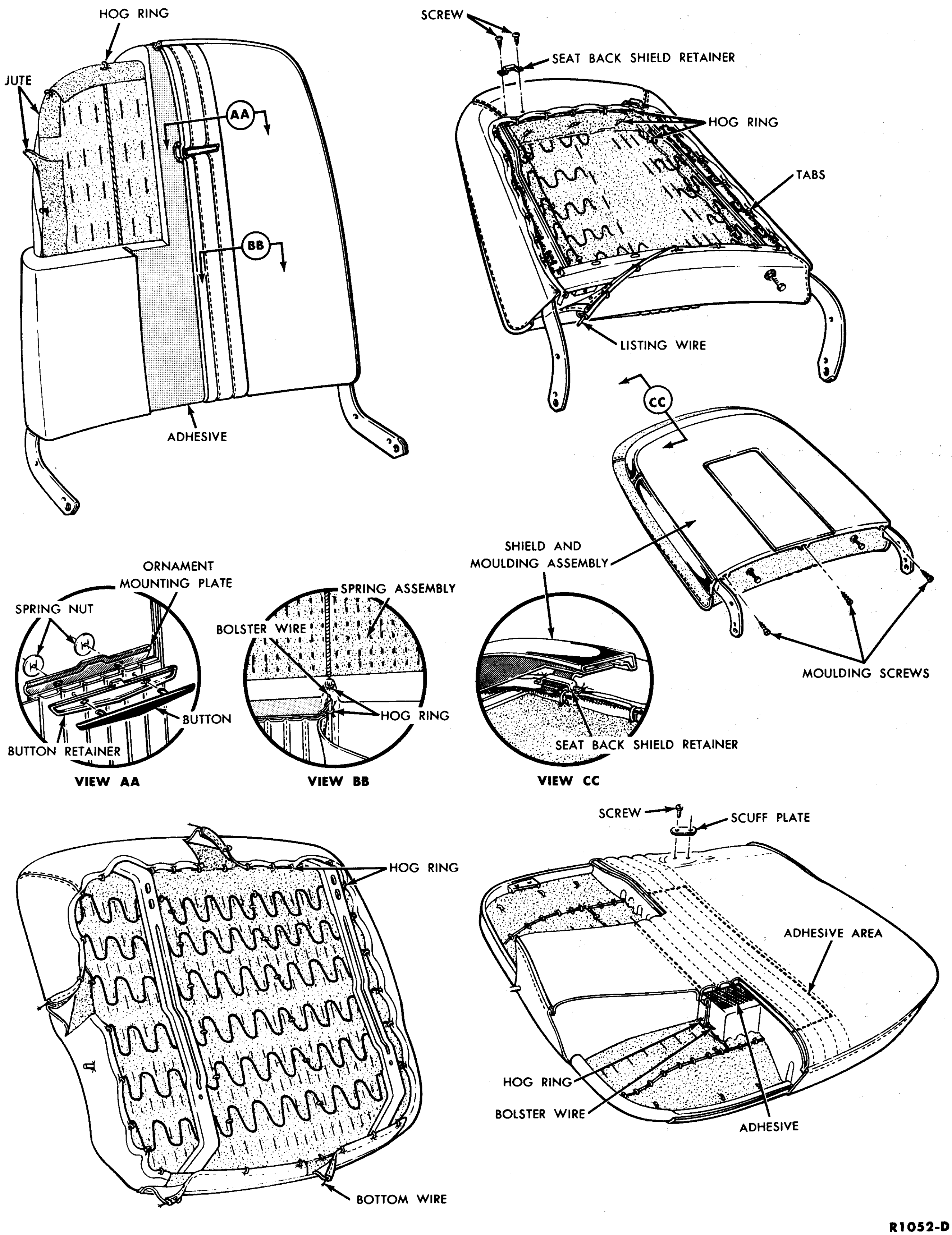


FIG. 6—Front Seat Back and Cushion Trim Assembly

pin in the open position by inserting the blade of a screwdriver (Fig. 5, View A) in the exposed slot to the right of the pin.

17. Remove and discard the cable release pin.

INSTALLATION

1. Install a new cable release pin and remove the screwdriver which is used to hold the clutch open.

2. Position the new cable into the release pin and bend the release pin slot closed.

3. Install the cable release clip (Fig. 5).

4. Position the cable to the seat spring elements and retain it with two hog rings.

5. Position the seat back trim over the tabs. Bend the tabs down and install new trim retaining hog rings.

6. Install the headrest stabilizer rod upper guide plates.

7. Position the seat back assembly to the seat cushion hinge assembly and install the roll pin which retains the lower actuator rod to the seat hinge.

8. Install the seat back hinge retaining pins and cotter pins.

9. Install new hog rings to retain the trim cover bottom flap.

10. Install the seat back stops.

11. Install the control cable under the two retaining clamps on the seat back pivot.

12. Position the control cable end on the adjusting handle and install the speed clip cable retainer.

13. Install the pivot side outer cover retainer.

14. Install the adjusting handle on the adjusting handle shaft.

15. Adjust the control cable, if necessary, and tighten the cable clamps.

16. Install the pivot side outer cover.

17. Position the headrest on the seat back assembly and install the headrest stabilizer rod lower spring retainers.

18. Position the seat back shield on the seat back and install the seat back shield retaining screws.

FRONT SEAT CUSHION COVER

1. Remove the seat assembly, and then remove the cushion side shields and seat track assembly. From each side of the seat, remove the seat back retaining pin and retainer, and then remove the seat back.

2. Remove the seat back scuff plates and remove the hog rings retaining the seat cushion cover to the spring assembly (Fig. 6). Separate the bottom facing from the cushion cover top rear panel, and allow the facing to remain cemented to the foam rubber pad. Remove the cushion cover.

3. Inspect the pad and spring assemblies, and repair or replace as necessary.

4. Transfer the listing wires to the new cover.

5. Place the new cover assembly over the pad and seat spring assembly and secure it to the front bolster wire with hog rings. Apply cement to the bottom of the cushion cover top rear panel and to the old facing which was left cemented to the foam rubber pad.

6. Secure each side bolster wire to the seat spring assembly with hog rings.

7. The front and side edges of the cover assembly can now be secured to the bottom of the spring assembly with hog rings as shown in Fig. 6.

8. Secure the rear edge of the cover assembly to the bottom of the spring assembly with hog rings.

9. Install the two scuff plates on the cushion.

10. Install the cushion side shields, seat back, and seat tracks. Install the seat assembly.

FRONT SEAT BACK COVER

1. From each side of the seat, remove the seat back pivot arm retaining pin and retainer, and then remove the seat back. Remove the two seat back stops, seat back pivot arm covers, and remove the shield and moulding assembly from the seat back (Fig. 7). Remove the hog rings from the seat back assembly, bend the tabs up on the seat back, and remove the seat back cover. Inspect the pad and spring assemblies, and repair or replace as necessary.

2. Transfer the listing wires to the new cover.

3. Place the new cover over the pad and spring assembly, and with hog rings, secure the cover to the bolster wire (Figs. 6 and 8).

4. Pierce the cover over the side and bottom retaining tabs, and bend the side retaining tabs toward the center of the seat.

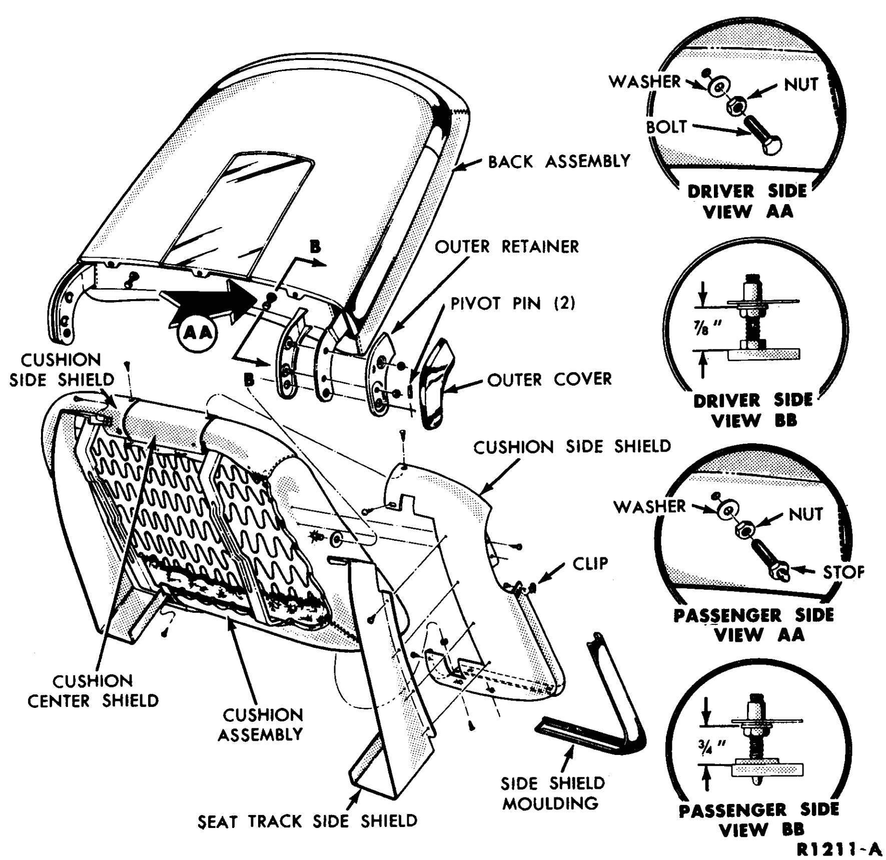


FIG. 7—Front Seat Back Installation

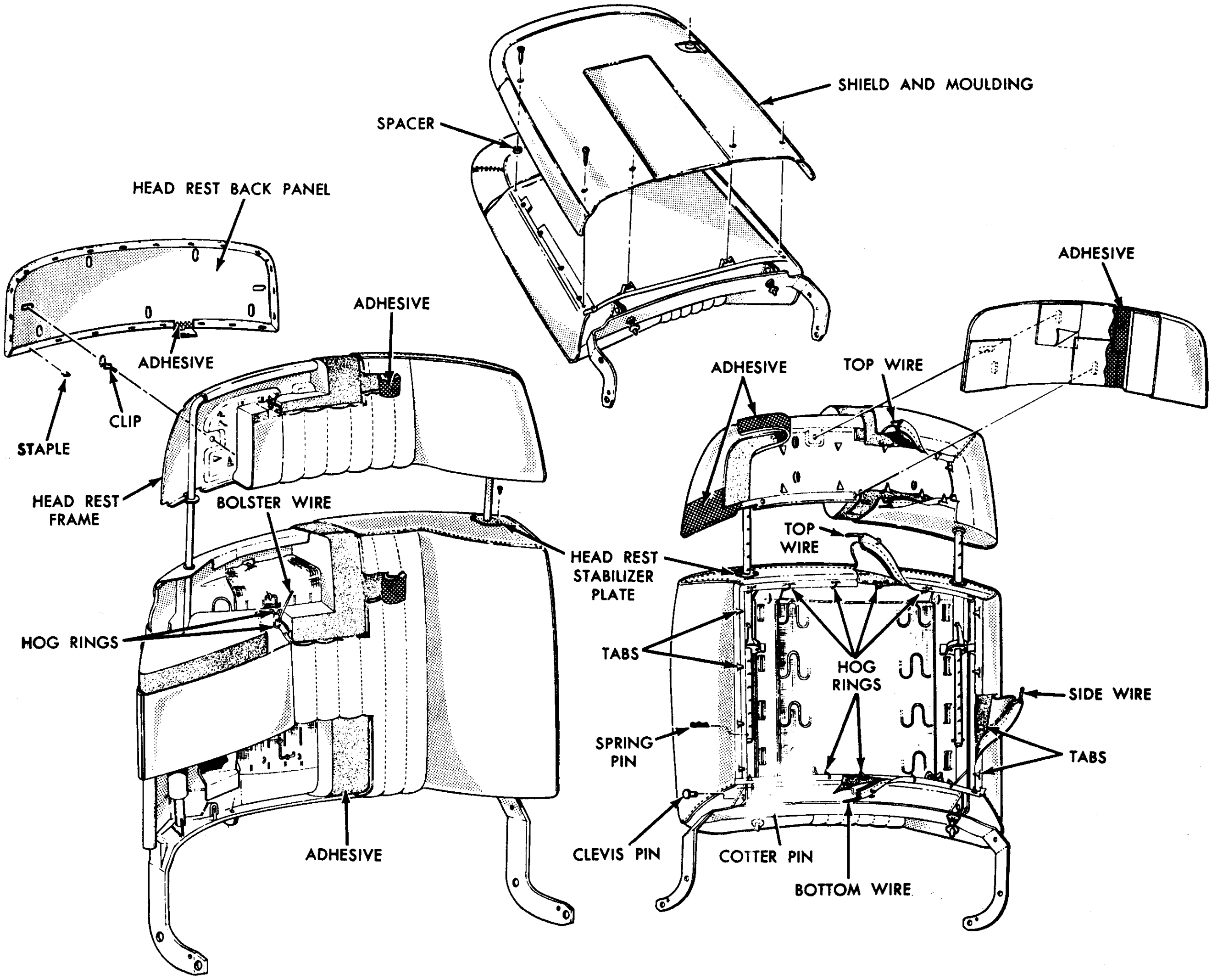


FIG. 8—RPO Front Seat Back Trim

5. Pull the lower rear edge of the cover over the bottom of the spring assembly, and secure each side with hog rings (Figs. 6 and 8).

6. Pull the lower front edge of the cover over the bottom of the spring assembly, and secure to the lower rear edge of the cover with hog rings on each side (Figs. 7 and 8). Secure the lower listing of the cover assembly to the spring assembly with hog rings, pierce the cover over the bottom retaining tab, and bend each tab toward the top of the seat.

7. Secure the top rear edge of the cover assembly to the spring assembly with hog rings.

8. Install the seat back panel with the retaining clips, the seat back pivot arm covers, and the two seat stops to the seat back assembly.

9. Connect the seat back to the seat cushion and install the pivot arm retainers and retaining pins.

REAR SEAT CUSHION COVER

1. Raise the front of the rear seat cushion and lift the cushion assembly from the car. Place the cushion on a clean work area. Remove the hog rings retaining the cover to the spring assembly (Fig. 9).

2. Inspect the pad and spring assemblies, and repair or replace as necessary.

3. Transfer the listing wires to the new cover.

4. Place the new cover assembly over the spring and pad assemblies. Attach the cover at each center bolster wire with six hog rings.

5. Carefully turn the cushion upside down and with 87 hog rings attach the cover to the bottom of the spring assembly (Fig. 9). Install the seat cushion in the car.

REAR SEAT BACK COVER

1. Remove the rear seat cushion. Remove the two screws retaining the bottom edge of the seat back to the body (Fig. 2) and remove the assembly from the car. Place the seat back assembly on a clean work area.

2. Remove the hog rings retaining the cover to the spring assembly (Fig. 9) and remove the cover. Inspect the pad and spring assemblies, and repair or replace as necessary.

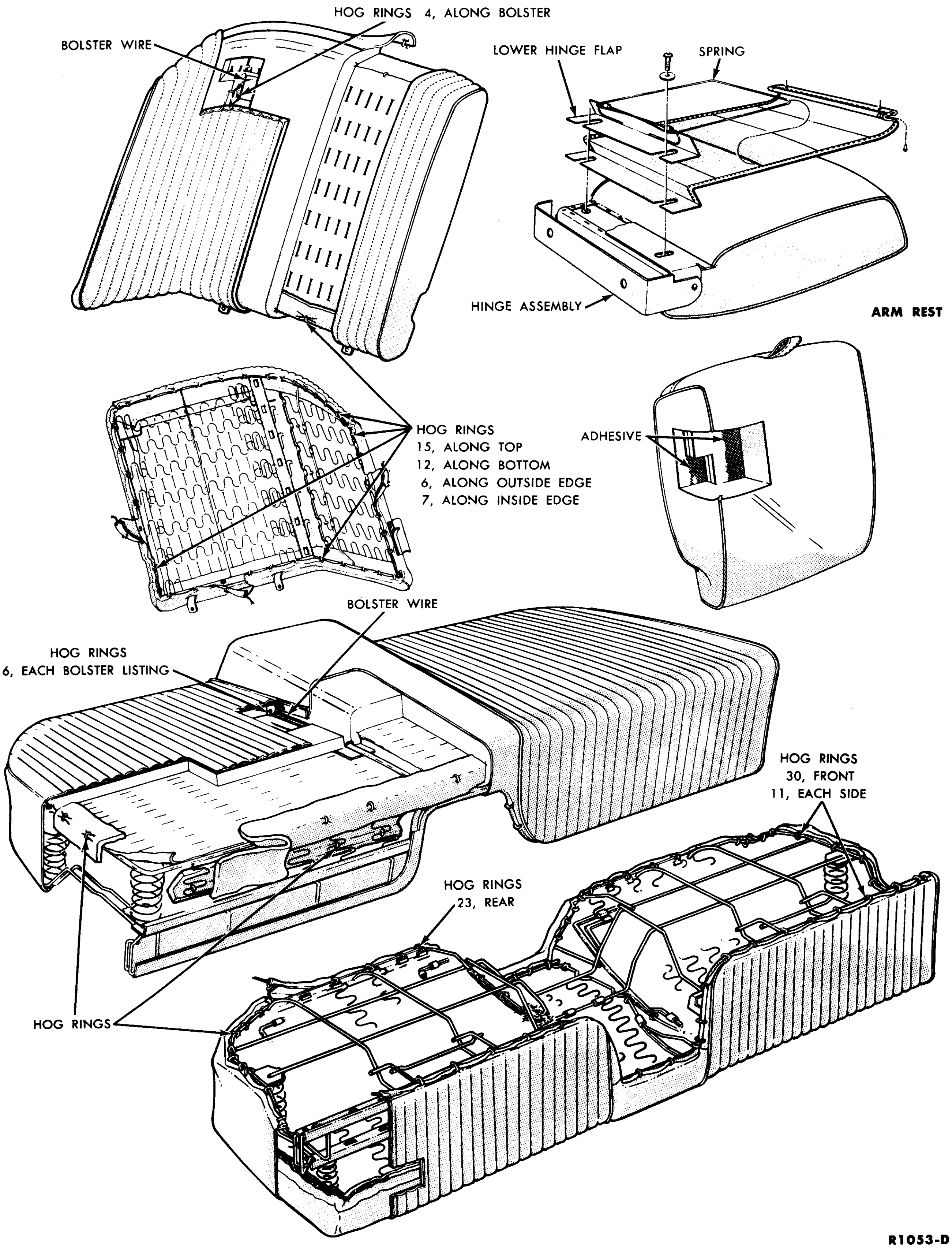


FIG. 9–Rear Seat Back, Cushion and Arm Rest Trim

3. Transfer the listing wire to the new cover.

4. Place the cover over the pad and spring assemblies. Turn the seat upside down and attach the cover along the top, sides, and bottom of the spring assembly with 44 equally spaced hog rings (Fig. 9).

5. Install the seat back assembly and the rear seat cushion.

REAR SEAT BACK CENTER ARM REST TRIM

The outer trim cover of the rear seat back center arm rest is held to the base with 24 staples as shown in Fig. 9.

PART 18-3 CONVERTIBLE TOP

1 DESCRIPTION AND OPERATION

The Thunderbird convertible top is lowered into and erected out of the luggage compartment. The cycles are automatic with the exception of manually locking or unlocking the windshield header clamps and opening or closing the rear window. The top operation is divided into two cycles, Top Retract Cycle and Top Erect Cycle.

The Top Retract Cycle is divided into six operations, Deck Lid Unlock, Deck Lid Open, Upper Back Panel Erect, Top Retract, Deck Lid Close, and Deck Lid Lock. The Top Erect Cycle is divided into six operations, Deck Lid Unlock, Deck Lid Open, Top Erect, Upper Back Panel Retract, Deck Lid Close, Deck Lid Lock.

Hydraulic pressure is used to raise and lower both the top and the deck lid (Fig. 1). The hydraulic pressure is produced by a reversible-electric motor and pump assembly and the top and deck lid linkages are actuated by the hydraulic cylinders.

Three electric-solenoid valves are placed in the hydraulic lines to control the flow of fluid to the desired cylinders.

The deck lid is unlocked and locked by jack screws (Fig. 2). A reversible-motor is used to operate the two jack screws through drive cables.

The upper back panel is extended and retracted by a motor and transmission mounted to the deck lid.

The deck lock screw motor and upper back panel motor are protected by a 15-ampere circuit breaker in the ground circuit. The top and deck motor and pump (and the entire circuit) is protected by a 60-ampere circuit breaker in the feed circuit (Fig. 6).

All circuits are protected by non-cycling circuit breakers. This type of circuit breaker will not reset itself until the control switch is released or the short circuit removed.

The power is supplied to the motors and solenoids through eight relays (six of which are double-contact relays). The double-contact relays are used to close the power supply circuit to both a motor and the related solenoids (or the armature and field windings in the shunt-wound upper back panel motor).

The instrument panel top control switch activates the top assembly (Fig. 3). A neutral switch relay is used to prevent top operation unless the transmission selector is placed in the neutral or park position. The ignition switch must be in the ON or ACC position and the neutral switch closed to energize the neutral switch relay, and close the control switch circuit.

The top mechanism operation is controlled by seven limit switches. These switches, actuated mechanically by the various panels or linkage, complete the supply circuit from the top control switch to the control relay coil windings. The switch lead wires may be color coded violet and yellow, or red, white and yellow at the switch itself. However, the wire colors between connectors are as indicated in the circuit diagrams (Fig. 3 through 14).

A luggage compartment light is mounted on the deck lid and is on whenever the deck lid is unlocked. The power source for this light is at the cigar lighter socket terminal in the console. The lower contacts of the luggage compartment door closed (or deck closed) limit switch control the function of the light (Figs. 3 through 14).

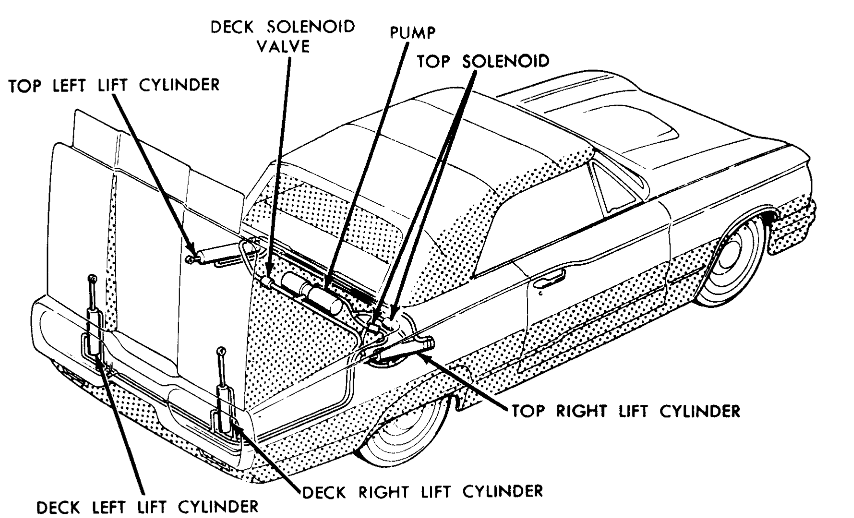


FIG. 1—Hydraulic System

TOP RETRACT CYCLE

This cycle starts with the top in the erected position and the deck lid closed and both locked. The top is manually unlocked, the rear window unfastened and rolled, and the top control switch is pressed and held. The transmission selector must be in the Neutral or Park position for top operation.

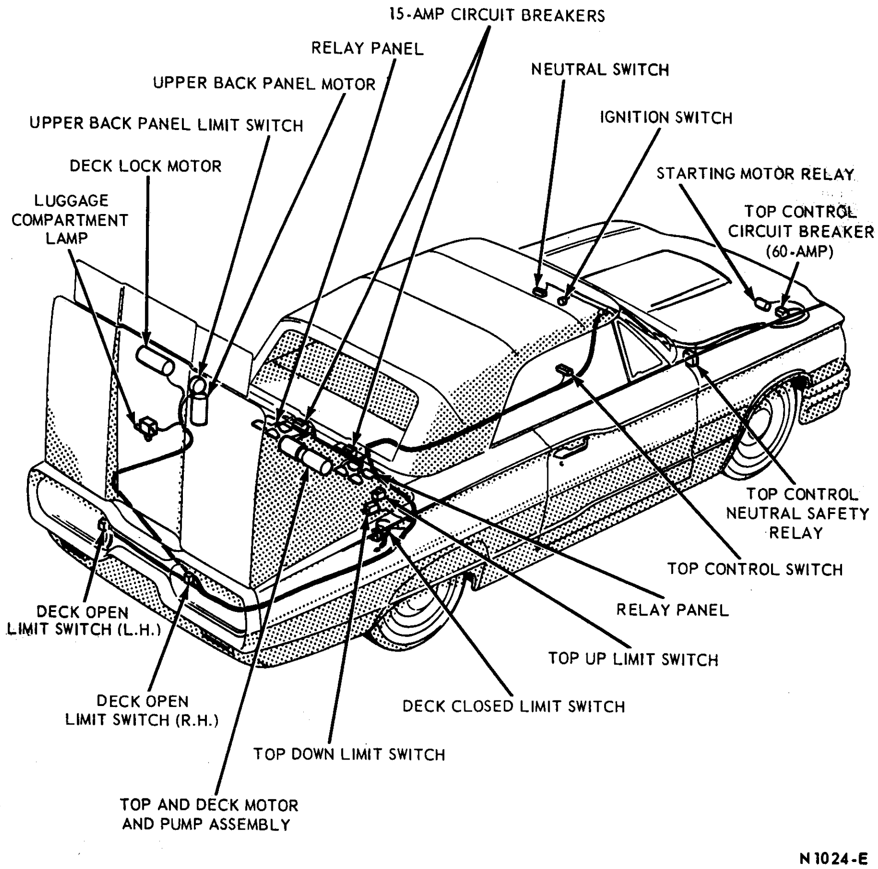


FIG. 2—Convertible Top Operating Parts and Locations

DECK LID UNLOCK

With the top control switch in the top down position, current flows from the top control switch, through the upper back panel retract limit switch, the deck open limit switch L.H., and the deck unlock relay coil to ground. The deck unlock relay coil is energized, closing the relay contacts which complete the power circuit from the 60-ampere circuit breaker, through the 15-ampere circuit breaker to the deck lock motor. The motor is energized and the deck lid is unlocked.

DECK LID OPEN

As soon as the deck lid is unlocked, the deck closed limit switch contacts are respositioned. The current now flows from the top control switch through the upper back panel limit switch through the deck open limit switch L.H., through the deck closed limit switch and the deck open relay coil to ground. This closes the deck open relay multiple contacts which complete the power circuits from the 60-ampere circuit breaker to the top-deck motor and the deck solenoid valve.

The deck solenoid valve is energized and the proper hydraulic lines are opened to the deck control cylinders. At the same time, the top-deck motor is energized and the deck lid is opened. **Deck locks continue to operate until the deck is completely open.**

UPPER BACK PANEL ERECT

When the deck lid is completely open, the plunger of the deck open limit switch L.H., is depressed and the switch contacts are repositioned. The current now flows from the top control switch, through the deck open switch L.H., the upper back panel limit switch, and the upper back panel erect relay coil to ground. The relay contacts close and the power circuit is completed from the 60-ampere circuit breaker, through the 15-ampere circuit breaker to the upper back panel motor. The motor is energized and the upper back panel is erected.

TOP RETRACT

The current now flows from the top control switch through the upper back panel limit switch, the top down limit switch, and the top down relay coil to ground. This closes the relay multiple contacts and completes the power circuits to the top-deck motor and the two top solenoid valves are energized and the proper hydraulic lines are opened to the control cylinders. At the same time the top-deck motor is energized and the top is lowered into the luggage compartment.

DECK LID CLOSE

When the top is stowed in the luggage compartment, the top down limit switch is actuated and the switch contacts are repositioned. The current now flows from the top control switch, through the top down limit switch, the deck closed limit switch, and the deck close relay coil to ground. The relay contacts are closed and the power circuit is complete to the top-deck motor and the deck control solenoid valve.

The deck control solenoid is energized and hydraulic lines are opened to the deck control cylinders. The top-deck motor is also energized and the deck lid is closed. This action is interrupted when the deck lid depresses the plunger on the deck closed limit switch.

DECK LID LOCK

At the same time the deck lid is closing, the deck lock motor is energized. This is accomplished by the current flowing from the top down limit switch through the deck lock relay to ground. This closes the relay contacts and completes the power circuit to the deck lock motor. The deck lock motor is energized until the top control switch is released.

TOP ERECT CYCLE

This cycle starts with the top in the luggage compartment and the deck lid closed and locked.

DECK LID UNLOCK

With the top control switch in the top up position, current flows from the top control switch, through the top down limit switch, the right-hand deck open limit switch, and the deck unlock relay coil to ground. The relay is energized, the contacts are closed, and the power circuit is completed to the deck lock motor. The motor is energized and the luggage compartment is unlocked.

DECK LID OPEN

As soon as the deck lid is unlocked, the deck closed limit switch contacts are repositioned. Now the current flows from the deck open limit switch R.H., through the deck closed limit switch, and the deck open relay to ground. The relay multiple contacts close the power circuits to the deck solenoid valve and the top-deck motor are completed. The deck solenoid valve is energized and the hydraulic lines are opened to the deck hydraulic control cylinders. The top-deck motor is energized and the deck lid is opened. **The deck lock motors will continue to run until deck is completely open.**

TOP ERECT

When the deck lid is completely opened, the deck open limit switch R.H. plunger is depressed and the switch contacts are repositioned. The current now flows from the top control switch, through the deck open limit switch R.H., the top up limit switch, and the top up relay to ground. The relay multiple contacts are closed and the power circuits are completed to the top deck motor and the two top control solenoid valves. The two top control solenoid valves when energized open the hydraulic lines to the top hydraulic control cylinders; at the same time the top-deck motor is energized and the top is erected.

UPPER BACK PANEL RETRACT

As soon as the top is in the full up position, the top up limit switch contacts are repositioned. This permits the current to flow from the top control switch through the upper back panel limit switch, the top up limit switch, and the upper back panel retract relay to ground. The relay contacts close, completing the power circuit to the upper back panel motors and the upper back panel is retracted.

DECK LID CLOSE

As soon as the upper back panel is retracted, the upper back panel limit switch is actuated and the switch contacts are repositioned. This stops the upper back panel motor. The current now flows from the top control switch, through the upper back panel limit switch, the deck closed limit switch, and the deck close relay to ground. The deck close relay multiple contacts close and the power circuits are complete to the deck control solenoid valve and the top-deck motor. The deck control solenoid valve and the top-deck motor are energized closing the deck lid.

DECK LID LOCK

At the same time the deck close relay is activated, the deck lock relay contacts are closed and the deck lock motor is activated. The deck lock motor continues to run while the deck lid is closing. When the deck lid closes the deck close limit switch plunger is depressed opening the circuit to the top and deck motor and pump. Deck lid movement stops.

The current now flows from the top control switch through the upper back panel limit switch to deck lock relay only. The deck lock relay contacts will remain closed and the deck lock motor will continue to run with the locks ratcheting after the deck is locked until the top control switch is released.

Release the top lock switch. Lock the windshield top header clamps and fasten the rear window.

2 DIAGNOSIS AND TESTING

To properly accomplish diagnosis and testing, the convertible top operating principles and sequence of operations should be thoroughly understood. There should also be an adequate power supply from the battery.

The most common operational failures will be due to maladjusted switches in the control circuit. The power circuits can be individually operated by energizing the correct power relay by means of a jumper wire. The following cautions must be observed:

1. Do not use an external power source. Extensive damage to electrical components could occur if an external power source is used.

2. When an individual component is cycled by means of a jumper wire, that component must be returned to its original position in the top cycle before proceeding. If this is not done, damage to the top, deck, and/or back panels could occur.

This method is applicable since it permits bypassing various limit switches and operating the motors directly. If bypassing a control circuit operates the motor, a continuity check should be made on the components of that particular control circuit. However, before this is attempted, the motor relay feed (power circuit) circuit breaker (50-ampere) must be checked and it must be ascertained that the motor is not jammed or stalled.

If bypassing the control circuit is not effective and no mechanical failure is evident, a failed relay, a failed motor, or an open circuit in the motor feed circuit is indicated. The relay can be bypassed to test the motor.

If at any point during the operation of the top, a motor continues to run after a cycle has been completed, and releasing the top control switch does not stop the motor, there is a probability of a stuck relay. Disconnect the battery to stop the motor; then, replace the applicable relay.

Before proceeding, the main power source circuit breaker, the top control neutral relay, and the top control switch should be tested, as they control the complete top circuit. If no voltage is available at the top control neutral relay, the control circuit 10-ampere circuit breaker or the neutral switch is at fault. **Don't overlook the hydraulic system. This system must be operating properly in order to obtain proper operation of the top.**

Sluggish operation of the top or deck lid assemblies is often accompanied by a loud and irregular pump noise. Very frequently this is caused by a low hydraulic fluil level. When this condition exists, cycle the top and then check the pump reservoir for the proper fluid level. The fluid level should be within ¼ inch of the filler plug hole with the deck lid and top in the raised position.

Before a systematic trouble-shooting procedure is attempted, a trouble-free source of electric current should be established at the top control switch and the service side of the 60-ampere circuit breaker. (Fig. 2).

POWER SUPPLY CHECK PROCEDURE

1. Check from the blue wire terminal of the 60-amp circuit breaker to ground, using a simple test lamp, a voltmeter or other appropriate test equipment, to determine that an adequate voltage supply is available at this point.

2. Check for full functioning of the neutral switch and top control neutral relay by placing the transmission selector lever in neutral and starting the engine. If any malfunction in this (starting) circuit is evident, check the circuit and make repairs.

3. With the starter circuit functioning properly, turn the ignition switch (key) to the ON or ACC position and check that an adequate voltage supply is available at the violet wire terminal of the top control switch. Use the same equipment as in 1 above.

4. In the event difficulties are encountered in the deck unlock and/or deck lid open phases of the top retract (top erect) cycle, check the voltage supply at the bus bar on the relay panel located back of the rear seat cushion. Use the same equipment as in 1 above. Also check the voltage supply at the service side of the two 15-ampere circuit breakers located in the same area.

5. The trouble-diagnosis guide following assumes an adequate voltage supply, for system operation purposes, at the top control switch, bus bar, and through the 15-ampere circuit breakers.

6. When using a self-powered test light for checking limit switches, disconnect the switch from the circuit.

TOP RETRACT CYCLE

All checks and tests detailed in the top retract cycle are to be performed with the top control switch (pressed down) (retract position). In the event of a stop in the cycle, release the control switch to avoid burning out a motor. If jamming is suspected, do not reactivate the control switch for over five seconds at one time until the condition is cleared.

TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—DECK LID UNLOCK (Fig. 3)

Malfunction	Probable Cause	Corrective Action
1 NO UNLOCKING ACTION—DECK UNLOCK RELAY NOT FUNCTIONING (NO AUDIBLE CLICK).	**(a)** Deck unlock relay defective.	**(a)** Move the top control switch to the up (erect) position, listen for ratcheting of the deck lid locks. Move the top control switch to the down position intermittently and listen for a click of the deck unlock relay. If there is no click, remove the rear seat back cushion and check for voltage at the orange-brown wire terminal. If the terminal is hot, the relay is defective. Replace the deck unlock relay.
	(b) No voltage at the relay orange-brown terminal.	**(b)** Bypass the relay by means of a jumper from the relay terminals as shown in Fig. 16 to activate the deck lock motor.
2 NO UNLOCKING ACTION—DECK UNLOCK RELAY FUNCTIONING (AUDIBLE CLICK).	**(a)** Maladjusted deck closed limit switch.	**(a)** A maladjusted deck closed limit switch will allow the top and deck motor and pump to operate and apply pressure to the deck lift cylinders and cause the lock screws to bind. Release the top control switch and unlock the deck lid as outlined in malfunction 1 (b). If this fails, the deck lid will have to be unlocked mechanically as detailed in Section 2.
	(b) Defective deck lock motor circuit or motor. Circuit and motor are inaccessible until deck is open.	**(b)** If a jumper is not effective in activating the deck lock motor, the deck lid will have to be unlocked mechanically to gain access to the deck lock motor and complete circuit (Section 2).

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TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—DECK LID UNLOCK (Fig. 3) Continued

Malfunction	Probable Cause	Corrective Action
3 NO UNLOCKING ACTION—DECK LOCK MOTOR RUNNING	(a) Broken flexible shaft or loose lock nuts, one or both sides.	(a) Unlock the deck lid mechanically as detailed in Section 2.
4 UNLOCKING ACTION—DECK LID JUMPS OFF LOCKS	(a) A maladjusted deck closed limit switch allows the top and deck motor and pump to operate early and apply pressure to the deck lid hydraulic cylinders before the locks are clear.	(a) When the deck lid has been opened, adjust the deck closed limit switch.

TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—DECK LID OPEN (Fig. 4)

Malfunction	Probable Cause	Corrective Action
1 NO DECK OPENING ACTION—DECK OPEN RELAY NOT FUNCTIONING	(a) Defective deck open relay (cycling stops as soon as deck lid locks clear).	(a) Check for voltage at the yellow-violet wire terminal of the deck open relay. If the terminal is hot, the relay is defective. Replace the deck open relay.
	(b) Defective circuit. Top control switch thru upper back panel limit switch, deck open limit switch L.H. and deck closed limit switch to yellow-violet wire terminal on deck open relay.	(b) If the yellow-violet wire terminal of the deck open relay is dead, use a jumper to bypass the deck open relay and activate the top and deck motor and pump and deck control solenoid to raise the deck lid. (Fig. 16).
	(c) Defective upper back panel limit switch.	(c) With the deck open for access, RELEASE THE TOP CONTROL SWITCH, using a self-powered test light check for an open circuit between the red-green wire terminal and the orange wire terminal of the six terminal group. If the light does not come on, the switch should be adjusted before deciding it is defective. Replace the defective upper back panel limit switch. At this time check the violet to yellow wire terminals of the six terminal group, and the grey to black-blue wire terminal of the 4-terminal group.
	(d) Defective deck open limit switch L.H. The deck lid must not be fully open to avoid repositioning of the switch terminals.	(d) TOP CONTROL SWITCH RELEASED. Using a self-powered test light, check for an open circuit between the yellow wire terminals of switch. If the test light fails to come on, the switch is defective. Also check the yellow wire terminals of deck open limit switch R.H. Replace the deck open limit switch(es) found defective.
	(e) Defective deck closed limit switch. Deck lid open for access.	(e) TOP CONTROL SWITCH RELEASED. Using a self-powered test light, check for an open cir-

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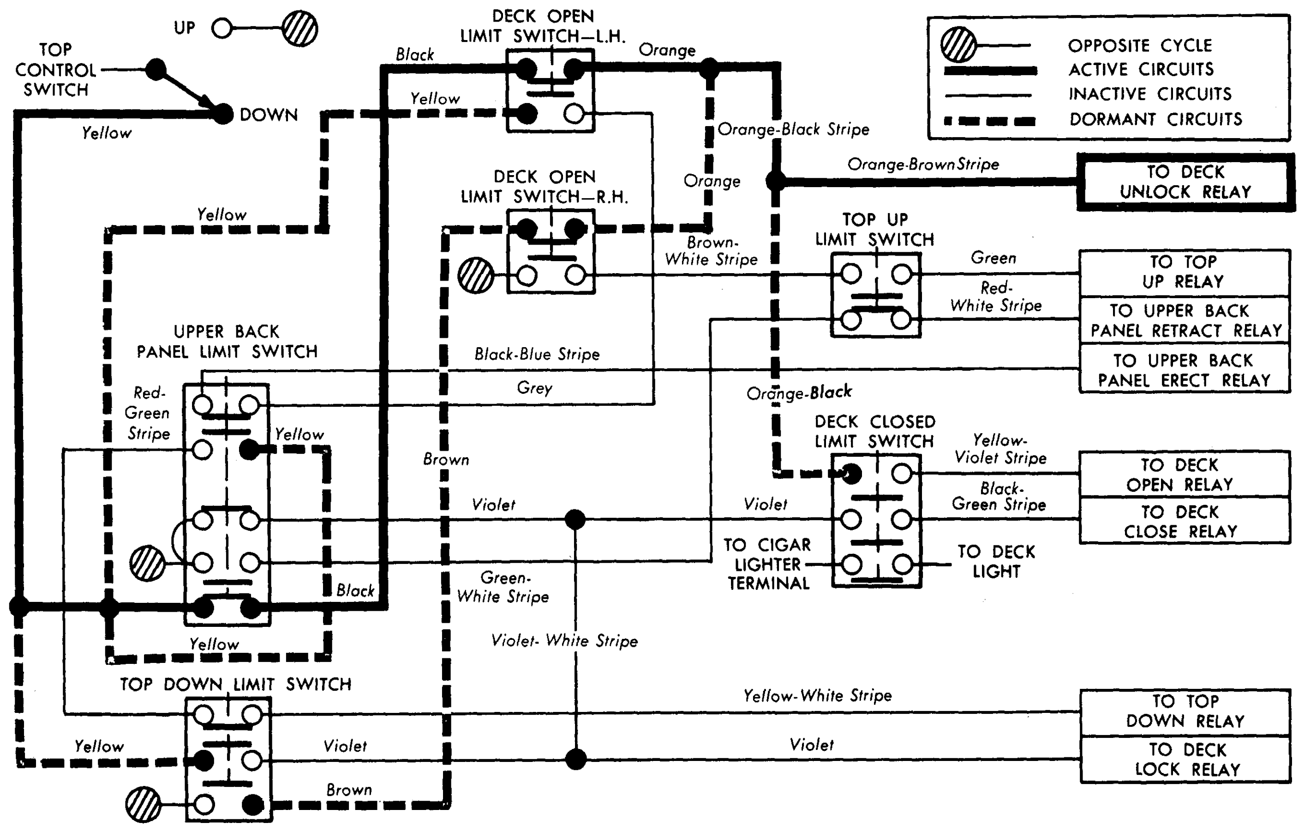

FIG. 3—Trouble Diagnosis Guide—Top Retract Cycle—Deck Lid Unlock

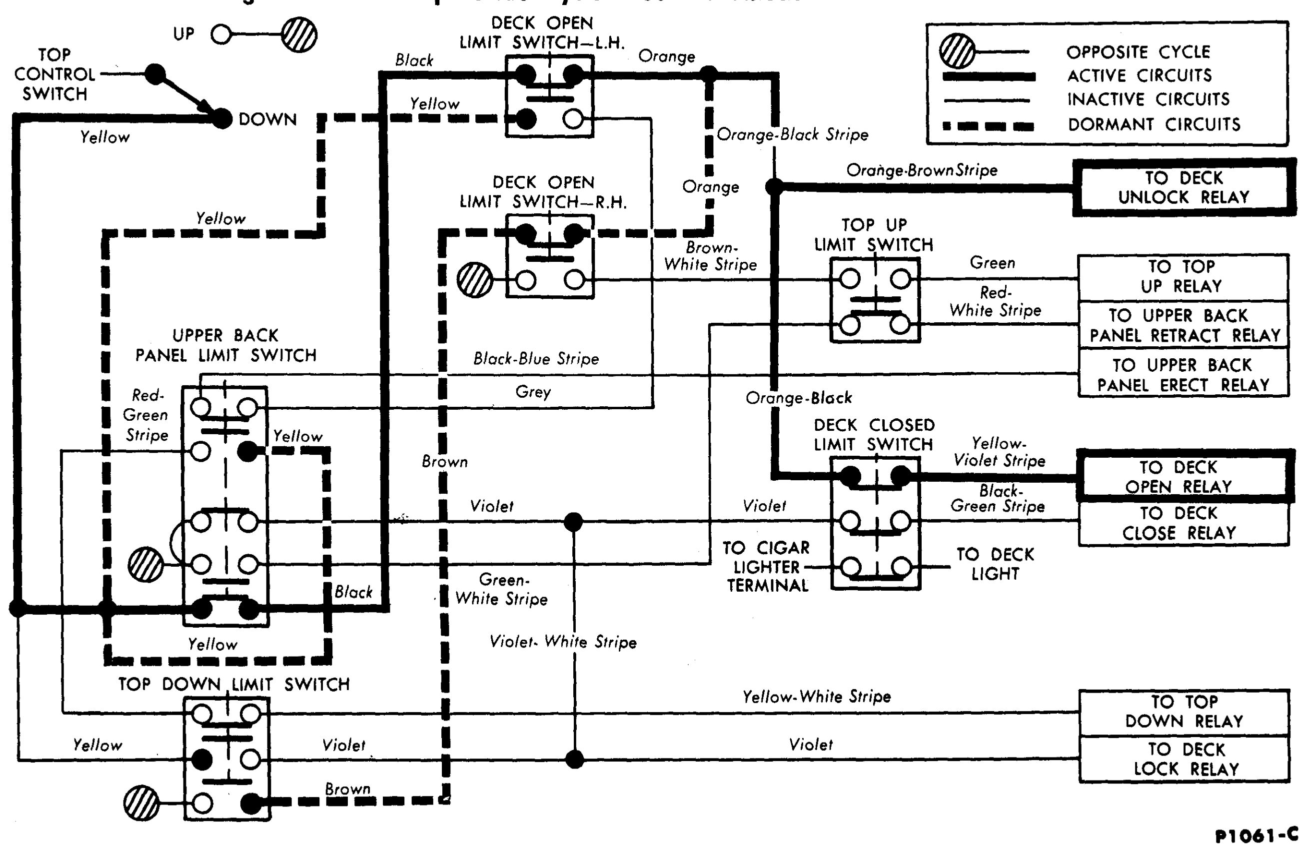

FIG. 4—Trouble Diagnosis Guide—Top Retract Cycle—Deck Lid Open

TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—DECK LID OPEN (Fig. 4) Continued

Malfunction	Probable Cause	Corrective Action
1 NO DECK OPENING ACTION—DECK OPEN RELAY NOT FUNCTIONING (Continued)		cuit between the yellow wires, red wires, and white wires of the switch. If the test light fails to come on for any check, switch is defective. Replace deck closed limit switch.
2 NO DECK OPENING ACTION—DECK OPEN, RELAY NOT FUNCTIONING. DECK BUMPS UP AND DOWN ON LOCKS.	(a) Maladjusted deck closed limit switch.	(a) Raise the deck lid manually until the deck motor and pump become energized. After the deck lid is open, adjust the deck closed limit switch.
3 NO DECK OPENING ACTION—FUNCTIONING DECK OPEN RELAY.	(a) Defective power circuit to the top and deck motor and the pump or deck control solenoid.	(a) A defective power circuit or defective motor or solenoid will prevent the deck opening regardless of the relay function and will be evident when the relay jumper is applied. The deck lid must be opened mechanically to gain access for repairs (Section 2).
	(b) Defective deck lock motor circuit or motor.	(b) (1) TOP CONTROL SWITCH RELEASED. If the deck lock motor is not functioning, check the power circuit for voltage at the motor red-yellow wire terminal. The deck lid should be open sufficient for access only to avoid respositioning of the deck open limit switch L.H. If there is no voltage, repair the circuit. (2) If the terminal shows voltage, the motor is defective. Replace the deck lock motor.
	(c) Broken deck lock flexible shaft(s).	(c) TOP CONTROL SWITCH RELEASED. With the deck lid open, check the deck lid lock shafts and lock nuts. If the shaft(s) are broken, replace the shafts. Otherwise tighten the lock nuts.
	(d) Faulty deck control solenoid valve or top deck motor and pump assembly power circuits.	(d) Open the deck lid mechanically (Section 2). Check the solenoid and motor circuits. Repair the faulty circuit.
	(e) Faulty deck control solenoid valve.	(e) TOP CONTROL SWITCH RELEASED. Open the deck lid mechanically, sufficient for access. If the circuit shows voltage at blue-red terminal on the valve and the top deck motor and pump operate when the top control switch is momentarily depressed but there is not action at the deck opening cylinders, the solenoid valve is defective. Replace the valve.

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TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—DECK LID OPEN (Fig. 4) Continued

Malfunction	Probable Cause	Corrective Action
3 NO DECK OPENING ACTION—FUNCTIONING DECK OPEN RELAY. (Continued)	(f) Faulty top deck motor and pump assembly.	(f) TOP CONTROL SWITCH RELEASED. Open the deck lid mechanically, sufficient for access. If the circuit checks hot at the red wire terminal of the motor and pump assembly and the motor does not operate when the top control switch is momentarily depressed, the motor is defective. Replace the top deck motor and pump assembly.

TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—UPPER BACK PANEL ERECT (Fig. 5)

Malfunction	Probable Cause	Corrective Action
1 DECK OPEN—NO UPPER BACK PANEL ACTION—UPPER BACK PANEL ERECT RELAY NOT FUNCTIONING (NO AUDIBLE CLICK).	(a) Defective upper back panel erect relay.	(a) Depress the top control switch intermittently while listening for a click. If there is no click, check for voltage at the black-blue wire terminal on the relay. If the terminal shows voltage, the relay is defective. Replace the upper back panel relay.
	(b) Defective deck open limit switch L.H. to upper back panel erect relay circuit.	(b) Check out the circuit from the black-blue terminal on the upper back panel erect relay connector, through the upper back panel limit switch to the violet wire terminal on the deck open limit switch L.H. Repair the circuit.
	(c) Defective deck open limit switch L.H.	(c) Loosen the switch actuator, press the switch plunger all the way in and check between the violet wire terminals on the switch with a self-powered test light. If the light does not come on, the switch is defective. Also check the violet wire terminal(s) of the deck open limit switch R.H. Replace the defective deck open limit switch(es).
	(d) Defective upper back panel limit switch. If defective circuits are found at this switch after the switch terminals have been repositioned by erection of the upper back panel, check the red to black wire terminals of the six-terminal group and the Red to Brown-Green wire terminals of the four-terminal group.	(d) If the circuit check performed in (b) above showed an open circuit at the black-blue to grey terminals of the upper back panel limit switch, adjust the four-terminal section of the switch. If the adjustment does not close the circuit, the switch is defective. Replace the upper back panel limit switch.
	(e) Defective power circuit to upper back panel erect relay.	(e) Check between the ground and blue-white wire terminal on the upper back panel motor. If the terminal is dead, the circuit is open. Repair the circuit.

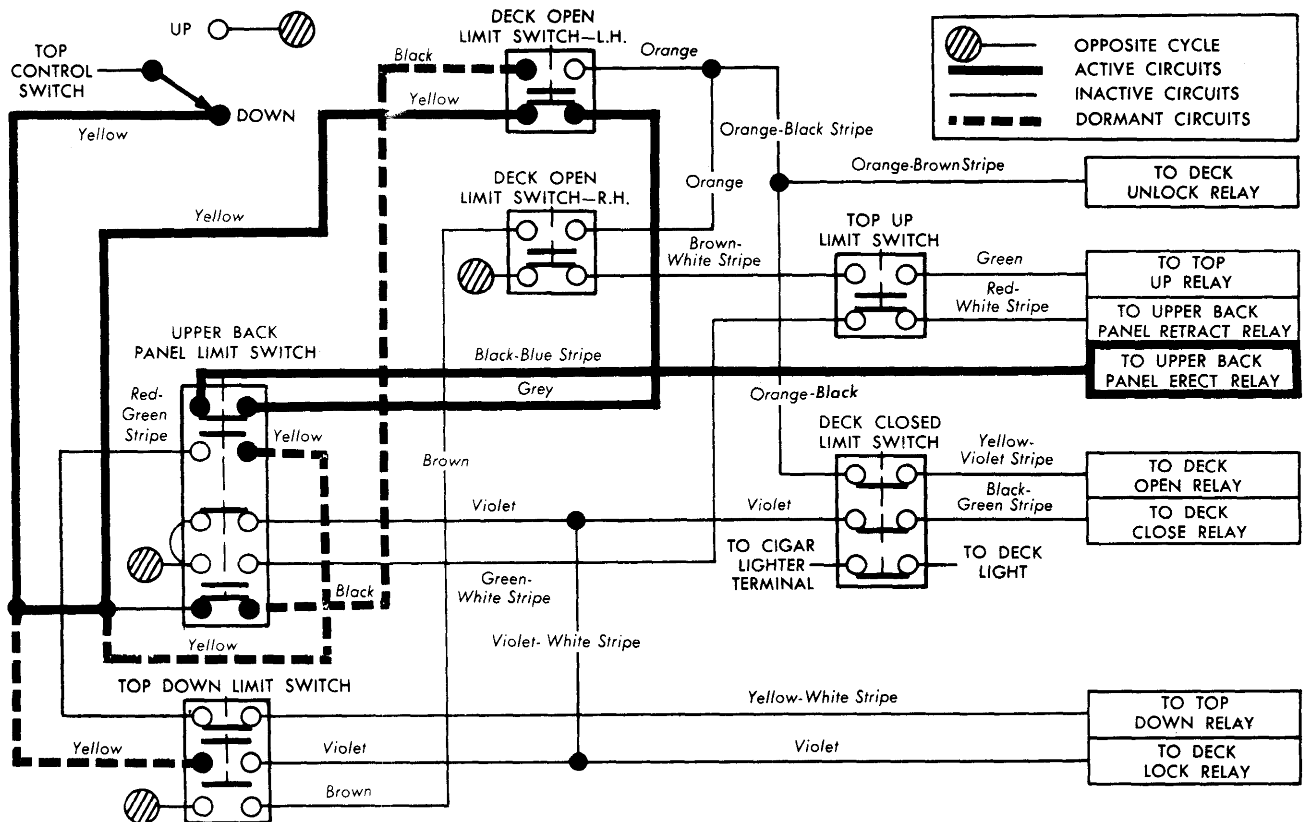

FIG. 5—Trouble Diagnosis Guide—Top Retract Cycle—Upper Back Panel Erect

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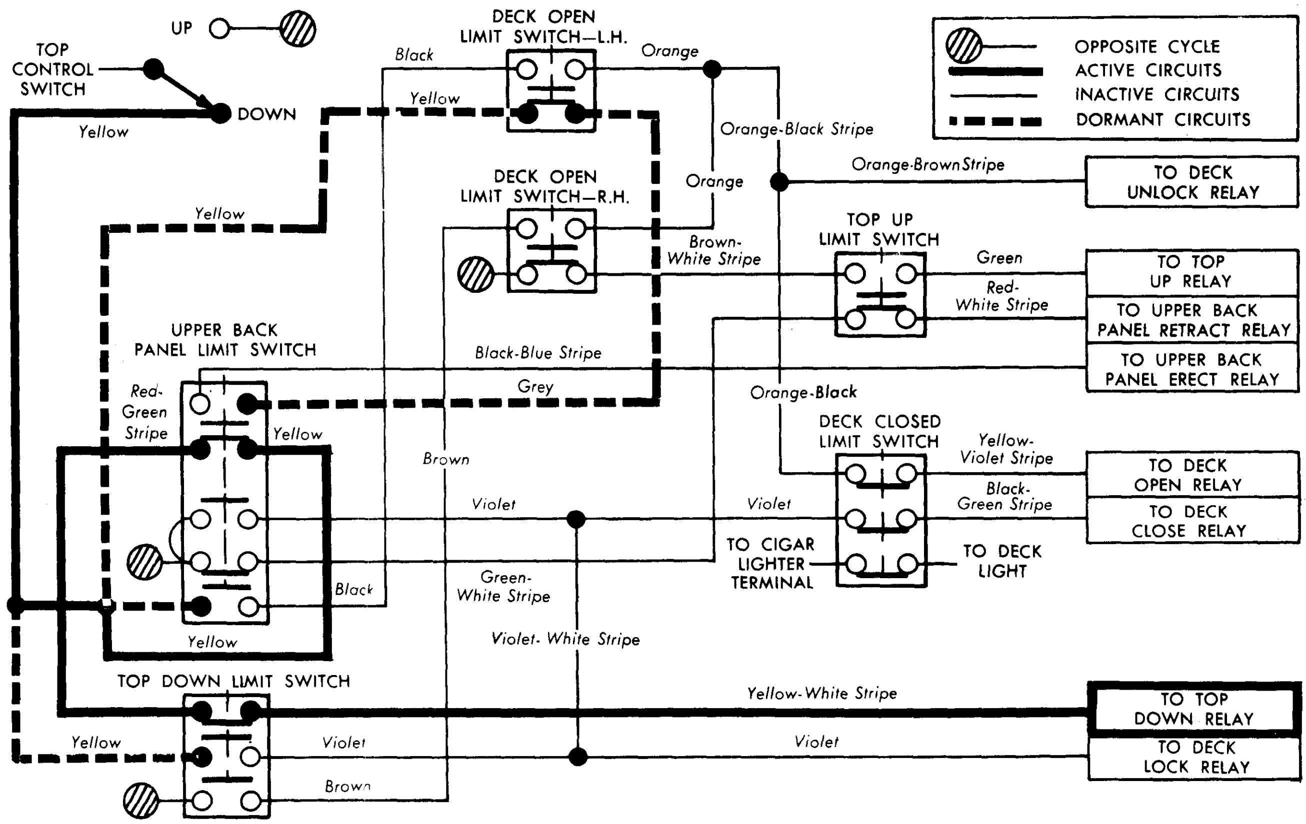

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FIG. 6—Trouble Diagnosis Guide—Top Retract Cycle—Top Retract

TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—TOP RETRACT (Fig. 6)

Malfunction	Probable Cause	Corrective Action
1 TOP RETRACT—NO TOP ACTIÓN—TOP DOWN RELAY NOT FUNCTIONING. (NO AUDIBLE CLICK).	(a) Defective top down relay.	(a) (1) Depress the top control switch intermittently and listen for the relay to click. If there is no click, bypass the relay with a jumper to activate the top and deck motor and the pump. Check for current at the yellow-white wire terminal on the relay. If the terminal shows voltage the relay is defective. Replace the top down relay. (2) If the yellow-white wire terminal is dead, check out the circuit from the top control switch to the relay (Fig. 6).
	(b) Defective top down relay to upper back panel limit switch circuit.	(b) Check out the circuit from the yellow-white wire terminal on the top down relay through the top down limit switch to the red-green wire terminal of the upper back panel limit switch connector. Repair the circuit.
	(c) Defective top down limit switch.	(c) Check between the yellow-white wire terminal and the violet-white wire terminal on the top down limit switch with a self-powered test lamp. If the lamp fails to come on, the switch is defective. Replace the top down limit switch.
2 NO TOP RETRACT ACTION—TOP DOWN RELAY FUNCTIONING (AUDIBLE CLICK) TOP AND DECK MOTOR AND PUMP ASSEMBLY OPERATING	(a) Defective top control solenoid valves.	(a) Check for voltage at the white-blue wire at the top control solenoid valves. If the wire shows voltage the solenoid valve is defective. If the wire is dead, check the power circuit and repair it.
3 NO TOP RETRACT ACTION—TOP DOWN RELAY FUNCTIONING (AUDIBLE CLICK) TOP AND DECK MOTOR AND PUMP ASSEMBLY NOT OPERATING.	(a) Defective top and deck motor and pump assembly or power circuit.	(a) Check for voltage at the yellow wire at the top and deck motor and pump assembly. If the wire shows voltage, the motor is defective. If the wire is dead, check the power circuit and repair it.

TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—DECK LID CLOSE AND LOCK (Figs. 7 & 8)

Malfunction	Probable Cause	Corrective Action
1 NO DECK CLOSE ACTION—DECK CLOSE RELAY NOT FUNCTIONING.	(a) Defective deck close relay.	(a) (1) Check for voltage at the black-green wire terminal on the relay. If the terminal shows voltage, the relay is defective. Replace the deck close relay. (2) If the black-green wire terminal is dead, proceed as in (b) below.

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TROUBLE DIAGNOSIS GUIDE—TOP RETRACT CYCLE—DECK LID CLOSE AND LOCK (Figs. 7 & 8)—(Cont'd)

Malfunction	Probable Cause	Corrective Action
1 NO DECK CLOSE ACTION—DECK CLOSE RELAY NOT FUNCTIONING. (Continued)	(b) Defective deck close relay to top down limit switch circuit.	(b) Check out the circuit from the black-green wire terminal on the deck close relay through the deck closed limit switch to the violet-white wire terminal on the top down limit switch. Repair the circuit.
	(c) Defective top down limit switch.	(c) Check between the violet-white wire terminal and the red wire terminal on the top down limit switch with self-powered test light. If the light fails to come on, the switch is defective. Replace the top down limit switch.
	(d) Defective deck closed limit switch.	(d) Check between the white wire terminals on the deck closed limit switch with a self-powered test light. If the light fails to come on, the switch is defective. Replace the deck closed limit switch.
2 NO DECK CLOSE ACTION—DECK CLOSE RELAY FUNCTIONING—TOP AND DECK MOTOR AND PUMP ASSEMBLY IS OPERATING.	(a) Defective deck control solenoid valve.	(a) Check for voltage at the deck control solenoid valve lead. If the wire shows voltage, the solenoid valve is defective. If the wire is dead check the power circuit and repair it.
3 NO DECK CLOSE ACTION—DECK CLOSE RELAY FUNCTIONING—TOP AND DECK MOTOR AND PUMP NOT OPERATING.	(a) Defective top deck motor and pump assembly or power circuit.	(a) Check the voltage at the yellow wire at the top and deck motor and pump assembly. If the wire shows voltage, the motor is defective. If the wire is dead, check the power circuit and repair it.
4 NO DECK LOCK ACTION—DECK LOCK MECHANISM NOT FUNCTIONING WHEN DECK LID STARTS TO CLOSE.	(a) Defective deck lock relay. The deck lock relay is activated simutaneously with the deck close relay.	(a) Check for voltage at the violet wire terminal of the relay. If the wire is hot, the deck lock relay is defective. If the wire terminal is dead, check for a break in the violet wire to violet-white wire circuit to the deck closed limit switch. Repair the circuit.
5 NO DECK LOCK ACTION—DECK LOCK RELAY FUNCTIONING.	(a) Open power circuit to top and deck lock motor or defective motor.	(a) When the deck lid starts to close, observe the deck lock mechanism. If the deck lock mechanism is not functioning, disconnect the motor leads at the motor. Use a jumper between the motor yellow-red lead and the yellow-blue wire receptacle of the deck lock relay connector. If the motor operates, the power circuit (yellow wire) is open. Repair the circuit. If the motor does not operate, the motor is defective. Replace the deck lock motor.

This completes the trouble shooting and tests for the top retract cycle. Release the top control switch.

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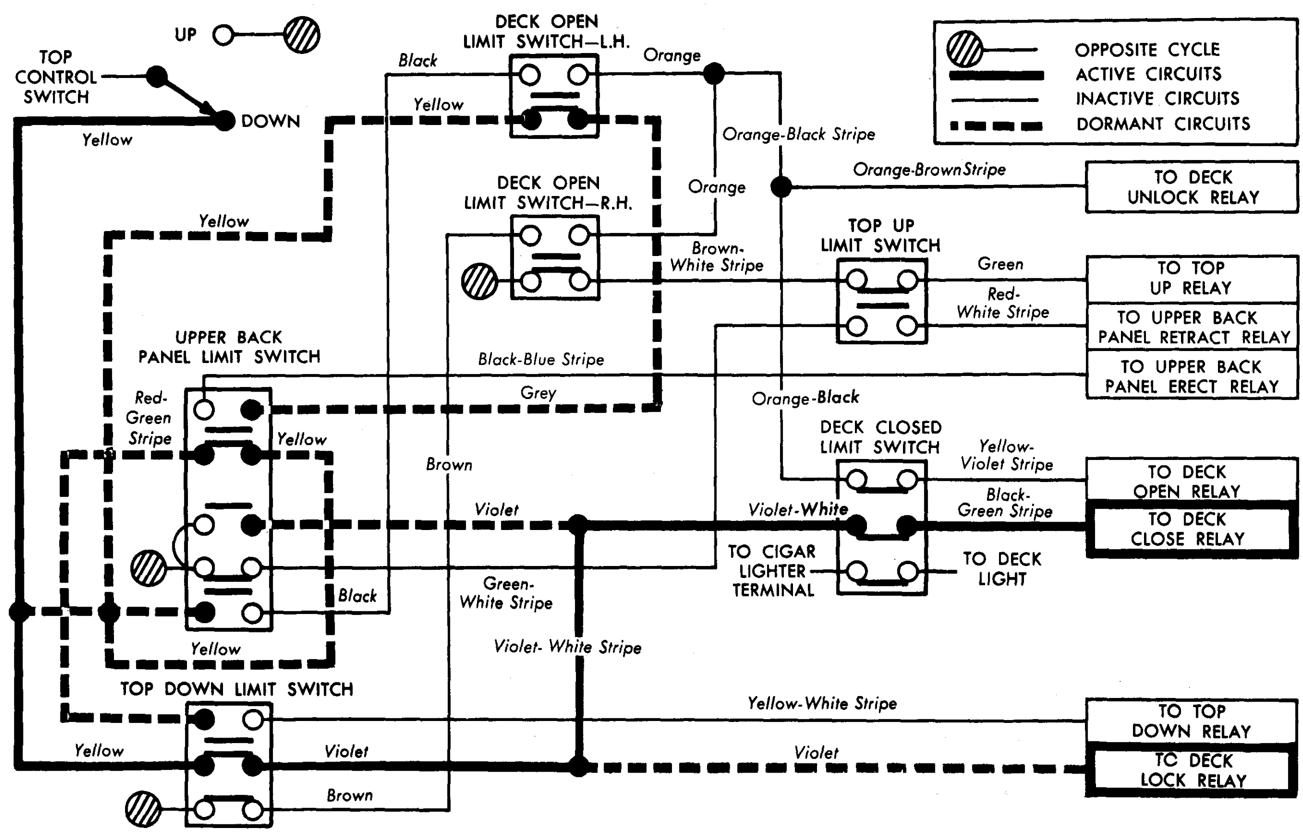

FIG. 7—Trouble Diagnosis Guide—Top Retract Cycle—Deck Lid Close

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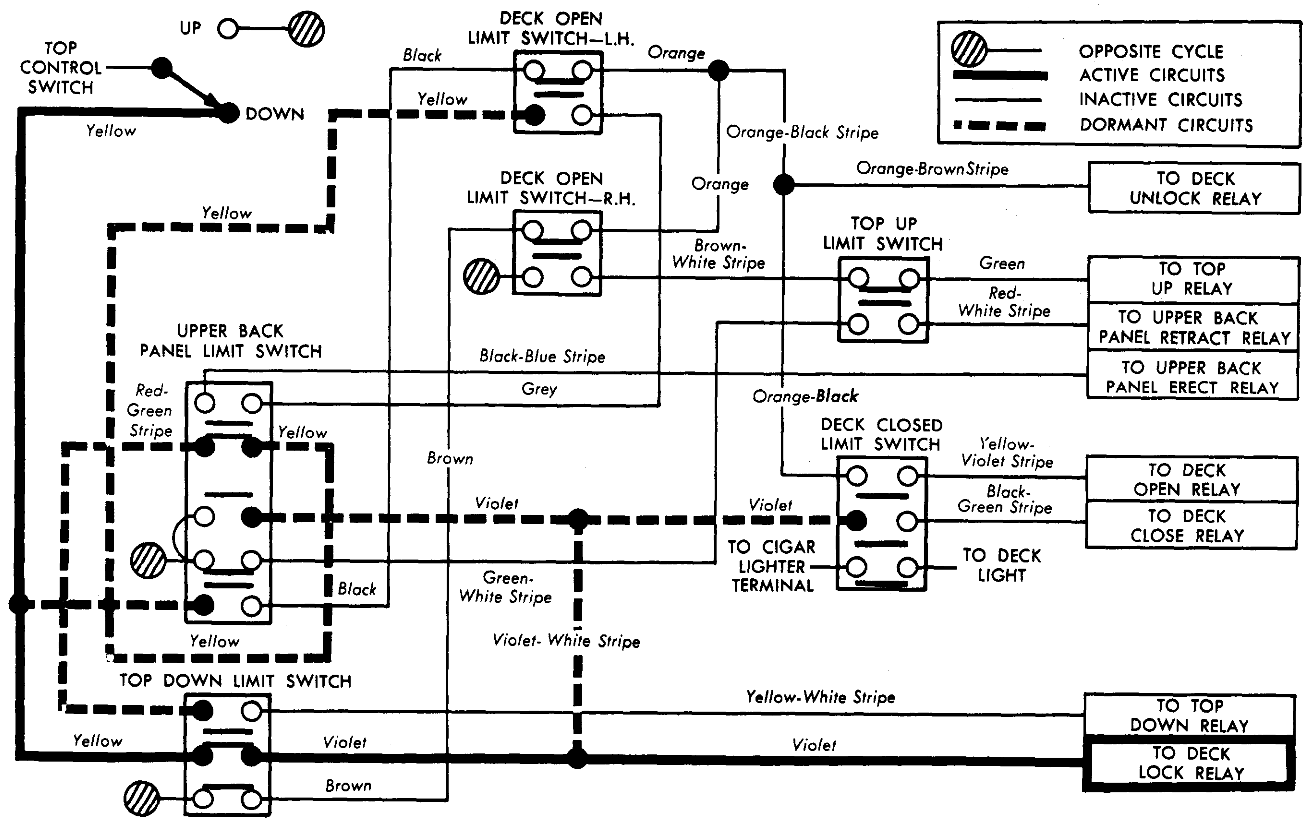

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FIG. 8—Trouble Diagnosis Guide—Top Retract Cycle—Deck Lid Lock

TOP ERECT CYCLE

The top erect cycle phases utilize the same motors as the top retract cycle phases. These motors, however, operate in the reverse direction of that for the retract cycle in the upper back panel retract and top erect phases. The circuits, switches, and/or switch positions differ in the various phases. All checks and tests detailed in this cycle are to be performed with the top control switch pushed up (erect position). In the event of a stop in the cycle, release the control switch to avoid burning out a motor. If jamming is suspected, do not reactivate the control switch for over five seconds at one time until condition is cleared.

TROUBLE DIAGNOSIS GUIDE—TOP ERECT CYCLE—DECK LID UNLOCK (Fig. 9)

Malfunction	Probable Cause	Corrective Action
1 NO UNLOCKING ACTION—DECK UNLOCK RELAY NOT FUNCTIONING (NO AUDIBLE CLICK).	(a) Deck unlock relay defective.	(a) Move the top control switch to the down (retract) position, listen for a ratcheting of the deck lid locks. Move the top control switch to the up (erect) position intermittently, and listen for a click of the deck unlock relay back cushion. If there is no click, remove the rear seat back cushion and check for voltage at the orange-brown terminal. If the terminal is hot, the relay is defective. Replace the deck unlock relay.
	(b) No voltage at the relay orange-brown terminal.	(b) Bypass the deck unlock relay by means of a jumper at the connector terminals as shown in Fig. 16, to activate the deck lock motor.
2 NO UNLOCKING ACTION—DECK UNLOCK RELAY FUNCTIONING (AUDIBLE CLICK).	(a) Maladjusted deck closed limit switch.	(a) A maladjusted deck closed limit switch will allow the top and deck motor and pump to operate and apply pressure to the deck lid cylinders and cause the lock screws to bind. Release the top control switch and unlock the deck lid as outlined in malfunction 1 (b). If this fails, the deck lid will have to be unlocked mechanically as detailed in Section 2.
	(b) Defective deck lock motor circuit or motors. (Circuit and motor are inaccessible until the deck is open).	(b) If the jumper is not effective in activating the deck lock motor, the deck lid will have to be unlocked mechanically to gain access to the deck lock motor and complete the circuit (Section 3).
3 NO UNLOCKING ACTION—DECK LOCK MOTOR RUNNING.	(a) Broken flexible shaft or loose lock nuts, one or both sides.	(a) Unlock the deck lid mechanically (Section 2).
4 UNLOCKING ACTION—DECK LID JUMPS OFF LOCKS.	(a) A maladjusted deck closed limit switch allows the top and deck motor and pump to operate too soon, and apply pressure to the deck lid hydraulic cylinders before the locks are clear.	(a) When the deck lid has been opened, adjust the deck closed limit switch.

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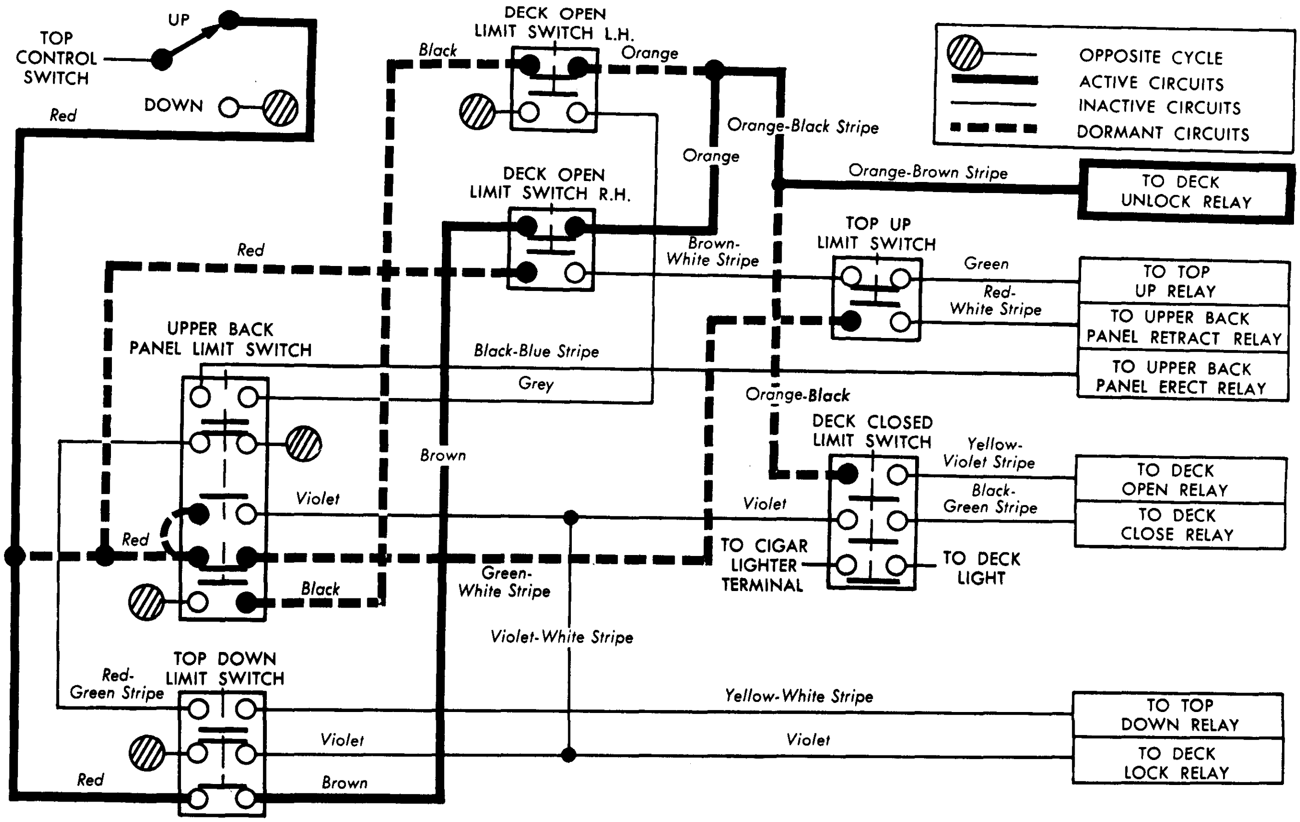

FIG. 9—Trouble Diagnosis Guide—Top Erect Cycle—Deck Lid Unlock

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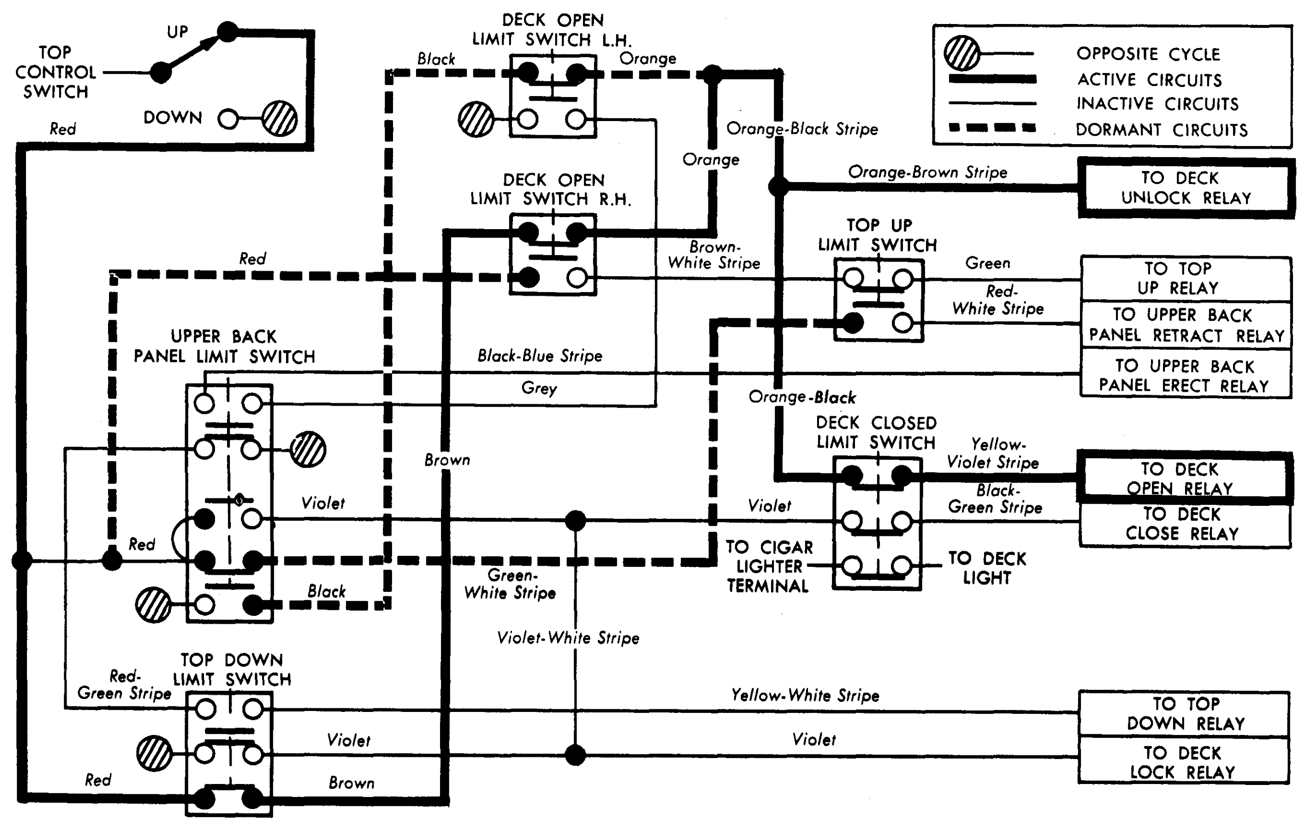

FIG. 10—Trouble Diagnosis Guide—Top Erect Cycle—Deck Lid Open

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TROUBLE DIAGNOSIS GUIDE—TOP ERECT CYCLE—DECK LID OPEN (Fig. 10)

Malfunction	Probable Cause	Corrective Action
1 NO DECK OPENING ACTION—DECK OPEN RELAY NOT FUNCTIONING.	(a) Defective deck open relay (cycling stops as soon as deck lid locks clear).	(a) Check for voltage at the yellow-violet wire terminal of the deck open relay. If the terminal shows voltage, the relay is defective. Replace the deck open relay.
	(b) Defective circuit, top control switch thru the top down limit switch, the deck open limit switch R.H. and the deck closed limit switch to the yellow-violet wire terminal on the deck open relay.	(b) If the yellow-violet wire terminal of the deck open relay is dead, use a jumper to bypass the deck open relay and activate the top and deck motor and pump and deck control solenoid to raise the deck lid (Fig. 16).
	(c) Defective top down limit switch.	(c) With the deck lid open for access only, use a self-powered test lamp to check the brown to yellow wire terminals of the top down limit switch. The light should come on. Also check the red to violet-white pair of wire terminals. The light should come on. If the light does not come on in either case, the switch is defective. Replace the top down limit switch.
	(d) Defective deck open limit switch R.H. (Deck lid must not be fully open to avoid repositioning of the switch terminals).	(d) TOP CONTROL SWITCH RELEASED. Using a self-powered test light, check for an open circuit between the yellow wire terminals of the switch. If the test light fails to come on, the switch is defective. Also check the yellow wire terminals of the deck open limit switch L.H. Replace the deck open limit switch(es) found defective.
	(e) Defective deck closed limit switch. (Deck lid open for access).	(e) TOP CONTROL SWITCH RELEASED. Using a self-powered test light, check for an open circuit between the yellow wires, red wires, and white wires of the switch. If the light fails to come on for any check, the switch is defective. Replace the deck closed limit switch.
2 NO DECK OPENING ACTION—DECK OPEN RELAY NOT FUNCTIONING. DECK BUMPS UP AND DOWN ON LOCKS.	(a) Maladjusted deck closed limit switch.	(a) Raise the deck lid manually until the deck motor and pump become energized. After the deck lid is open, adjust the deck closed limit switch.
3 NO DECK OPENING ACTION—DECK OPEN RELAY FUNCTIONING.	(a) Defective power circuit to the top and deck motor and pump or the deck control solenoid.	(a) A defective power circuit or defective motor or solenoid will prevent the deck opening regardless of the relay operation and will be evident when the relay jumper is applied. The deck lid must be opened mechanically to gain access for repairs (Section 2).

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TROUBLE DIAGNOSIS GUIDE—TOP ERECT CYCLE—DECK LID OPEN (Fig. 10) (Cont'd)

Malfunction	Probable Cause	Corrective Action
3 NO DECK OPENING ACTION—DECK OPEN RELAY FUNCTIONING (Continued)	(b) Defective deck lock motor circuit or motor.	(b) (1) TOP CONTROL SWITCH RELEASED. If the deck lock motor is not functioning, check the power circuit for voltage at the motor red-yellow wire terminal. The deck lid should be open sufficiently for access only to avoid repositioning of the deck open limit switches. If there is no voltage, repair the circuit. (2) If the terminal is hot, the motor is defective. Replace the deck lock motor.
	(c) Broken deck lock flexible shaft.	(c) TOP CONTROL SWITCH RELEASED. With the deck lid open, check the deck lid lock shafts and lock nuts. If the shaft(s) are broken, replace the shafts. Otherwise tighten the lock nuts.
	(d) Faulty deck control solenoid valve or the top deck motor and pump assembly power circuits.	(d) Open the deck lid mechanically. See Section 2. Check the solenoid and motor circuits. Repair the faulty circuit.
	(e) Faulty deck control solenoid valve.	(e) TOP CONTROL SWITCH RELEASED. Open the deck lid mechanically, sufficiently for access. If the circuit shows voltage hot at the blue-red terminal on the valve and the top-deck motor and pump operate when the top control switch is momentarily pushed up, but there is no action at the deck opening cylinders, the deck control solenoid valve is defective. Replace the valve.
	(f) Faulty top-deck motor and pump assembly.	(f) TOP CONTROL SWITCH RELEASED. Open the deck lid mechanically, sufficiently for access. If the circuit shows voltage at the red wire terminal of the top-deck motor and pump assembly and the motor does not operate when the top control switch is momentarily pushed up, the motor is defective. Replace the top-deck motor and pump assembly.

TROUBLE DIAGNOSIS GUIDE—TOP ERECT CYCLE—TOP ERECT PHASE (Fig. 11)

Malfunction	Probable Cause	Corrective Action
1 NO TOP ERECT ACTION—TOP UP RELAY NOT FUNCTIONING, (NO AUDIBLE CLICK).	(a) Defective top up relay.	(a) (1) Push the top control switch up intermittently, while listening for a click from the relay. If there is no click, check for voltage at the green wire ter-

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TROUBLE DIAGNOSIS GUIDE—TOP ERECT CYCLE—TOP ERECT PHASE (Fig. 11) (Cont'd)

Malfunction	Probable Cause	Corrective Action
1 NO TOP ERECT ACTION—TOP UP RELAY NOT FUNCTIONING, (NO AUDIBLE CLICK). (Continued)	**(a)** Continued	minal on the relay. If the terminal shows voltage, the relay is defective. Replace the top up relay. (2) If the green wire terminal is dead, proceed as in (b) below.
	(b) Defective circuit from the top control switch through the deck open limit switch R.H., the top up limit switch, to the top up relay.	**(b)** TOP CONTROL SWITCH RELEASED. Check out the circuit and switches using a self-powered test light.
	(c) Defective top up limit switch.	**(c)** TOP CONTROL SWITCH RELEASED. Check between the green and brown-white wire terminals of the switch. If the light fails to come on, the switch is defective. Replace the top up limit switch.
	(d) Defective deck open limit switch R.H.	**(d)** TOP CONTROL SWITCH RELEASED. Check between the violet wire terminals of the switch. If the light fails to come on, the switch is defective. Replace the deck open limit switch.
2 NO TOP ERECT ACTION—TOP UP RELAY FUNCTIONING.	**(a)** Defective top and deck motor and pump assembly.	**(a)** Disconnect the two wire connectors on the motor leads. Jumper from each motor lead in turn to the bus bar on the relay panel. If the motor is not activated, it is defective. Replace the top and deck motor and pump assembly. (Section 5).
	(b) Defective top and deck motor power circuit.	**(b)** If the motor will operate, reconnect the leads disconnected in (a) above and push the top control switch up. If the motor still does not operate, the motor power circuit is defective. Repair the defective circuit (red wire) or (yellow wire).
	(c) Defective top control solenoid valves power circuits.	**(c)** Disconnect the solenoid valve leads and with an ordinary test lamp, check for voltage from the lead terminal to ground. If either or both leads are defective, check and repair the wire circuit. (Fig. 16).
	(d) Defective top control solenoid valves.	**(d)** If the solenoid power lead(s) show voltage, the solenoid valve(s) is defective. Replace the top control solenoid valve.

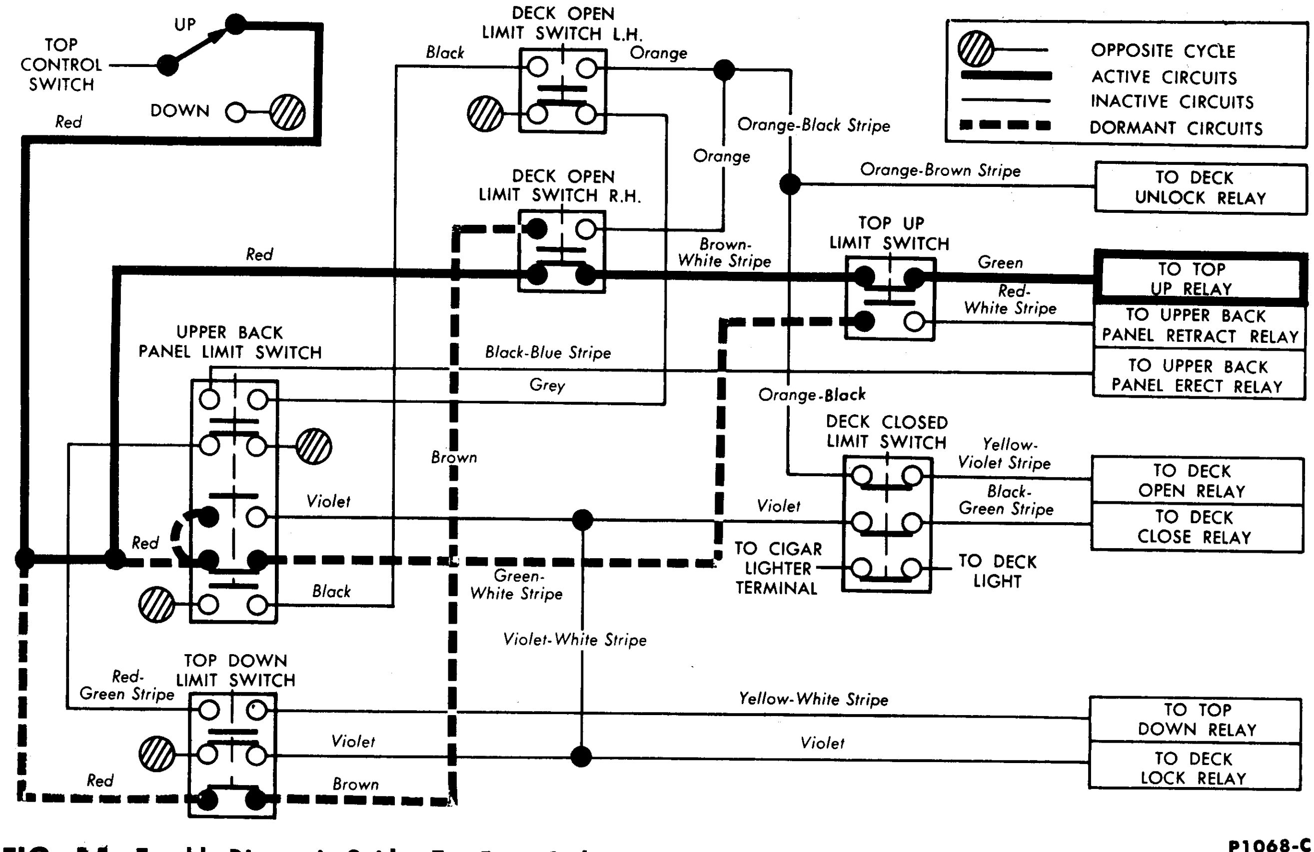

FIG. 11—Trouble Diagnosis Guide—Top Erect Cycle—Top Erect

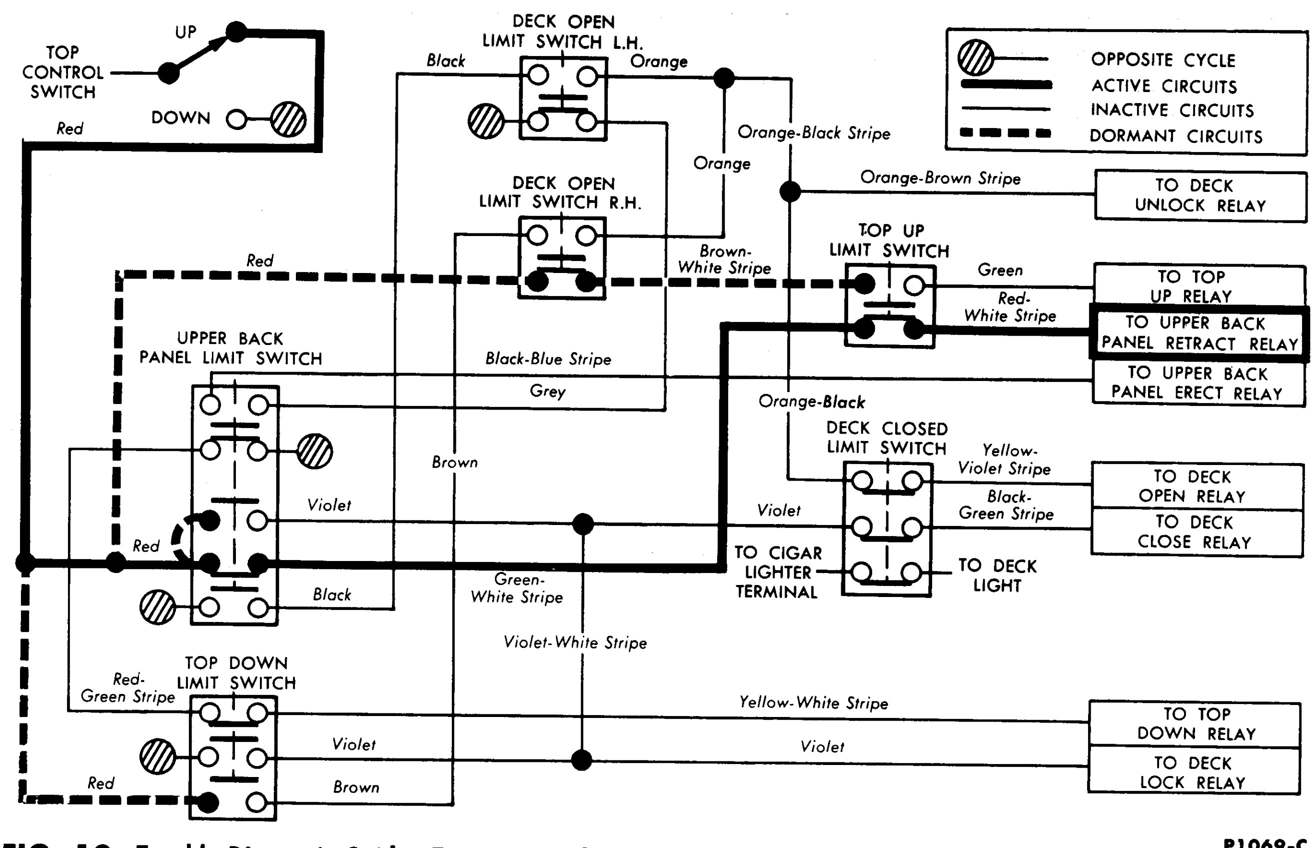

FIG. 12—Trouble Diagnosis Guide—Top Erect Cycle—Upper Back Panel Retract

TROUBLE DIAGNOSIS GUIDE—TOP ERECT CYCLE—UPPER BACK PANEL RETRACT (Fig. 12)

Malfunction	Probable Cause	Corrective Action
1 NO UPPER BACK PANEL RETRACT ACTION—RELAY NOT FUNCTIONING (NO AUDIBLE CLICK).	**(a)** Defective upper back panel retract relay.	**(a)** Push the top control switch up intermittently while listening for the relay to click. If there is no click, check for voltage at the red-white wire receptacle of the relay connector. If the circuit shows voltage, the relay is defective. Replace the upper back panel retract relay. If the circuit is dead, proceed as in (b) below.
	(b) Defective circuit from the top control switch through the upper back panel limit switch, the top up limit switch, and the upper back panel retract relay.	**(b)** TOP CONTROL SWITCH RELEASED. Check out the circuit wiring and switches using a self-powered test light.
	(c) Defective top up limit switch.	**(c)** Apply a test light between the red-white and green-white terminals of the switch. If the light does not come on, the switch is defective. Replace the top up limit switch.
	(d) Defective upper back panel limit switch.	**(d)** Using a self-powered test light, check between the black and the red wire terminals of the switch. If the light does not come on, make sure that the switch is properly adjusted before deciding it is defective.
	(e) Defective upper back panel motor or power circuit (Fig. 5).	**(e)** Disconnect the motor leads at the motor. Use a jumper between the blue-white motor lead and white-blue motor lead bus bar on the relay panel. If the motor does not operate, the motor is defective. Replace upper back panel motor. If the motor operates, check the power circuits back to the relay and the 15-ampere circuit breaker.

TROUBLE DIAGNOSIS GUIDE—TOP ERECT CYCLE—DECK LID CLOSE AND LOCK (Fig. 13 and 14)

Malfunction	Probable Cause	Corrective Action
1 NO DECK CLOSE ACTION—DECK CLOSE RELAY NOT FUNCTIONING.	**(a)** Defective deck close relay.	**(a)** (1) Check for voltage at the black-green wire terminal on the relay. If the terminal shows voltage, the relay is defective. Replace the deck close relay. (2) If the black-green wire terminal is dead, proceed as in (b) below.
	(b) Defective circuit from the top control switch through the upper back panel limit switch and the deck closed limit switch to the relay.	**(b)** TOP CONTROL SWITCH RELEASED. Check out the circuit wiring and switches using a self-powered test light.

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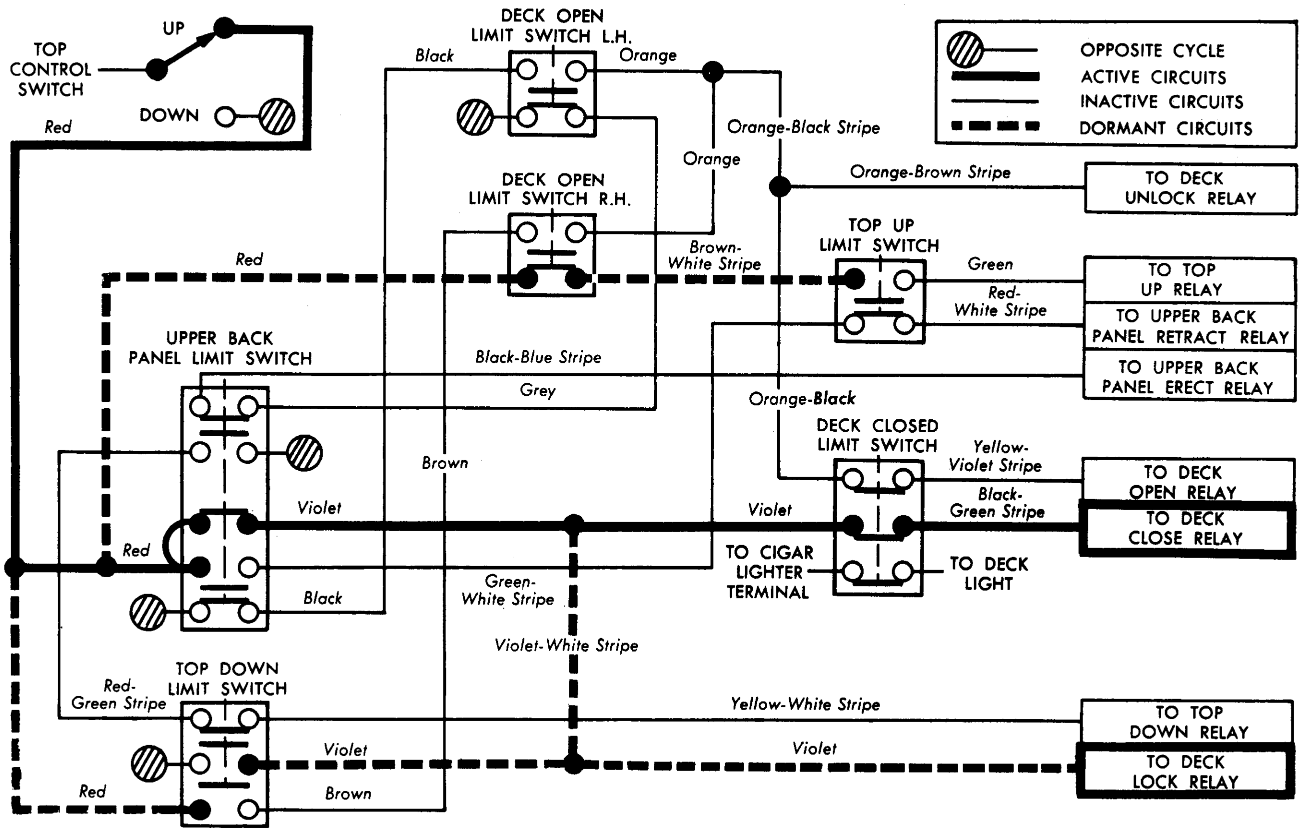


FIG. 13—Trouble Diagnosis Guide—Top Erect Cycle—Deck Lid Close

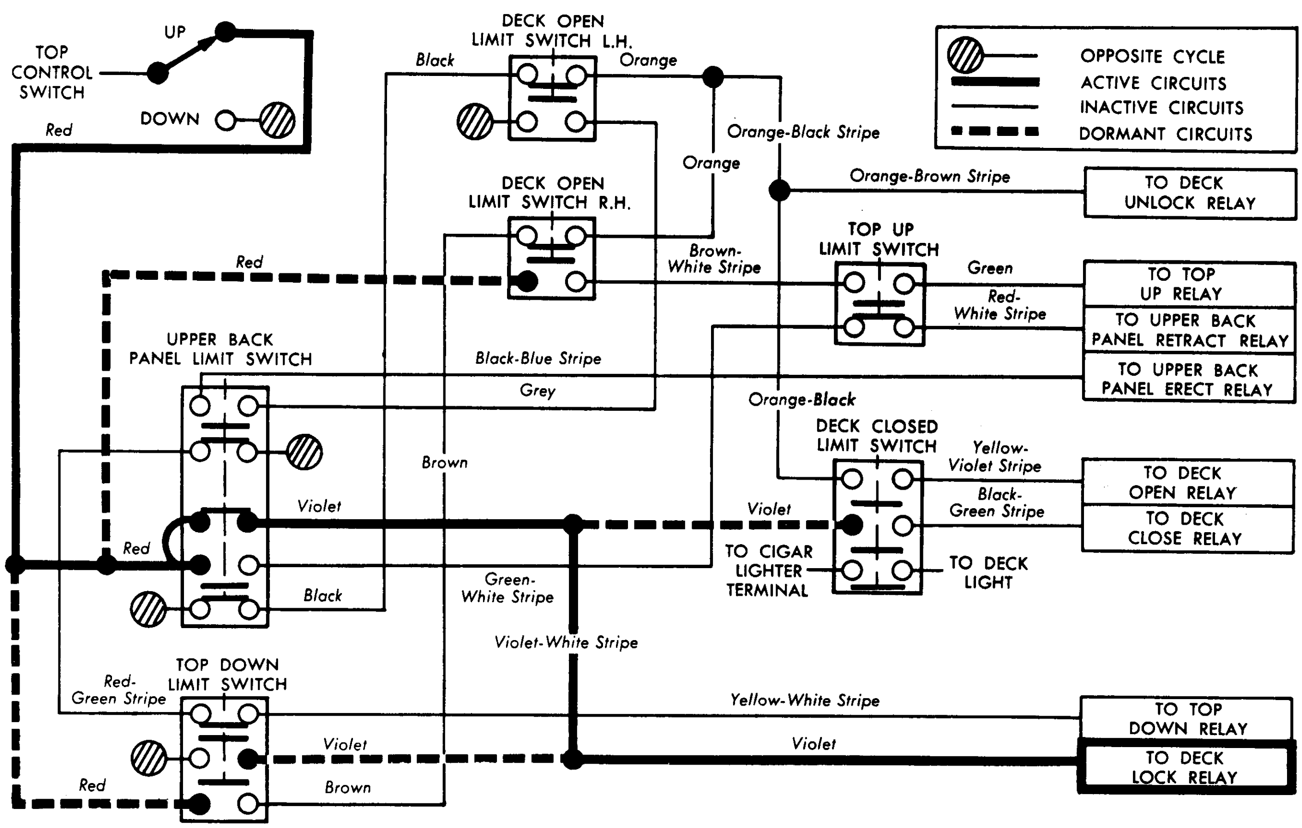


FIG. 14—Trouble Diagnosis Guide—Top Erect Cycle—Deck Lid Lock

TROUBLE DIAGNOSIS GUIDE—TOP ERECT CYCLE—DECK LID CLOSE AND LOCK (Figs. 13 and 14) (Cont'd)

Malfunction	Probable Cause	Corrective Action
1 NO DECK CLOSE ACTION—DECK CLOSE RELAY NOT FUNCTIONING. (Continued)	(c) Defective upper back panel limit switch.	(c) Check between the violet and yellow wires of the switch. If the light does not come on, the switch is defective. Check the switch adjustment before replacing the switch.
	(d) Defective deck closed limit switch.	(d) Check between the white wire terminals on the deck closed limit switch with a self-powered test light. If the light fails to come on, the switch is defective. Replace the deck closed limit switch.
2 NO DECK CLOSE ACTION—DECK CLOSE RELAY FUNCTIONING—TOP AND DECK MOTOR AND PUMP ASSEMBLY IS OPERATING.	(a) Defective deck control solenoid valve.	(a) Check for voltage at the deck control solenoid valve lead. If the wire shows voltage, the solenoid valve is defective. If the wire is dead, check the power circuit and repair it.
3 NO DECK CLOSE ACTION—DECK CLOSE RELAY FUNCTIONING TOP AND DECK MOTOR AND PUMP NOT OPERATING.	(a) Defective top deck motor and pump assembly or power circuit.	(a) Check for voltage at the yellow wire at the top and deck motor and pump assembly. If the wire shows voltage, the motor is defective. If the wire is dead, check the power circuit and repair it.
4 NO DECK LOCK ACTION—DECK LOCK MECHANISM NOT FUNCTIONING WHEN DECK LID STARTS TO CLOSE.	(a) Defective deck lock relay. (Deck lock relay is activated simultaneously with the deck close relay).	(a) If the relay is not activated in the cycle, the relay is defective.
5 NO DECK LOCK ACTION—DECK LOCK RELAY FUNCTIONING.	(a) Open power circuit to deck lock motor or defective deck lock motor.	(a) When the deck lid starts to close, observe the deck lock mechanism. If the deck lock mechanism is not functioning, disconnect the motor leads at the motor. Use a jumper between the motor yellow-red lead and the yellow-blue wire receptacle of the deck lock relay connector. If the motor operates, the power circuit (yellow wire) is open. Repair the circuit. If the motor does not operate, the motor is defective. Replace the deck lock motor.

ELECTRICAL TESTING

Before attempting any trouble checks, read Section 1, Top Operation. The following over-all observations and checking procedures will assist in isolating the malfunction part.

SUPPLY CIRCUIT

A continuity light attached between ground and various points in the supply circuit will identify an inoperative or defective component. With the ignition switch in the ON or ACC position and the transmission selector in N or P, checks at the circuit breakers, neutral switch relay, actuator switch and relay power bus bar (in that order) will isolate the problem. Fig. 15 will assist in identifying the neutral switch relay terminals.

SWITCH CIRCUITS

The switch circuits can be checked by bypassing the various components with a jumper wire. A continuity light cannot be used as the current draw required by the light will not allow the relay coils to en-

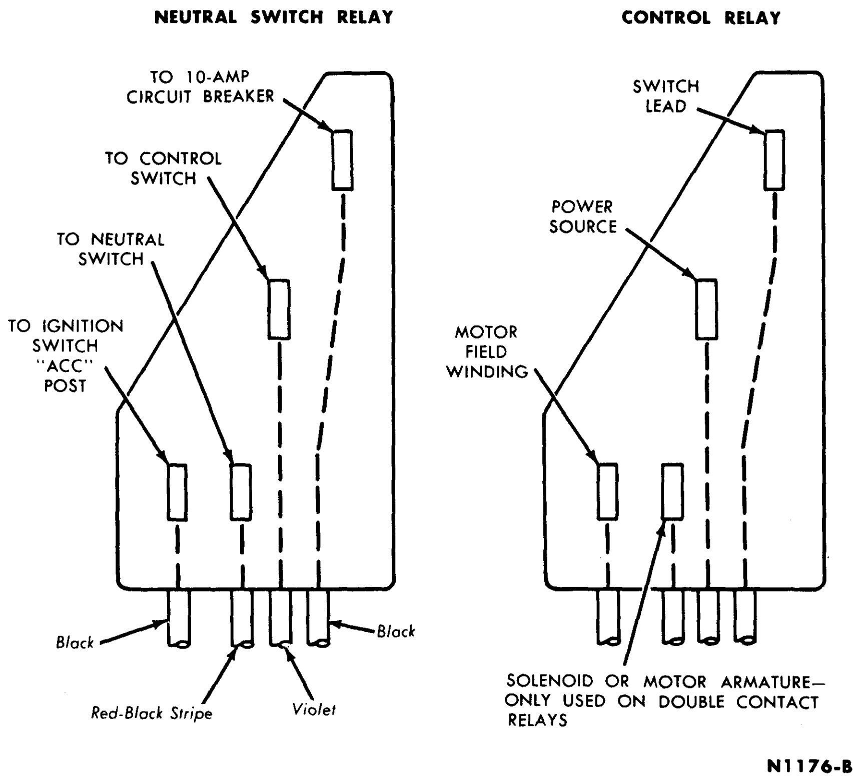


FIG. 15—Relay Wire Connector Terminal Identification

ergize. Fig. 3 through 14 should be referred to for identification of the wires. Fig. 15 will identify the control relay terminals.

Connecting the jumper wire between the relay bus bar and the relay coil terminal will bypass the switch circuit. If the motor or solenoid operates, the switch circuit can be checked to locate the inoperative or maladjusted switch, loose wire connector, or defective switch circuit wire. An audible click of the relay is another indication of switch circuit problems. If the component fails to operate and the relay is functional (the relay clicks) the motor or solenoid circuits are at fault. Moving the jumper wire to the relay motor terminal will determine if the relay is at fault. Should the motor or solenoid still fail to function, the motor or solenoid should be checked.

When the deck lid is opened, all switches are accessible for a direct check of their function. A malfunction of the top can be caused by a defective or improperly adjusted switch. A check for this condition should be made before making further tests. A switch can be checked by depressing the switch stem, if improperly adjusted, or bypassing the switch with a jumper wire directly at the switch contact terminals or wire connectors.

MOTOR OR SOLENOID CIRCUITS

Application of a 12-volt power source with a jumper wire directly to the motor or solenoid, or bypassing the motor ground circuit breaker will isolate the cause of the malfunction.

SWITCH ADJUSTMENT OR FUNCTION CHECKS

An ammeter (100-ampere scale) inserted in the motor feed circuit will aid in determining which of the electrical components is operating (both normally and abnormally). The ammeter should be connected between the main feed 60-ampere circuit breaker on the starter relay and the motor supply lead (No. 8 gauge blue wire) which supplies the control delay bus bars.

TABLE 1—Electrical Component Current Draw

Unlatch Rear Deck	20 amps
Raise Rear Deck	70 amps
Raise Package Tray	23-27 amps
Lower or Raise Top	65 amps
Lower Package Tray	22 amps
Latch Rear Deck	22 amps
Lower Rear Deck	70 amps

Should a switch be improperly adjusted and close the relay circuit for any functional cycle and yet not open the cycle just finishing, the ammeter reading will indicate the problem. Use Figs. 3 through 14 and Table 1 as a guide to the various components in use at each step of the top operation. The ammeter reading can be directly converted to a diagonsis of the problem.

MECHANICAL AND HYDRAULIC CHECKS

MECHANICAL CHECKS

Improper top operation can be caused by bent or misaligned linkage, binding linkage pins, and/or broken pivot bushings. Should the electrical and hydraulic systems be functionally correct and unsatisfactory operation of the top persists, check and adjust or replace the mechanical components as required.

HYDRAULIC CHECKS

Faulty hydraulic system operation can be caused by lack of fluid, air in the system, obstructions or kinks in the hoses, or faulty operation of a cylinder or the pump.

FLUID LEVEL CHECK

1. Erect the top.

2. Place absorbent cloths below the filler plug.

3. Remove the filler plug, and check the fluid level. It should be level with the bottom edge of the hole.

4. If the level is low, check the system for leaks, adding automatic transmission fluid Type A, Suffix A, as required.

LIFT CYLINDER OPERATION CHECK

Operate the top control switch and observe the operation of the lift cylinders for the following:

If the movement of the piston rods is sluggish or uneven, check the hoses from the pump to the cylinders for kinks.

If one piston rod moves more slowly than the other, the cylinder with the slower rod is defective and should be replaced.

If both rods move slowly, or do not move at all, disassemble and repair the pump.

3 EMERGENCY PROCEDURES

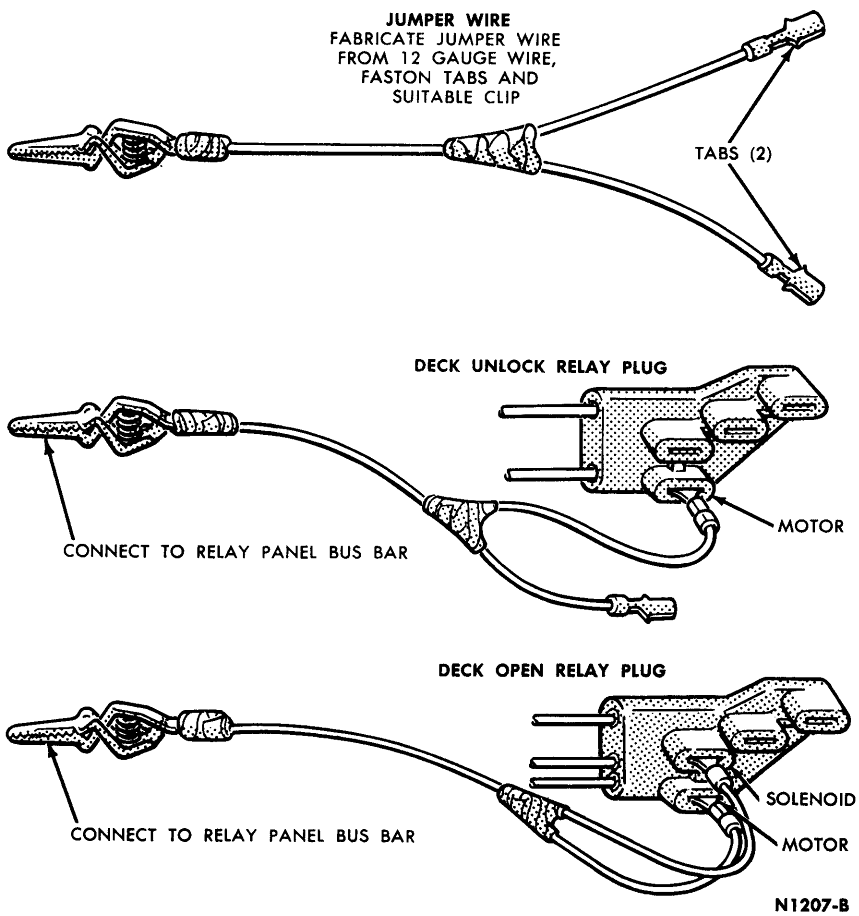


FIG. 16—Alternate Method of Opening Deck Lid—Jumper Fabrication

If a part of the electrical, mechanical, or hydraulic system of the deck lid does not work, the following manual procedures may be used to get at the malfunctioning part.

OPENING THE DECK LID WITH A JUMPER WIRE

When the deck lid will not open through the use of the top control switch, an alternate electrical method can be used to open the deck lid.

1. Remove the rear seat back to gain access to the deck unlock and open relays.

2. Remove the multiple plug from the deck unlock relay (Fig. 2).

3. Fabricate a jumper wire as shown in Fig. 16. Energize the deck unlock motor through the disconnected multiple plug and relay panel bus bar with the jumper wire (Fig. 16).

4. If the deck lid will not unlock, there is either an open wire to the motor or a failed motor. The deck lid will have to be manually unlocked.

5. If the deck lid will not open after being unlocked, remove the multiple plug from the deck open relay located behind the rear seat back. Energize the deck motor and pump assembly through the deck open relay plug with the use of the jumper wire (Fig. 16).

6. If the deck will not open, there is an open wire or a failed motor. If the motor operates but is under a heavy load, the solenoid could not be opening. It will be necessary to manually open the deck lid.

UNLOCKING DECK LID MANUALLY

1. Raise the car approximately 10 inches by placing a floor jack under the underbody rear cross member.

2. From the underside of each wheel housing, remove each deck lid lock retaining screw (Fig. 17).

3. After lifting the front edge of the deck lid about one inch, operate the top control switch to complete the opening of the deck lid.

4. When installing the lock nut housing retaining bolt, torque to 10-15 ft-lbs.

OPENING DECK LID MANUALLY

1. Unlock the deck lid by operating the top control switch or by using the preceding method for manually unlocking the deck lid.

2. From underneath the lower back panel, remove the deck cylinder bracket retaining bolts from each cylinder (Fig. 18).

3. Complete the opening of the deck lid manually. If the deck lid locks have been released from the wheel housings, the nut and housing portion of the locks will remain attached to the deck lid.

ERECTING TOP MANUALLY

If it becomes necessary to erect the top manually, proceed as follows:

1. Unlock and open the deck lid.

2. Energize both top solenoid valves, using suitable jumper wires

and a 12-volt source. It either valve is inoperative, disconnect the hydraulic line(s) connected to the valve(s) so that there will be no hydraulic block in the top cylinders.

3. Manually erect the top.

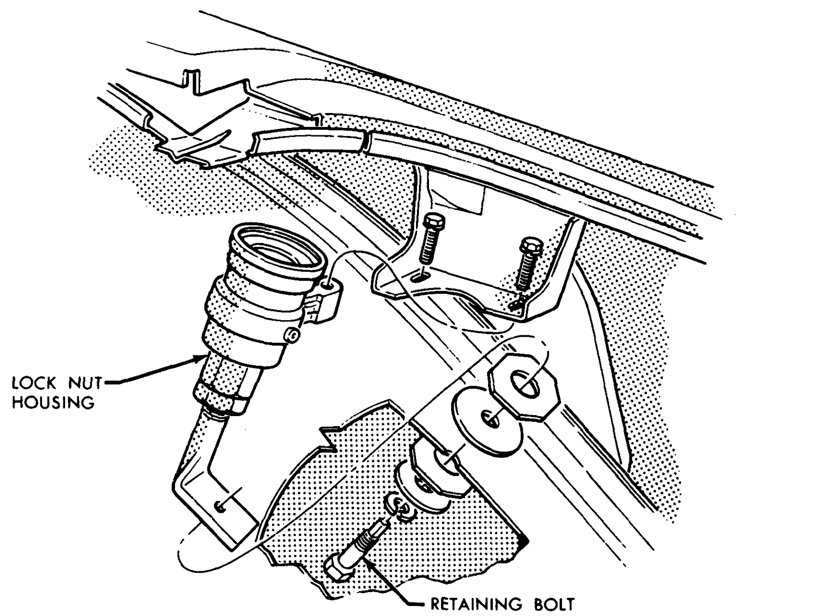


FIG. 17—Detaching The Deck Lid Locks

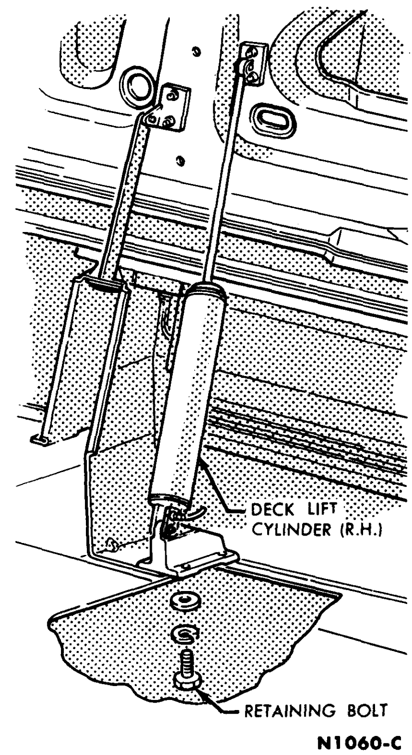


FIG. 18—Detaching the Deck Lift Cylinders

4 ADJUSTMENTS

LIMIT SWITCHES

Locations of the various limit switches are shown in Fig. 2.

TOP UP LIMIT SWITCH ADJUSTMENT

Raise the top until the package tray is aligned with the quarter panels and the rear seat back. Adjust the actuator to the switch plunger until the normally closed switch is open (Fig. 19).

TOP DOWN LIMIT SWITCH ADJUSTMENT

Lower the top until it is completely stowed in the luggage compartment. Adjust the actuator to the switch plunger until the normally closed switch is open at this point (Fig 20).

DECK OPEN LIMIT SWITCH ADJUSTMENT

Open the deck lid to the desired open position. Loosen the two screws retaining the switch bracket and rotate the switch bracket and actuator assembly toward the deck

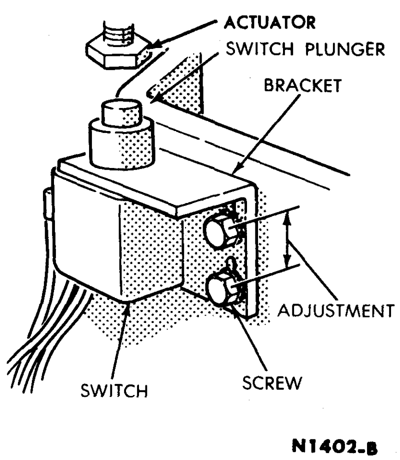


FIG. 19—Top Up Limit Switch Adjustment

lid hydraulic cylinder until the normally closed switch is open at this point (Fig. 21).

DECK CLOSED LIMIT SWITCH ADJUSTMENT

Set the deck closed limit switch at

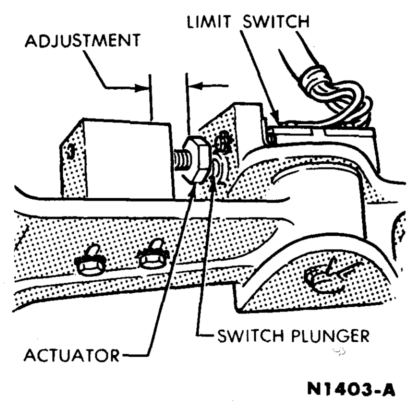


FIG. 20—Top Down Switch Adjustment

the mid point of the adjusting range. Close and lock the deck lid. Unlock the deck lid. The deck lid should become unlocked and start to open simultaneously. If the deck lid does not start to open, adjust the switch downward slightly. If the deck lid becomes energized before it is completely unlocked, adjust the switch

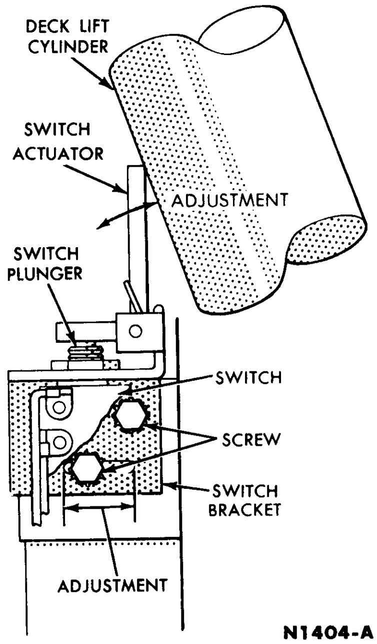


FIG. 21—Deck Open Limit Switch Adjustment

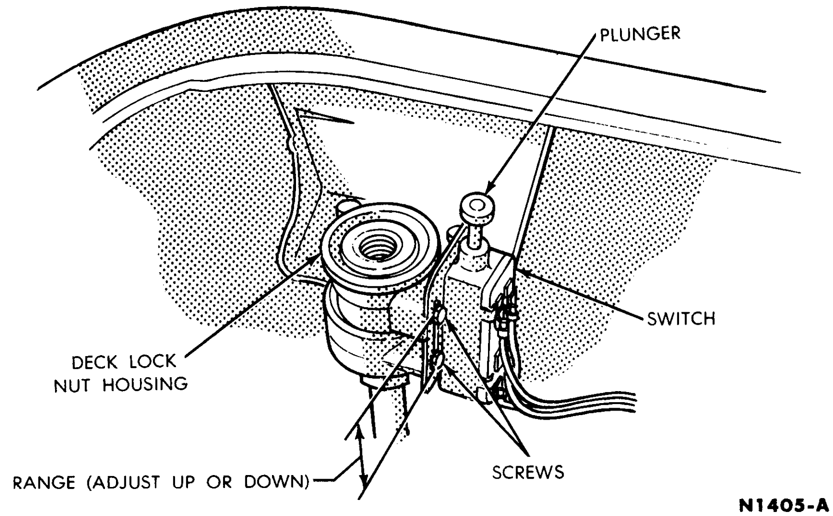


FIG. 22—Deck Closed Limit Switch Adjustment

upward slightly. Repeat until simultaneous operation.

UPPER BACK PANEL LIMIT SWITCH ADJUSTMENT

Loosen the switch retaining nuts C and switch adjustment screws D & E (Fig. 24). Operate the upper back panel to the desired extended position. Rotate the outer adjustment ring F until the normally closed switch contacts open at this point (grey and black with blue stripe wires) and tighten the adjustment screw D.

Retract the upper back finish panel until the rubber stops (Fig. 24), have been compressed 30 to 60% of normal. Rotate the inner adjustment ring G until the normally closed switch contacts open at this point (red-white stripe and green-white stripe and orange and red-green stripe wires) and tighten the adjustment screw E.

FOLDING TOP ADJUSTMENTS

If the top is misaligned, corrections should not be made until after a check has been made for bent linkage. All pivot points in the top linkage should be lubricated periodically with light engine oil.

Before aligning the top, visually determine if the trouble results from top misalignment and/or window misalignment. It may be necessary to align both the top and the windows because of the relationship between the two. Adjustments of the door and quarter windows must be checked and any necessary changes made before making top adjustments These windows must be fully closed to insure proper adjustment. Door and quarter window adjustments are outlined in Part 11-3.

If the stack has been replaced, the stack should be completely adjusted first, then the side glass adjusted to fit the stack.

There are 4 main adjustment areas for the top of the deck lid: the header area, the side rail area, the deck lid area, and the main pivot bracket area.

HEADER AREA ADJUSTMENTS

NO. 1 BOW ADJUSTMENT

The No. 1 bow can be adjusted fore and aft, to provide alignment with the header.

1. With a pencil, mark the present location of the joint between the No. 1 bow and the front side rail. This mark provides a measuring point for adjustment.
2. Raise the top to a satisfactory working level; prop it in position and remove the screws that hold the forward part of the front side rail weatherstrip retainer to the front side rail and the No. 1 bow (Item A—Fig. 23).
3. Using a putty knife, loosen the front part of the weatherstrip from the front side rail and the No. 1 bow. It is not necessary to remove the entire weatherstrip.
4. Loosen the two nuts (Item A—Fig 26) and move the No. 1 bow fore or aft to get the proper alignment at the header, and tighten the nuts.
5. Loosen the dowels in the No. 1 bow and lower the top to check their location and alignment with the striker plates in the header. See Dowel Adjustment below.
6. After proper alignment is achieved, carefully raise the top and tighten the dowels. Again lower the top and check the dowel alignment.

DOWEL ADJUSTMENT

The No. 1 bow dowels must be aligned with their striker plates in the header. After making any top adjustment check the dowel alignment and adjust as required. Access to the dowel adjusting screws is gained by removing the No. 1 bow weatherstrip and penetrating the sealer to turn the screws. The dowels can be moved after loosening the screws.

TOGGLE CLAMP ADJUSTMENT

The toggle clamps that hold the No. 1 bow against the header can be adjusted to provide a good seal.

1. Check the weatherstrip between the No. 1 bow and the header to determine which side is not sealing properly. It is not always necessary to adjust both toggle clamps.
2. Check for proper toggle hook

seating in the header slots (Fig. 26 Sectional View AA).

3. Release the toggle clamps by means of the handle. Thread the hook in or out by turning right to tighten, or left to loosen, to obtain a 15 to 20 pound effort to release the clamp by pulling down on the handle.

SIDE RAIL AREA ADJUSTMENTS

Adjustments in the side rail area are made as required to bring the top rails and weatherstrip in proper relationship with the previously adjusted door and quarter windows. See Fig. 23 for weatherstrip adjustment.

1. With the top locked to the windshield header, loosen two bolts (B, Fig. 26, D, Fig 25) and two nuts (A, Fig. 26), on each side of the top.

2. Slide the front side rail fore or aft in the No. 1 bow to obtain a constant parallel condition between the outside **front** edge of the rear side intermediate rail and the outside **rear** edge of the quarter window glass frame as shown in Fig. 26 Sectional View CC and View EE.

3. After adjustment, tighten nuts A and bolts B (Fig. 26).

4. Unlock the top at the header clamps. Raise the top sufficiently to check the position of the set screw E (Fig. 26 Sectional View DD). The set screw E must be flush with the end of the front side intermediate rail assembly on both sides of the top. Lock the top to the header.

5. Loosen two bolts C Fig. 26, on each side of the top. Lengthen or shorten the balance link to eliminate sag in the roof side rail at point W (Fig. 26), to obtain a constant parallel condition between windows and rails as shown in Fig. 26 Sectional View BB.

6. Excessive crown at point W of the side rails may be eliminated by backing off screw E (Fig. 26 View DD).

7. Operate the top mechanism to check all adjustments. Place the top in folded position and lock the adjustments by tightening the four screws (C Fig. 25).

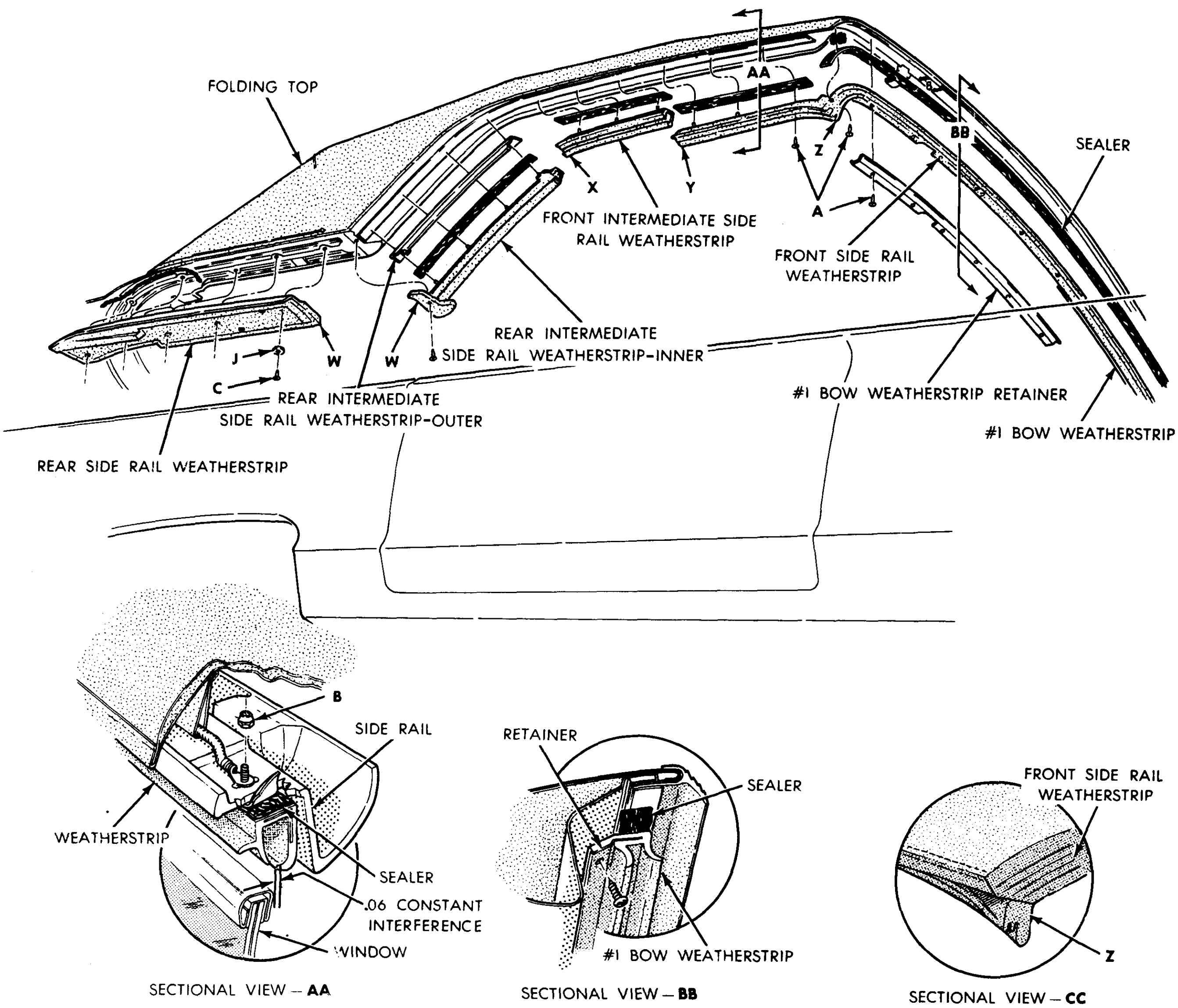


FIG. 23—Folding Top Weatherstrip Adjustment

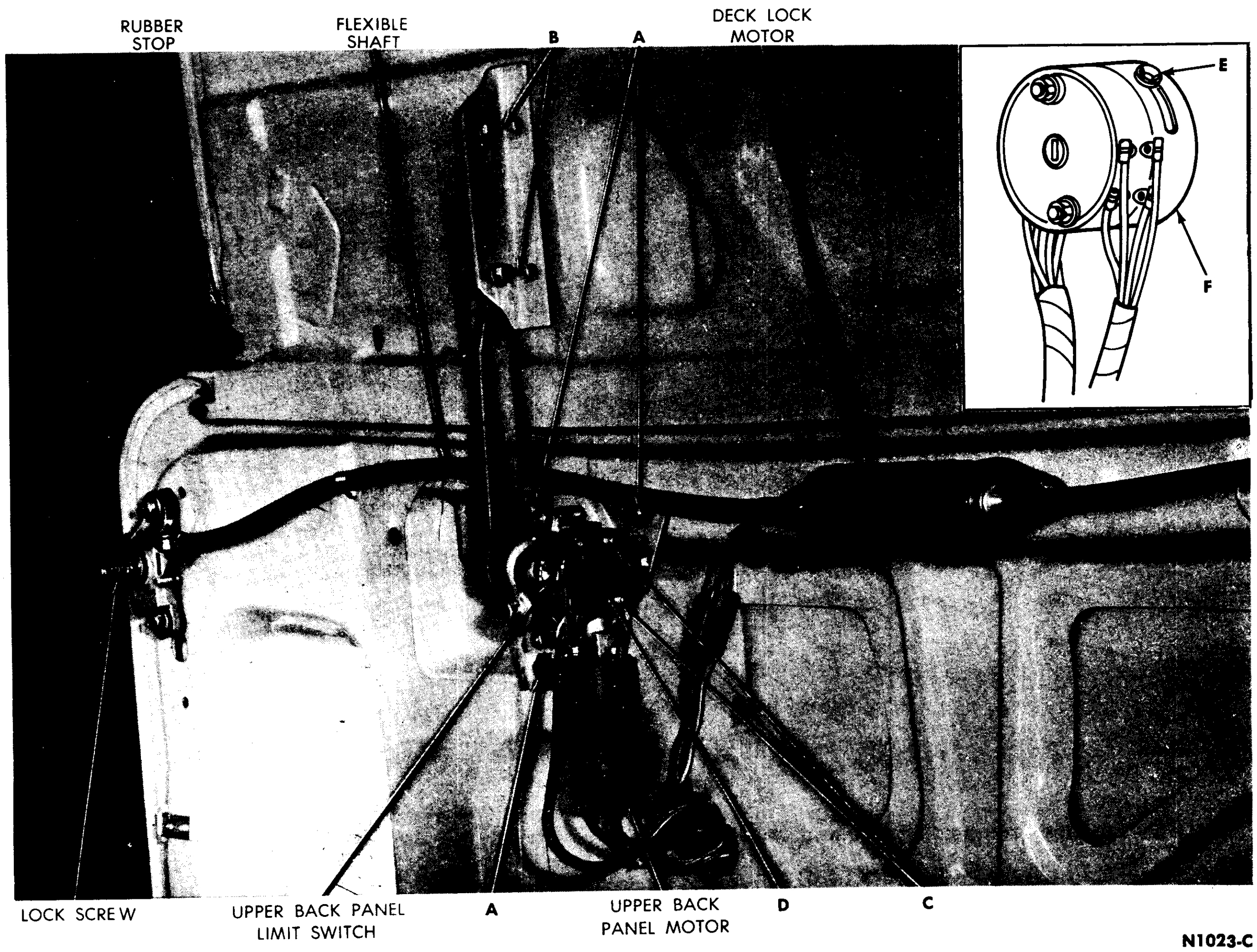


FIG. 24—Upper Back Panel Adjustment

FOLDING TOP WEATHERSTRIP ADJUSTMENT

The folding top weatherstrip adjustment will affect proper sealing between the folding top and the windshield header, door windows, rear quarter windows, and the rear quarter panel. Adjustment of the weatherstrip should not be attempted until the folding top mechanism has been completely adjusted. Inspect the weatherstripping fit around the complete joining areas of the top and adjust as required. Make a careful check and inspection of disturbed sealer and reseal where required for water-tight joints.

HEADER WEATHERSTRIP ADJUSTMENT

1. With the top up and locked, inspect the No. 1 bow weatherstrip for fit at the windshield header. (Passing a wooden shim or thin strip of plastic along the header under the weatherstrip will help to detect a loose fit.)
2. Raise the No. 1 bow sufficiently to loosen the weatherstrip retainer screws A, Fig. 23. Carefully loosen the weatherstrip from the seal. Adjust the weatherstrip fore or aft to align it parallel with the No. 1 bow forward edge. Reseal where the weatherstrip seal is loose or broken (Fig. 23 Sectional View BB).
3. Tighten the weatherstrip retainer screws (A Fig. 23). Lock the top to the header.

SIDE RAIL WEATHERSTRIP ADJUSTMENT

1. With the top up and locked and the door and quarter windows closed, inspect the weatherstrip interference fit at the inside surface of the window frames.
2. Lower the door and quarter windows and loosen the weatherstrip retaining nuts (B, Fig. 23 Sectional View AA), as required. Carefully loosen the weatherstrip.
3. Close the windows and move the weatherstrip fore or aft or in or out to obtain the proper watertight joints at points X, Y and Z and the 0.6 inch interference as shown in Fig. 23 Sectional View AA. Tighten nuts B.

REAR SIDE RAIL WEATHERSTRIP ADJUSTMENT

1. With the top up check the joint at point W (Fig. 23) for a water-tight fit. With a pencil, mark the rear side rail and weatherstrip for a measuring point. Measure the gap at point W, either or both sides.
2. Lower the top to the stacked position and loosen the 5 screws (C, Fig. 23), either or both sides, and move the rear side rail weather-

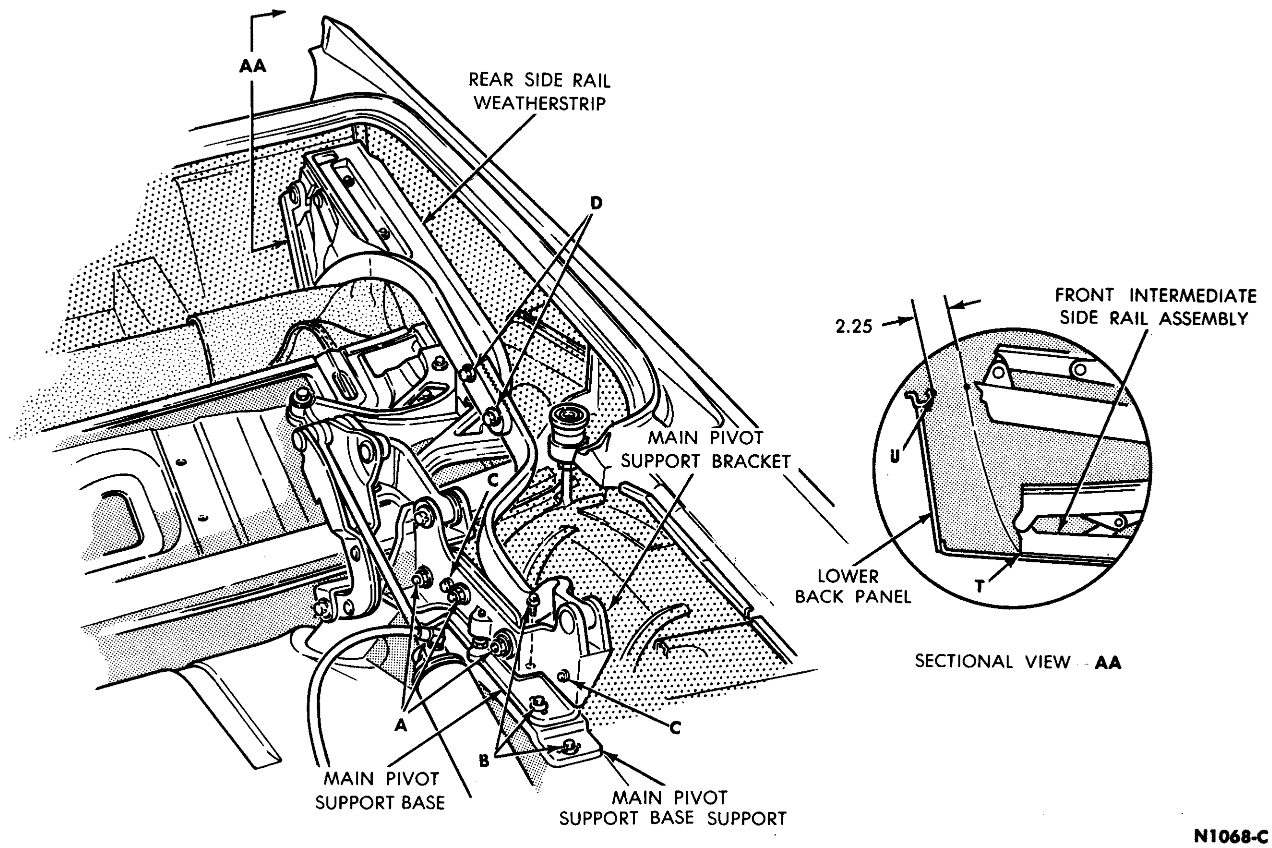


FIG. 25—Package Tray and Top Stacking Adjustment

strip fore or aft the distance of the gap width, as measured in step 1, above, to obtain a watertight joint at point W. Tighten screws C.

DECK LID AREA ADJUSTMENTS

Fore - And - Aft and Up - And - Down Adjustment of The Finish Panel. Adjust the space between the edges of the finish panel and the deck lid and/or the body and for a flush surface fit as follows:

1. Slightly loosen the hinge arm retaining bolts B at the panel (Fig. 24).
2. Shift the panel so that there is equal space between the edges of the finish panel, deck lid, and the rear seat back panel.
3. Raise or lower the upper back panel until the panel is flush with the surface of the deck lid, rear seat back panel, and the upper quarter panel. Make certain that the weatherstrip seal is not disturbed.
4. Tighten the retaining bolts and nuts B securely.

Lateral Deck Lid Adjustment.

1. Slightly loosen the hinge retaining bolts A at the deck lid (Fig. 24).
2. Shift the deck lid to the right or left in the enlarged holes, until there is equal clearance along the sides of the deck lid finish panel.
3. Tighten the hinge bolts securely.

MAIN PIVOT BRACKET AREA ADJUSTMENTS

Adjustments in this area affect the fit of the package tray, fit of rear rail, and top stacking. Fig. 25 locates the points of adjustment. The screws and bolts designed A, B, and C are more easily accessible for loosening with the top in the folded position. However, adjustments must be made with the top up, and the screws and bolts must be tightened to hold the adjustment before the top is again lowered.

1. Loosen 3 nuts (A), 6 screws (B), and 4 screws (C), on each side of the body (Fig. 25).
2. Operate the mechanism to place the top in the up position. As the top is rising, check the clearance between the rear end of the bottom rail (Point T) (front end of the front side intermediate rail assembly) and the top front edge (Point U) of the lower back panel (Fig. 25 Sectional View AA). Adjust for this clearance by moving the main pivot support base fore or aft on the main pivot support base support. Tighten the 3 screws sufficiently to hold the adjustment (Fig. 25).
3. Adjust the entire folding top assembly fore or aft, in or out, or up or down as required to obtain the correct margin between the package tray panel and the upper quarter panel at points D (Fig. 26). A flush condition must be obtained along the top surface of the body metal and along the vertical wall of the luggage compartment drain trough. The bottom surface of the rear rail weatherstrip must rest flush on the surface of the upper quarter panel. After adjustment, tighten six screws B, and three nuts A, each side.
4. Check the position of the No.1 bow in alignment with the header. Adjust, if required, as in Header Area Adjustments.

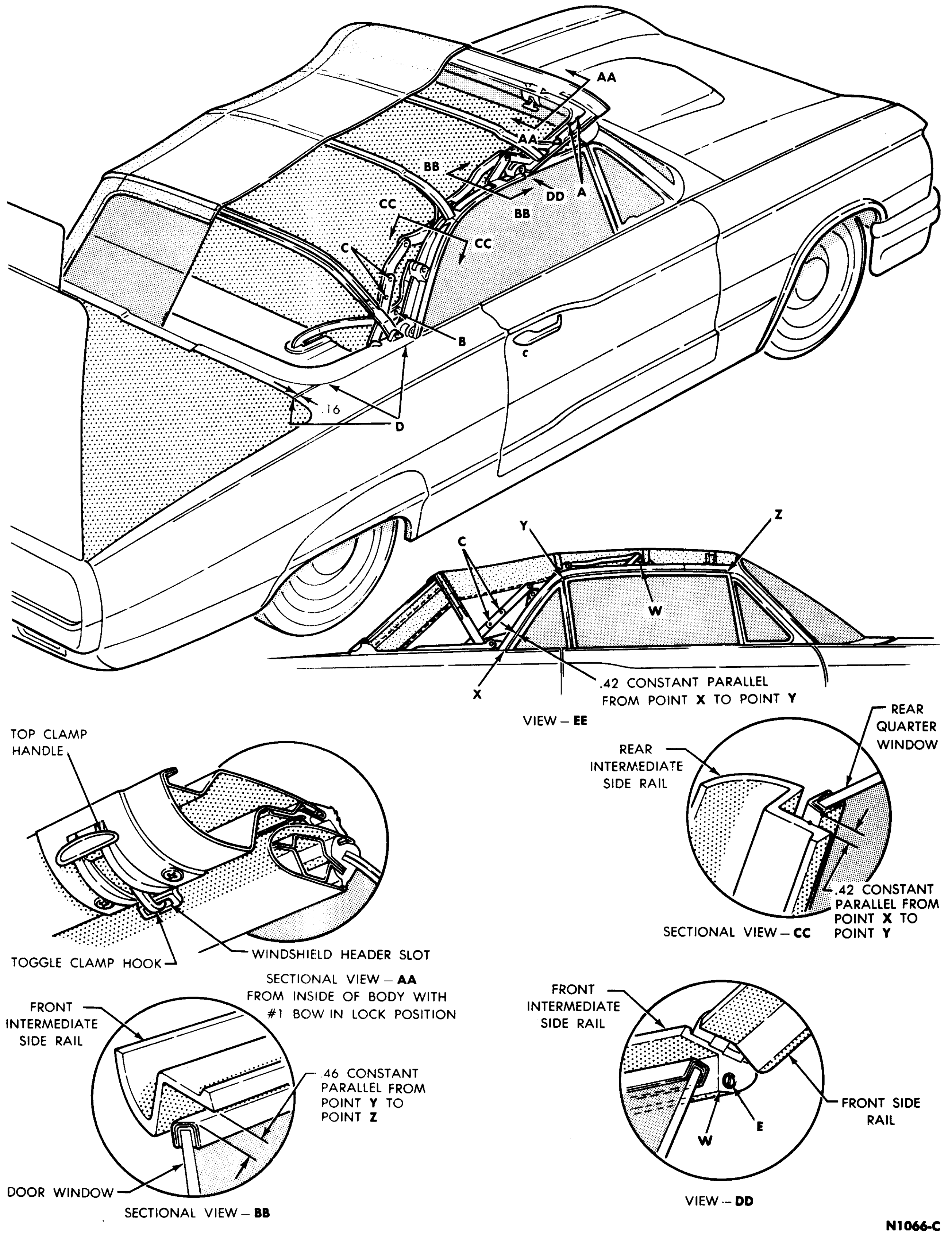


FIG. 26—Folding Top Mechanism Adjustment

DECK LOCK ADJUSTMENT

For an adequate seal, the deck lock screw assembly must be adjusted to engage properly with the lock nut assembly.

DECK LOCK SCREW ASSEMBLY

Loosen the two nuts retaining the lock screw assembly to the deck lid and adjust the assembly fore or aft to align with the lock nut housing assembly.

DECK LOCK NUT HOUSING SUPPORT

Loosen the two screws retaining the lock nut housing support to the quarter panel and adjust the support side to side to align with the lock screw (Fig. 27). Torque the screws to 7-12 ft-lbs.

DECK LOCK NUT SET SCREW

Loosen the set screw retaining the lock nut in the housing assembly and turn the lock nut in or out to the required position. Turn the lock nut, using tool T57P-53510-A, so that the lock screw will ratchet and the deck lid weatherstrip is compressed.

Do not attempt any trial locking of the deck unless the set screw is properly tightened.

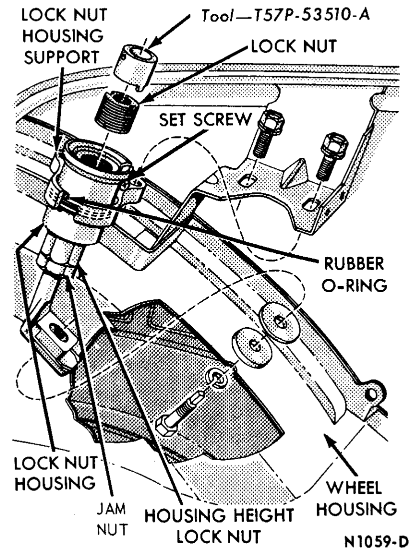


FIG. 27—Deck Lid Lock

DECK LOCK NUT HOUSING HEIGHT

The foot of the lock nut housing assembly may be adjusted up or down from the wheelhouse to insure the correct positioning of the O-ring. The O-ring should be centrally located in the housing support (Fig. 27). Adjustment is as follows:

Loosen the lock nut housing jam nut. Turn the housing height lock nut to move the housing up or down to obtain the correct position of the O-ring. Do not loosen the bolt attaching the lower end of the lock nut housing to the wheel housing to perform this adjustment.

5 REMOVAL AND INSTALLATION

MOTOR AND PUMP

A pump repair kit and a reservoir repair kit are available for service.

REMOVAL

1. Open the deck lid. (See Section 2 for manual opening, if required). Remove the fabric covering from the front of the rear compartment for access to the motor and pump, and solenoid.

2. Disconnect the motor leads at the two wire connector and the solenoid leads at the connectors (Fig. 28).

3. Using a jumper wire from the blue wire terminal at the relay feed bar (or a separate 12 volt power source), energize the top control solenoids to relieve pressure in the hydraulic lines.

4. Remove the motor ground from the left relay panel mounting bolt (Fig. 28).

5. Place absorbent cloths under the hose connection at the pump. Disconnect both hoses at the pump fittings. Plug the hose fittings (Fig. 28).

6. Remove the attaching nuts and washers at the forward ends of the motor and pump mounting bracket. Lift or pry the motor bracket fasteners from the holes in the floor pan bracket. Do not lose the mounting stud grommets when lifting the motor from the mounting (Fig. 29).

DISASSEMBLY

1. Remove the filler plug, and drain the fluid from the reservoir into a clean container (Fig. 30).

2. Scribe lines on the reservoir, pump body and reservoir cover so that these parts can be assembled properly (Fig. 31).

3. Remove the center bolt from the reservoir cover (Fig. 30).

4. Remove the cover and reservoir, and the O-ring seals at each end of the reservoir.

5. Remove the mounting bolts that hold the valve body on the pump body.

6. Place a cloth under the assembly, and carefully remove the valve body so that the check balls are not lost.

7. Remove both rotors from the motor shaft.

ASSEMBLY

When assembling the pump, use all the parts supplied in the pump repair kit (Fig. 30).

1. Install the inner rotor on the motor shaft.

2. Install the outer rotor, and place the check balls in the valve body channels.

3. Install the valve body on the pump body.

4. Install an O-ring seal in each end of the reservoir.

5. Install a new seal on the center bolt, and install the reservoir and cover on the valve body, using the lines previously scribed as guides (Fig. 31). The cover must be mounted with the embossed lines in a vertical and horizontal position and the filler plug at 10 o'clock in relation to the mounting bracket base line.

6. After positioning the assembly horizontally, fill the reservoir with automatic transmission fluid Type A, Suffix A to the level of the bottom of the filler plug hole. Install the filler plug and new seal.

INSTALLATION

1. Position the pump mounting grommets to the pump, and install the pump assembly mounting nuts (Fig. 29). Be sure that the motor ground lead is installed under the relay panel screw to a good electrical ground (Fig. 28).

2. Remove the plugs from the lines and fittings and connect both

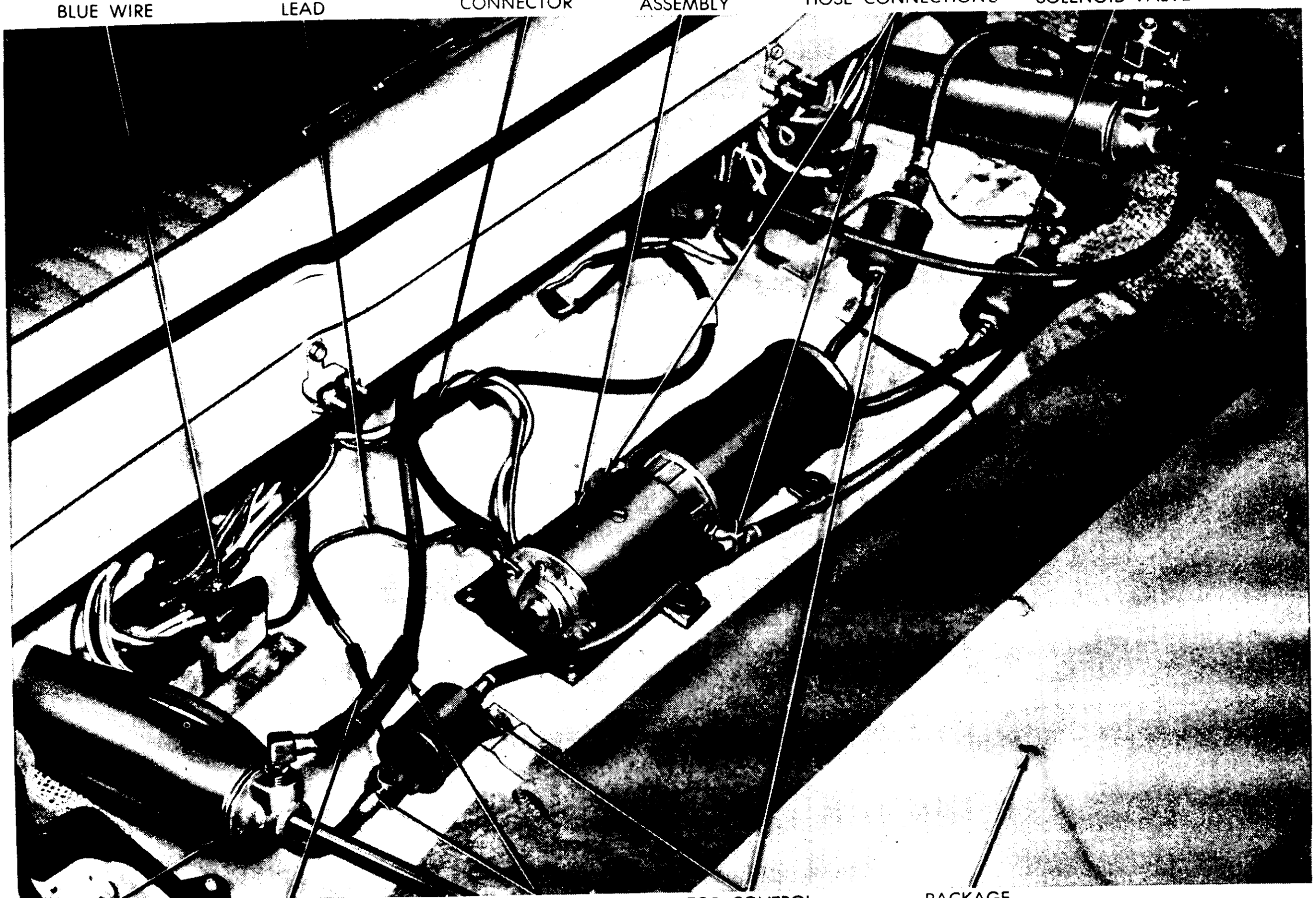


FIG. 28—Pump Assembly and Solenoid Valves Installed

lines to the pump assembly (Fig. 28).

3. Connect the motor leads at the connector (Fig. 28).

4. Bleed the system by operating the top 2 or 3 times, and check the fluid level. The top must be in the raised position when the fluid level is checked.

FOLDING TOP LIFT CYLINDER

1. Open the luggage compartment door.

2. Remove the rear seat cushion and seat back.

3. Remove the locking pin, washer, and clevis pin from the cylinder to body attaching bracket. Lift the cylinder out of the bracket and remove the grommets from the cylinder (Fig. 32).

4. Remove the locking pin, washers, clevis pin, and bushings from the lift cylinder to top mechanism pivot.

5. Lay the lift cylinder on the floor pan in a horizontal position on some absorbent rags and disconnect the hydraulic lines.

6. Cap the hydraulic lines and remove the cylinder from the car.

7. Lay the lift cylinder in the luggage compartment. Remove the caps from the hydraulic lines and connect the lines to the lift cylinder in the same location as they were removed.

8. Install the grommets in the cylinder lower pivot holes and position the cylinder to the lower pivot bracket. Install the clevis pin, washer, and locking pin.

9. Position the cylinder rod to the top linkage and install the bushings, clevis pin, washers, and locking pin.

10. Install the rear seat back and seat cushion.

11. Remove the filler plug from the top pump and motor reservoir and add type A automatic transmission fluid. The fluid level should not be more than ¼ inch below the bottom of the plug opening.

12. Operate the top with the filler plug loose to bleed air from the system. Then, add fluid as necessary and check for leaks.

LUGGAGE COMPARTMENT DOOR LIFT CYLINDER

1. Open the luggage compartment door.

2. Position the floor mat aside and remove the lift cylinder shield.

3. Support the luggage compartment door in the up position.

4. Remove the locking pin, washers, clevis pins, grommets and bushings from the cylinder lower pivot (Fig. 33).

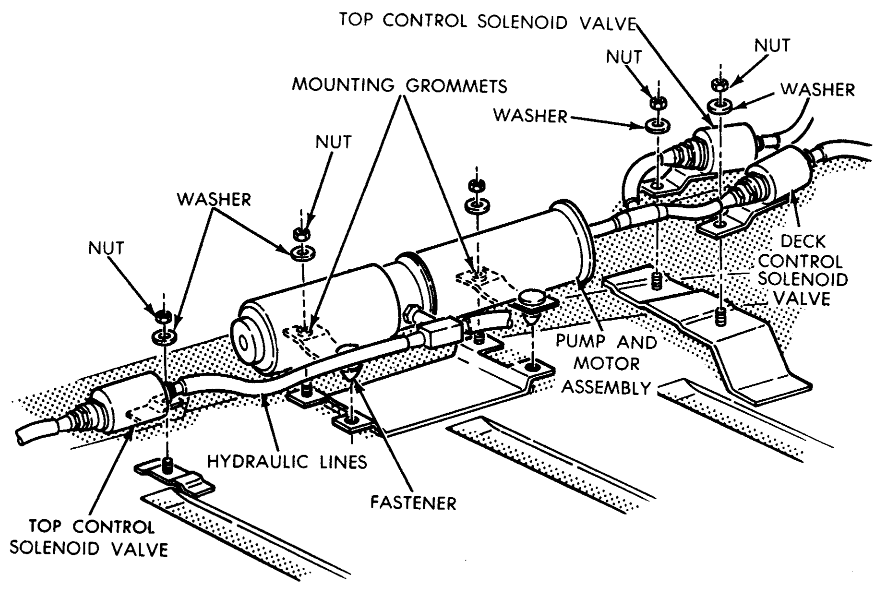


FIG. 29—Pump Assembly, Solenoid Valves and Attaching Parts

5. Remove the locking pin, washer, clevis pin, and bushings from the cylinder upper pivot.

6. Move the cylinder to a horizontal position and disconnect the hydraulic lines and cap them. **Place absorbent rags under the cylinder hose connections before removing them from the cylinder.**

7. Remove the hydraulic cylinder from the car.

8. Position the hydraulic cylinder to the lower pivot bracket and install the bushings, grommets, clevis pin, washers, and locking pin (Fig. 33).

9. Position the cylinder rod to the upper pivot bracket and install the bushings, clevis pin, washer, and locking pin.

10. Remove the caps from the hydraulic lines and connect the lines to the cylinder. Be sure that the lines are connected to the correct fittings.

11. Remove the support from the luggage compartment door.

12. Remove the reservoir filler plug and fill the reservoir to within ¼ inch of the bottom of the filler plug with Type A automatic transmission fluid.

13. Operate the top with the reservoir filler plug loose to bleed air from the system. Then, add fluid to the reservoir as necessary and check for hydraulic leaks. Tighten the reservoir filler plug.

14. Install the lift cylinder shield and reposition the floor mat. Then, close and lock the luggage compartment door.

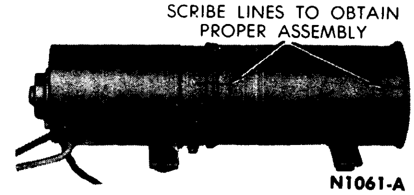


FIG. 31—Reservoir Marked Before Disassembly

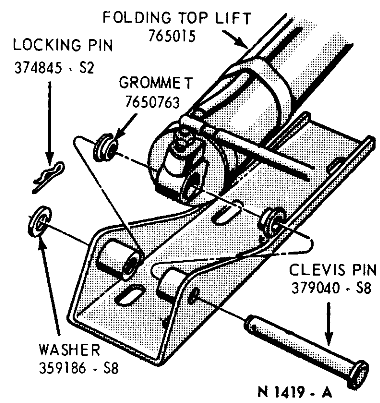


FIG. 32—Folding Top Lift Cylinder Lower Pivot

LUGGAGE COMPARTMENT DOOR HINGE

1. Open the luggage compartment door.

2. Remove the luggage compartment rear liningboard and disconnect the taillight wires at the connectors.

3. Remove the right and left taillight mouldings.

4. Remove 4 screws from each taillight and remove the right and left taillights.

5. Remove the rear bumper assembly.

6. Prop the luggage compartment door up and remove 2 bolts attaching the hinge to the luggage compartment door.

7. Remove 4 bolts attaching the hinge to the body and remove the hinge.

8. Position the hinge to the body

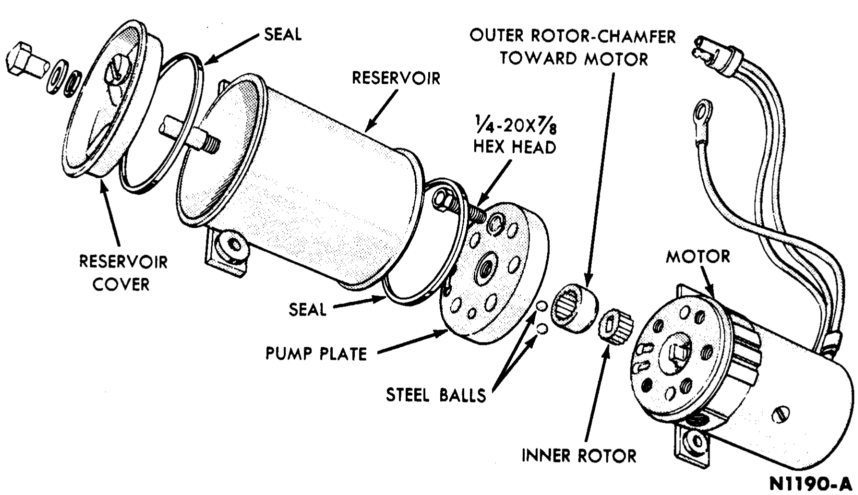


FIG. 30—Motor and Pump Disassembled

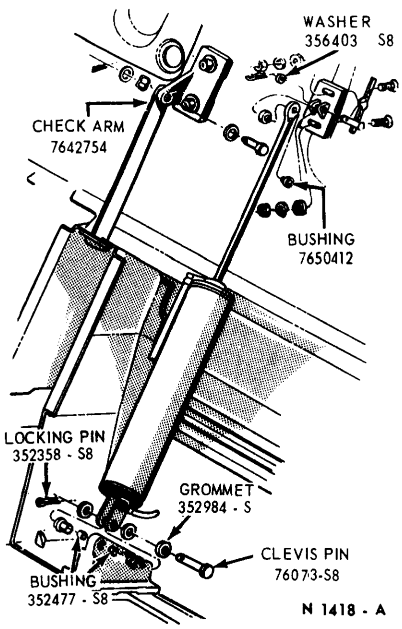


FIG. 33—Luggage Compartment Door Lift Cylinder Installation

and luggage compartment door and install the attaching bolts.

9. Lower the luggage compartment door and adjust as necessary (Section 4).

10. Install the rear bumper assembly.

11. Install the right and left taillight assemblies and mouldings.

12. Connect the taillight wires at the connectors and install the luggage compartment rear liningboard. Then, close and lock the luggage compartment door.

LUGGAGE COMPARTMENT DOOR LOCK NUT

1. Raise the rear of the car and remove the right and left deck lid locknut lower retaining screws located in the wheel housings.

2. Raise the luggage compartment door approximately one inch by hand to free the lock assemblies from the bracket. Then, operate the top switch to complete the deck-open cycle.

3. Remove the right and left lock nuts from the transmission lock screws.

4. Position the lock nuts in the brackets and install the lower retaining screws at the wheel housings. Torque the screws to 15-20 ft-lbs.

5. Loosen the locknut set screw and remove the lock nut from the housing with Tool T57P-53510-A.

6. Install the door lock nut in the housing using Tool T57F-53510-A. Then, close and lock the luggage compartment door and check the door closing height.

7. Open the luggage compartment door and adjust the nut up or down with Tool T57F-53510-A to obtain a flush surface when the luggage compartment door is closed.

LUGGAGE COMPARTMENT DOOR LOCK TRANSMISSION

REMOVAL

1. Raise the rear of the car and remove the right and left luggage compartment door lock nut lower retaining screws located in each wheel housing.

2. Raise the luggage compartment door approximately one inch by hand to free the lock assemblies from the bracket. Then, operate the top switch to complete the deck-open cycle.

3. Remove the right and left lock nuts from the transmission lock screws.

4. Position the lock nuts in the brackets and install the lower retaining screws at the wheel housing. Torque the scrws to 15-20 ft-lbs.

5. Scribe the location of the transmission on the luggage compartment door.

6. Loosen the 2 nuts retaining the transmission to the luggage compartment door (Fig. 34) and slide the bolts out of the slots in the door inner panel.

7. Loosen the transmission drive cable retaining screw and remove the transmission from the luggage compartment door.

INSTALLATION

1. Transfer the bolts, washers, sleeves, bushings, and nuts (Fig. 34) to the new transmission (also transfer the limit switch activator on the right transmission).

2. Position the drive cable in the transmission and install the transmission to the luggage compartment door inner panel. Torque the transmission rėtaining nuts to 3-6 ft-lbs.

3. Tighten the screw retaining the drive cable in the transmission.

4. Carefully lower the luggage compartment door and check the alignment of the transmission with the lock nut.

5. Raise the luggage compartment door and adjust the transmission fore or aft as required for proper fore or aft alignment with the lock nut.

6. Adjust the lock nut assembly side to side as required to align with the transmission.

7. Close the luggage compartment door and check for proper alignment and for a good weatherstrip seal.

8. Adjust the lock nut height as necessary for a flush luggage compartment door fit with Tool T57P-53510-A.

9. Adjust the luggage compartment door close limit switch and activator using Tool T57P-15780-A. Then, check the operation of the luggage compartment door locks and the switch adjustment.

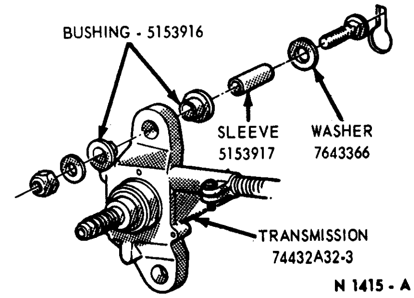


FIG. 34—Luggage Compartment Door Lock-Transmission Installation

LUGGAGE COMPARTMENT DOOR LOCK TRANSMISSION DRIVE CABLE AND HOUSING

1. Raise the rear of the car and remove the right and left luggage compartment door lock nut lower retaining screws located in each wheel housing.

2. Raise the luggage compartment door approximately one inch by hand to free the lock assemblies from the bracket. Then, operate the top switch to complete the deck-open cycle.

3. Remove the right and left lock nuts from the transmission lock screws.

4. Position the lock nuts in the brackets and install the lower retaining screws at the wheel housing. Torque the screws to 15-20 ft-lbs.

5. Remove the clip and screw retaining the cable and housing to the door inner panel.

6. Disconnect the drive cable and housing from the motor and transmission and remove the cable and housing.

7. Place the cable and housing in

the transmission and tighten the retaining screw.

8. Connect the drive cable and housing to the motor and retain it in place with the clip and screw.

UPPER BACK FINISH PANEL LIFT

REMOVAL

1. Open the luggage compartment door.

2. Remove the upper back panel motor and switch wires from the retaining clip; pull the wires out of the hole in the inner panel and disconnect at the connectors.

3. Scribe the location of the lift assembly on the upper back finish panel bracket; then, remove 2 bolts, nuts, and washers attaching the upper back finish panel to the lift assembly.

4. Remove 2 bolts attaching the lift assembly to the luggage compartment door inner panel. Remove the lift assembly.

5. Remove 2 switch retaining nuts and remove the switch from the transmission.

6. Remove 2 motor retaining nuts and remove the motor from the transmission.

7. Remove 4 bolts and 2 nuts and remove the transmission and arm from the mounting plate.

INSTALLATION

1. Position the mounting plate to the transmission and arm assembly and install the 4 bolts and 2 nuts.

2. Position the motor and rubber drive coupling to the transmission and install the 2 retaining nuts.

3. Position the switch to the transmission and install the 2 retaining nuts.

4. Position the lift assembly to the luggage compartment door inner panel and install the 2 attaching bolts.

5. Position the arm of the lift assembly to the upper back finish panel bracket and install the attaching bolts, nuts, and washers.

6. Connect the motor and switch wires to the harness. Push the wire connectors in the hole in the inner panel and install the harness retaining clip.

7. Check the upper back finish panel operation; adjust the hinges and adjust the upper back finish panel (deck open) limit switch. Refer to Adjustments in Section 4.

UPPER BACK FINISH PANEL HINGE

1. Open the luggage compartment door and remove the nuts, washers, and bolts attaching the hinge to the package tray.

2. Remove 2 hinge to luggage compartment door attaching bolts and remove the hinge.

3. Position the hinge to the luggage compartment door and install the retaining bolts.

4. Position the hinge to the package tray and install the bolts, washers, and nuts.

5. Adjust the upper back finish panel hinge. See Upper Back Finish Panel Adjustment in Section 4.

ROOF HOLD DOWN CLAMP

1. Unlatch the top and raise it off the windshield header.

2. Remove 2 screws attaching the hold down clamp to the No. 1 bow and remove the clamp.

3. Position the clamp to the No. 1 bow and install the attaching screws. Adjust the clamp hook to the proper length (Section 4).

DOWEL PIN

1. Lower the convertible top into the luggage compartment. **Do not allow the luggage compartment door to close.**

2. Remove 2 screws attaching the dowel to the No. 1 bow and remove the dowel.

3. Position the dowel to the No. 1 bow and install the retaining screws. Snug but do not tighten the screws so that the dowel will move when placed against the windshield header.

4. Raise the top to the windshield header to align the dowel pins with the header.

5. Lower the top and tighten the dowel pin attaching screws.

6. Raise the top and lock it to the windshield header.

DOWEL PIN STRIKER PLATE

1. Lower the top.

2. Remove the sun visor attaching screws and remove the right and left sun visors from the windshield header.

3. Remove 2 screws and remove the right and left windshield pillar weatherstrips (Fig. 35).

4. Remove the right and left windshield pillar weatherstrip retainers.

5. Remove the windshield pillar drip moulding attaching screws and remove the right and left drip rails.

6. Remove 2 screws attaching each windshield outside upper side moulding and remove the right and left moulding.

7. Remove the right and left top latch clamps from the header.

8. Remove the sun visor arm clip from the center of the windshield header.

9. Remove the windshield outside top moulding.

10. Remove the dowel pin striker plate.

11. Install the dowel pin striker plate and the windshield outside top moulding.

12. Install the sun visor retainer.

13. Install the right and left top latch clamps.

14. Install the right and left windshield upper side mouldings (Fig. 35).

15. Install the right and left windshield pillar drip mouldings.

16. Install the right and left windshield pillar weatherstrips.

17. Install the sun visors.

NO. 1 BOW WEATHERSTRIP

1. Unlatch the top and raise it from the windshield header.

2. Remove 2 bolts and nuts attaching the weatherstrip to the right and left side rails (Fig. 23).

3. Remove 2 screws from the weatherstrip right and left front corners.

4. Remove the weatherstrip front retainer attaching screws and remove the retainers.

5. Remove the No. 1 bow weatherstrip from the car.

6. Position the weatherstrip to the No. 1 bow and install the corner attaching screws.

7. Position the weatherstrip front retainers to the weatherstrip and No. 1 bow and install the attaching screws (Fig. 23).

8. Install the weatherstrip side rail attaching bolts and nuts.

9. Lower the top on the windshield header and latch it in place.

SIDE RAIL WEATHERSTRIPS

1. Unlatch the top and raise it up off the windshield header.

2. Remove 3 bolts and nuts attaching the front intermediate side

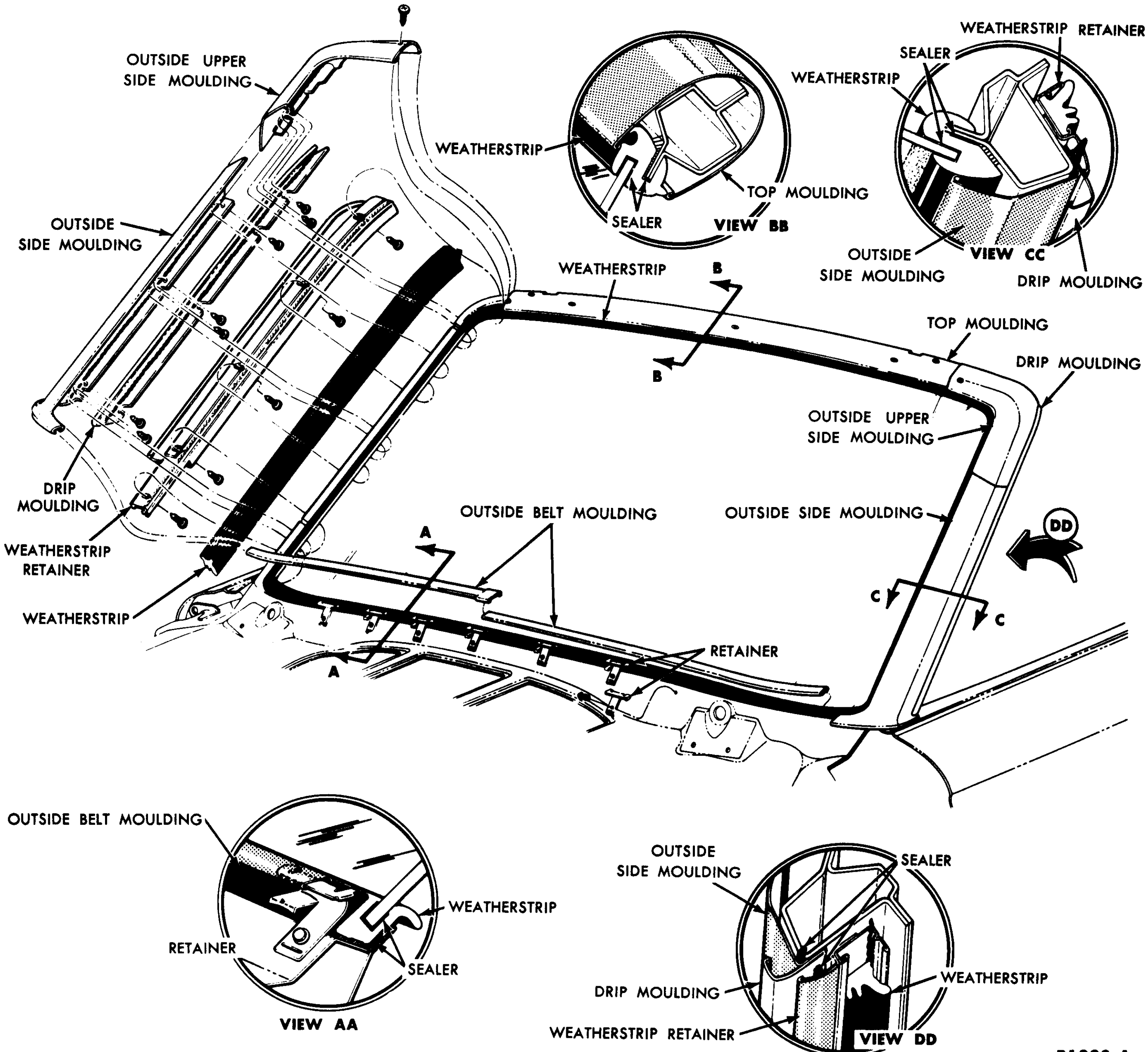


FIG. 35—Windshield Outside Mouldings

rail weatherstrip to the roof side rails and remove the weatherstrip (Fig. 23).

3. Remove 4 bolts and nuts and one screw attaching the rear intermediate side rail weatherstrips and remove the inner and outer weatherstrips.

4. Position the weatherstrips to the roof side rail and install the attaching bolts, nuts, and screw.

5. Lower the top to the windshield header and latch it in place. Then, adjust as necessary (Section 4).

REAR SIDE RAIL WEATHERSTRIP

1. Unlatch the top from the windshield header and lower the top. **Do not allow the luggage compartment door to close.**

2. Remove the rear side rail weatherstrip attaching screws and remove the weatherstrip (Fig. 23).

3. Position the weatherstrip to the rear roof rail and install the attaching screws.

4. Raise the top and latch it to the windshield header. Check for a good rear side rail weatherstrip seal.

MAINTENANCE SCHEDULE

GROUP 19

THOUSANDS OF MILES OR NUMBER OF MONTHS, WHICHEVER OCCURS FIRST (Except Where Noted)		As Required	6	12	18	24	30	36

ENGINE

Change engine oil and filter**			X	X	X	X	X	X
Check engine oil level					At Fuel Stops			
Adjust carburetor—idle speed, idle mixture, and fast (cold) idle speed		X						
Clean carburetor air cleaner and filter (paper type)			X	X	X	X	X	
Replace carburetor air cleaner filter	Paper†							X
	Plastic†			X		X		X
Clean crankcase oil filler breather cap**			X	X	X	X	X	X
Check engine accessory drive belts		X						
Clean positive crankcase ventilation system and replace valve**					X			X
Check ignition timing and adjust as required				X		X		X
Check distributor points		X						
Check spark plugs		X						
Replace fuel filter								X
Adjust accelerator pump lever					Seasonal			
Replace engine coolant								X*
Check engine coolant level		X						

TRANSMISSION

Adjust Cruise-O-Matic transmission bands	Rear	X						
	Front							X
Check transmission fluid level			X	X	X	X	X	X

CHASSIS

Inspect and cross-switch wheels and tires	X						
Check power steering reservoir fluid level		X	X	X	X	X	X
Check brake master cylinder fluid level		X	X	X	X	X	X
Check rear axle fluid level		X	X	X	X	X	X
Check steering gear over-center mesh load	X						
Clean and pack front wheel bearings as required						X†	
Check brake lines and lining						X	
Check air conditioning system				Annually at Beginning of A/C Season			
Check front wheel alignment and linkage	X						
Check tire pressures	X						
Check battery fluid level	X						

BODY

Lubricate hood latch	X						
Lubricate hood auxiliary catch	X						
Lubricate door lock cylinders	X						
Lubricate luggage compartment lock cylinder	X						
Lubricate fuel filler door hinges	X						
Check convertible top operation	X						
Check convertible top fluid level	X						
Replace windshield wiper blades	X						
Lubricate door hinge and hinge check	X						
Lubricate hood hinge pivots	X						
Lubricate luggage compartment hinge pivots	X						

*or every two years †at mileage interval only

**On engine items, more frequent intervals will be required if the vehicle is operated in extremely dusty areas, for extended periods of idling or short runs which prevent the engine from reaching normal operating temperatures.

MAINTENANCE OPERATIONS

GROUP 20

PART 20-1 MAINTENANCE OPERATIONS

1 ENGINE

CHANGE OIL AND FILTER

1. Raise the car.

2. Remove the oil pan drain plug and allow the engine oil to drain into a container.

3. Place a drip pan under the filter. Unscrew the filter from the adapter fitting.

4. 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.

5. Replace the oil pan drain plug and tighten it securely.

6. Refill the crankcase with the proper amount and grade of oil.

7. Lower the car.

8. Operate the engine at fast idle and check for oil leaks. If oil leaks are evident, perform the necessary repairs to correct the leakage.

ADJUST CARBURETOR—IDLE SPEED, IDLE MIXTURE, AND FAST (COLD) IDLE SPEED

1. Operate the engine for 30 minutes at 1200 rpm to stabilize engine temperatures. Be sure the dashpot is not interfering with the throttle lever, and make sure the choke fast idle cam is in the slow position (fast idle screw not contacting the fast idle cam).

On a car with air conditioner, operate the air conditioner for 20 minutes before setting the engine idle speed. Adjust the idle speed with the air conditioner running.

2. Attach a tachometer to the engine. Set the parking brake. **It is necessary to inactivate the vacuum power unit to keep the parking brake engaged when the engine is running during the adjustment procedures.** Turn on the headlights. Place the transmission selector lever in drive range. Check the engine idle speed. Adjust the engine idle speed to specifications by turning the screw inward to increase the speed or by turning the screw outward to decrease the speed. **When performing this adjustment, be sure the dashpot is not interfering with the throttle lever or the fast idle adjusting screw is not contacting the fast idle cam.**

3. Turn each mixture screw (needle) in until the engine rpm begins to drop, due to the lean mixture. Turn the needles out until the engine rpm increases and then begins to drop, due to the rich mixture; then, turn the needles inward for maximum engine rpm and smoothness. The needles should be turned approximately the same amount. The final setting may vary about ½-turn difference between the needles. Always favor a slightly rich mixture rather than a lean mixture.

4. Check the final engine idle speed by manually opening and closing the throttle. Adjust the idle speed, if necessary.

Final engine idle speed may be varied to suit the conditions under which the car is to be operated.

Engine Fast (Cold) Idle Speed. The adjusting screw on the right side of the carburetor contacts one edge of the fast idle cam. The cam permits a faster engine idle speed for smoother running when the engine is cold during choke operation. As the choke plate is moved through its range of travel from the closed to the open position, the fast idle cam pick-up lever rotates the fast idle cam. Each position on the fast idle cam permits a slower idle rpm as engine temperature rises and choking is reduced.

Manually rotate the fast idle cam until the fast idle adjusting screw rests on the next to highest (starting) step of the fast idle cam, adjacent to the shoulder (kickdown step).

Start the engine and turn the fast idle adjusting screw as required to obtain the specified fast idle rpm.

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 checked after the idle fuel mixture has been adjusted.

CLEAN CARBURETOR AIR CLEANER AND PAPER TYPE FILTER

REMOVAL

1. Disconnect the positive crankcase ventilation inlet hose at the air cleaner.

2. Remove the wing nut retaining the air cleaner on the carburetor; then, lift the air cleaner off the carburetor. **To prevent dirt from entering the carburetor, the filter element must never be removed when the air cleaner body is mounted on the carburetor.**

3. Remove the cover and filter element. Discard the air cleaner mounting gasket on the carburetor if it is excessively worn or damaged.

FILTER ELEMENT

The filter element must never be cleaned with a solvent or cleaning solution. Also, oil must not be added to the surfaces of the filter element or air cleaner body.

There are two alternate procedures that can be used to clean the air filter element. One method is performed with the use of compressed air. The other is performed by tapping the element on a smooth horizontal surface.

Compressed Air Method. Direct a stream of compressed air through the element in the direction opposite that of the intake air flow, that is from the inside outward. **Extreme care must be exercised to prevent rupture of the element material.**

Tapping Method. Hold the element in a vertical position and tap it lightly against a smooth, horizontal surface to shake the dust and dirt out. **Do not deform the element or damage the gasket surfaces by tapping too hard.** Rotate the filter after each tap until the entire outer surface has been cleaned.

Inspection. Hold the filter in front of a back-up light and carefully inspect it for any splits or cracks. If the filter is split or cracked, replace it.

BODY AND COVER

Clean the air cleaner body and the cover with a solvent or compressed air. **Probe the air cleaner body at the positive crankcase ventilation system inlet connection to assure removal of deposits.** Wipe the air cleaner dry if a solvent is used. Inspect the air cleaner body and cover for distortion or damage at the gasket mating surfaces. Replace the cover or body if they are damaged beyond repair.

INSTALLATION

1. Install the air cleaner mounting gasket on the carburetor. Install the air cleaner body on the carburetor so that the word "FRONT" faces the front of the car.
2. Place the element in the air cleaner body. Make sure the element gasket is properly seated. Install the cover and tighten the retaining wing nut.
3. Connect the crankcase ventilation inlet hose to the air cleaner body.

REPLACE CARBURETOR AIR CLEANER FILTER

REMOVAL

1. Remove the wing nuts retaining the air cleaner assembly.
2. Remove the air cleaner assembly from the carburetor. **To prevent dirt from entering the carburetor, the filter element must never be removed when the air cleaner body is mounted on the carburetor.**
3. Remove the cover and filter element. Discard the filter element. Discard the air cleaner mounting gasket if it is excessively worn or damaged.

INSTALLATION

1. Install a new air cleaner mounting gasket on the carburetor, if necessary. Install the air cleaner body on the carburetor so that the word "FRONT" faces the front of the car.
2. Place the new element in the air cleaner body. **Make sure the element gasket is properly seated.** Install the cover. Tighten the retaining wing nut.

CLEAN CRANKCASE OIL FILLER BREATHER CAP

Wash the crankcase filler cap in solvent. **Do not oil the filter mesh.**

CHECK ENGINE ACCESSORY DRIVE BELTS

BELT TENSION

1. Install the belt tension tool on the drive belt (Fig. 1) and check the tension following the instructions of the tool manufacturer.
2. If adjustment is necessary, loosen the alternator mounting bolts and the alternator adjusting arm bolt. Move the alternator toward or away from the engine until the correct tension is obtained. Remove the gauge. Tighten the alternator adjusting arm bolt and the mounting bolts. Install the tension gauge and check the belt tension.

If the car is equipped with air conditioning:

1. Loosen the four compressor mounting bolts.

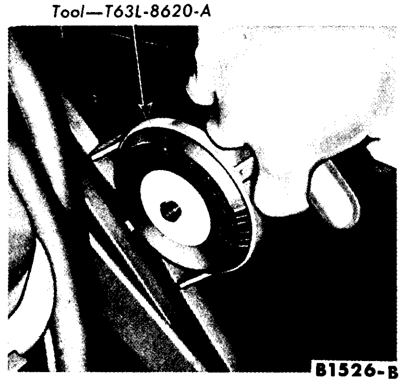


FIG. 1—Checking Drive Belt Tension

2. Adjust the belt tension by sliding the compressor towards the center of the car to decrease the tension, and towards the outside of the car to increase the tension.
3. Tighten the four mounting bolts to specification and check the belt tension.

If the car is equipped with power steering:

1. Loosen the mounting bolts incorporated on the front face of the pump cover plate (hub side) and the one nut at the rear.
2. Fix a 9/16-inch open end wrench on the projecting 1/2-inch boss and pry upward to correct tension. **Do not pry against the reservoir to obtain proper belt load as it can be deformed and cause a leak.**
3. Recheck the belt tension. When the tension has been correctly adjusted, tighten the bolts to specifications.

DRIVE BELT REPLACEMENT

1. On a car with power steering, loosen the pump mounting bolts and remove the drive belt.

On a car with an air conditioner, remove the compressor drive belt.

2. Loosen the alternator mounting bolts and the alternator adjusting arm bolt. Move the alternator or generator toward the engine. Remove the belt(s) from the alternator and crankshaft pulleys, and lift them over the fan.
3. Place the belt(s) over the fan. Insert the belt(s) in the water pump pulley, crankshaft pully and alternator pully grooves. Adjust the belt tension to specifications.
4. On a car with an air conditioner, install and adjust the compressor drive belt to specifications.
5. On a car with power steering, install the pump drive belt and tighten the mounting bolts. Adjust the drive belt tension to specifications.

CLEAN POSITIVE CRANKCASE VENTILATION SYSTEM AND REPLACE VALVE

1. Remove the carburetor air cleaner.
2. Grasp the crankcase ventilation regulator valve and pull it straight upwards and out of the grommet in the right valve rocker arm cover.
3. Use a hose clamp tool to slide both hose clamps off the ends of the inlet hose. Remove the inlet hose from the carburetor spacer, and sep-

arate the hose from the regulator valve.

4. **Do not attempt to clean the crankcase regulator valve.** The breather cap, located on the left valve rocker arm cover, should be cleaned at the proper mileage interval. Remove the cap and wash it in a low-volatility, petroleum-base solvent. Probe the breather hole(s) to assure removal of any accumulated deposits. Shake the cap dry and install it. **Do not dry with compressed air as air pressure may damage the filter element.**

Clean the crankcase ventilation system connection on the carburetor spacer by probing the inlet nipple with a flexible wire or bottle brush.

Clean the rubber hose with a low-volatility, petroleum-base solvent and dry with compressed air.

5. Install the inlet hose and hose clamp on the regulator valve. Position the hose clamp.

6. Install the inlet hose and hose clamp on the carburetor spacer inlet nipple. Position the hose clamp.

7. Install the crankcase ventilation regulator valve in the right valve rocker arm cover. Be sure the grommet is properly seated around the regulator valve and valve rocker arm cover.

CHECK IGNITION TIMING AND ADJUST AS REQUIRED

1. Disconnect the vacuum line to the distributor. If necessary, clean and mark the desired timing mark (Fig. 2).

2. Attach a timing light to the number one spark plug.

FIG. 2—Timing Marks

3. Connect a tachometer to the engine.

NOTE: **When connecting a tachometer to a vehicle equipped with a transistorized ignition, connect the leads to the tachometer block (positive lead to red terminal, negative to black).**

4. Start the engine and adjust the speed to the specified RPM for initial timing adjustment. Allow the engine to warm up.

5. Observe the timing with the light.

6. If the timing is not correct, loosen the hold down bolt and rotate the distributor clockwise to advance the timing or counterclockwise to retard it.

7. Tighten the hold down bolt and check the timing.

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

9. 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.

CHECK AND ADJUST OR REPLACE DISTRIBUTOR POINTS

Unsnap the distributor cap retaining clips, lift the distributor cap off the distributor housing, and position the cap out of the way (if necessary, remove the air cleaner and/or the high tension wire to gain access to the distributor).

Lift the rotor off the cam. Remove the dust cover (transistorized ignition).

INSPECTION

Replace the distributor point assembly if the contacts are badly burned or excessive metal transfer between the points is evident. Metal transfer is considered excessive when it equals or exceeds the gap setting.

REMOVAL

1. Remove the primary distributor-transistor lead and condenser wire (if equipped) from the breaker plate.

2. Remove the screw attaching the ground wire to the distributor point assembly.

3. Remove the screw nearest the distributor points, then remove the distributor point assembly.

INSTALLATION

1. When installing new distributor points, reverse the procedure for removal and make sure that the ground wire is attached to the distributor point assembly attaching screw which is furthest from the distributor points.

2. If the used points are serviceable, set the gap using a dwell meter.

To set the gap with a dwell meter:

Connect the dwell meter following the manufacturer's instructions.

NOTE: **In a car equipped with transistor ignition, make sure that the dwell meter is connected to the tachometer block rather than the coil.**

Operate the engine at idle speed and note the reading on the dwell meter.

Stop the engine and adjust the gap (decreasing the gap increases the dwell). Now check the dwell again.

Repeat this procedure until the proper dwell is obtained.

If new points are installed, set the gap to specifications using a feeler gauge or a dwell meter.

3. Install the dust cover (transistorized ignition).

4. Install the rotor. Install the distributor cap on the distributor housing and snap the retaining clips in place.

5. Install the air cleaner and/or the high tension lead if either was removed.

CHECK AND ADJUST OR REPLACE SPARK PLUGS

REMOVAL

1. Remove the wire from each spark plug by grasping the moulded cap of the wire 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 port with compressed air, then remove the spark plugs.

3. 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 carbon and other deposits from the threads with a stiff wire brush. Any deposits will retard the heat flow from the plug to the cylinder head causing

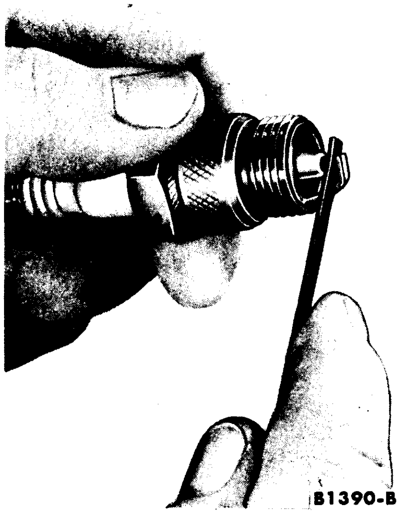


FIG. 3—Cleaning Plug Electrode

spark plug overheating and pre-ignition.

4. Clean the electrode surfaces with a small file (Fig. 3). Dress the electrodes to secure flat parallel surfaces on both the center and side electrode.

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

ADJUSTMENT

Set the spark plug gap to specifications by bending the ground electrode (Fig. 4).

INSTALLATION

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

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.

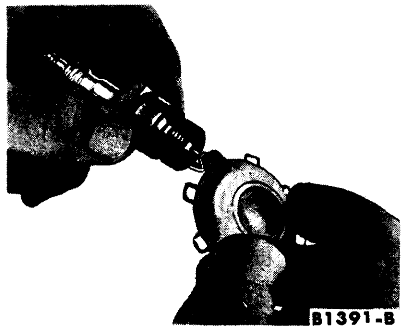


FIG. 4—Gapping Spark Plug

REPLACE FUEL FILTER

1. Remove the filter housing, gasket and filter element. Discard the filter element.

2. Place a new filter element over the spout in the valve housing cover. Lightly lubricate with oil and position the gasket, then screw the filter housing on to the pump. Hand-tighten the filter housing until the gasket contacts the pump, then advance it ⅛ turn.

ADJUST ACCELERATOR PUMP LEVER

The accelerating pump stroke adjustment is made with the carburetor air cleaner removed from the carburetor.

The over-travel lever has 4 holes and the accelerating pump link has 2 holes to control the accelerating pump stroke for various ambient temperatures and operating conditions of the engine. The correct position for the link operating rod for all climatic conditions is in the inboard hole (hole nearest the pump plunger). Refer to specifications, and insert the operating rod in the proper hole of the over travel lever to suit the climatic conditions in which the car is to be operated.

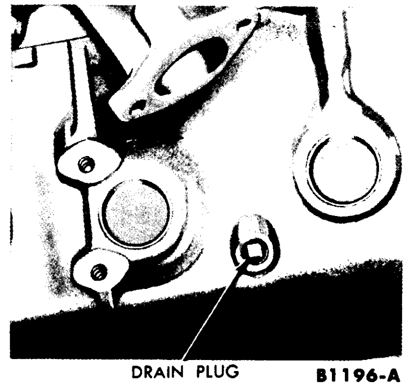


FIG. 5—Typical Cylinder Block Drain Plug

REPLACE ENGINE COOLANT

To drain the radiator, open the drain cock located at the bottom of the radiator. The cylinder block has drain plugs located on both sides of the block (Fig. 5).

To fill the cooling system, install the plugs in the block and close the radiator drain cock. Fill the system to just below the filler neck of the radiator supply tank. 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 until normal operating temperature has been reached. **After the initial fill, the coolant level will drop approximately one quart after the engine has been operated about 20 minutes at 2000 rpm. This is due to the displacement of entrapped air.** Add more coolant to fill the radiator supply tank.

CHECK ENGINE COOLANT LEVEL

The coolant level should be kept just below the bottom of the filler neck.

2 TRANSMISSION

ADJUST CRUISE-O-MATIC TRANSMISSION BANDS

FRONT BAND ADJUSTMENT

1. Disconnect the fluid filler tube from the oil pan, and drain the fluid from the transmission. **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. Make sure that the container is clean. Re-use the fluid only if it is in good condition.**

2. Remove and thoroughly clean the oil pan. **Do not attempt to clean the filter. If dirty install a new one.** Discard the oil pan gasket.

3. Loosen the front servo adjusting screw locknut two full turns with a ⁹⁄₁₆-inch wrench. Check the adjusting screw for free rotation in the actuating lever after the locknut is loosened, and free the screw if necessary.

4. Pull the adjusting screw end of the actuating lever away from the servo body, and insert the adjusting tool gauge block (Fig. 6) between the servo piston stem and the adjusting screw.

5. Install the socket handle on the ⁹⁄₁₆-inch socket. Insert the T-handle extension through the socket handle and socket, and install the screwdriver socket on the T-handle extension. Place the tool on the adjusting screw so that the screwdriver socket

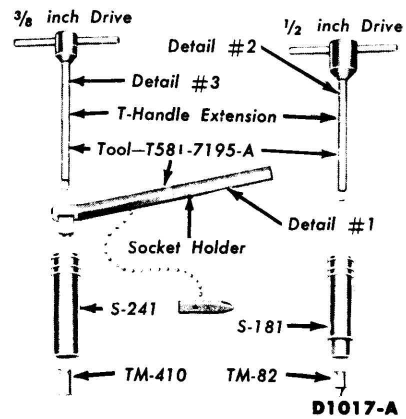


FIG. 6—Front and Rear Band Adjusting Tools

engages the screw and the 9/16-inch socket engages the locknut. With a torque wrench on the T-handle extension, tighten the adjusting screw to 10 in-lbs torque, and then back off the screw exactly one full turn. **Severe damage may result to the transmission if the adjusting screw is not backed off exactly one full turn.**

6. Hold the adjusting screw stationary, and torque the locknut to specification.

7. Remove the gauge block from the transmission.

8. Place a new gasket on the oil pan; install the filter and pan on the transmission.

9. Connect the filler tube to the oil pan and tighten to specifications.

10. Add 3 quarts of transmission fluid. Run the engine for 2 minutes. Place selector lever in P position and check fluid level. Add fluid if necessary.

REAR BAND ADJUSTMENT

1. Working from under the right side of the instrument panel, lift enough carpet away from the console to gain access to the rear band adjustment opening.

2. Remove the plastic plug from the floor pan.

3. Wipe all dirt from the rear band adjusting screw threads, and oil the threads.

4. Place the socket holder on the 3/4-inch socket (Fig. 6). Insert the T-handle extension through the handle and socket. Place the 5/16-inch 8-point socket on the extension. Place a torque wrench on the T-handle extension.

5. Insert the assembled tool in the access hole so that it engages the adjusting screw and the locknut.

6. Loosen the adjusting screw locknut.

7. Torque the adjusting screw to specification.

8. Remove the torque wrench from the T-handle extension and back off the adjusting screw exactly 1½ turns. **Severe damage may result to the transmission if the adjusting screw is not backed off exactly 1½ turns.**

9. Hold the adjusting screw stationary, and torque the locknut to specification.

10. Install the plastic plug in the floor pan.

11. Fit the carpet into place on the console.

CHECK TRANSMISSION FLUID LEVEL

1. Make sure that the car is standing level.

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.

3. Shift the selector lever through all positions, and place the lever at P. Do not turn off the engine during the fluid level checks. Firmly apply the parking brake.

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. Be sure it is properly seated.

6. Pull the dipstick out of the tube again, and check the fluid level. If necessary, add enough fluid to the transmission through the filler tube to raise the fluid level to the F (full) mark on the dipstick. **Do not overfill the transmission.**

3 CHASSIS

INSPECT AND CROSS-SWITCH WHEELS AND TIRES AS REQUIRED

Switch the tires according to Fig. 7.

Tighten the wheel nuts to specified torque.

CHECK POWER STEERING RESERVOIR FLUID LEVEL

Run the engine until the fluid is at normal operating temperature. Then turn the steering wheel all the way to the left and right several times, and shut off the engine.

Check the fluid level in the reservoir. The level must be at the full mark on the dipstick. If the level is low, add enough fluid to raise the level to the F mark on the dipstick. **Do not overfill the reservoir.**

CHECK BRAKE MASTER CYLINDER FLUID LEVEL

1. Remove the filler cap from the master cylinder. The diaphragm which seals the master cylinder should come off with the cap.

2. Fill the reservoir to 3/8 inch from the top.

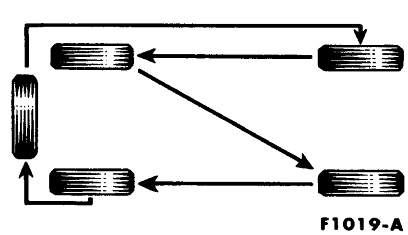


FIG. 7—Tire Cross Switching Diagram

3. Install the filler cap, making sure that the diaphragm is properly seated in the cap.

CHECK REAR AXLE FLUID LEVEL

The lubricant level should be maintained at the bottom of the filler plug hole with the specified lubricant.

CHECK STEERING GEAR OVER-CENTER MESH LOAD

Preload (thrust bearing adjustment) and worm to rack perload cannot be changed in service. (The only adjustment which can be performed is the total over-center position load, to eliminate excessive lash between the sector and rack teeth.)

1. Disconnect the pitman arm from the sector shaft.

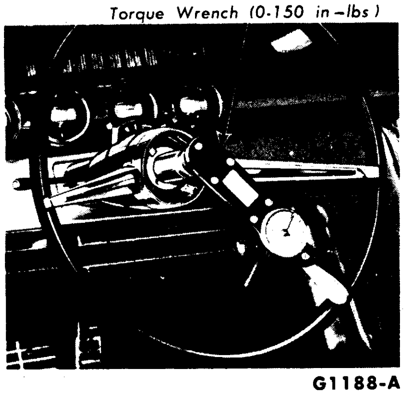


FIG. 8—Checking Steering Gear Over Center Mesh Load

2. Disconnect the fluid return line at the reservoir, at the same time cap the reservoir return line pipe.

3. Place the end of the return line in a clean container and cycle the steering wheel in both directions as required, to discharge the fluid from the gear.

4. Remove the ornamental cover from the steering wheel hub and turn the steering wheel to 45° from the left stop.

5. Using an inch-pound torque wrench on the steering wheel nut, determine the torque required to rotate the shaft slowly through an approximately ⅛ turn from the 45° position (Fig. 8).

6. Turn the steering gear back to center, then determine the torque required to rotate the shaft back and forth across the center position. Loosen the adjuster nut, and turn the adjuster screw (Fig. 9) in until the reading is at specifications.

Retighten the lock nut while holding the screw in place.

7. Recheck the readings and replace pitman arm and steering wheel hub cover.

8. Connect the fluid return line to the reservoir and fill the reservoir with specified lubricant to the proper level.

CLEAN AND PACK FRONT WHEEL BEARINGS

1. Raise the car until the wheel and tire clear the floor.

2. Remove the wheel cover or hub cap from the wheel.

3. Remove the wheel and tire from the hub and rotor.

4. Remove 2 bolts and washers retaining the caliper to the spindle. Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose.

5. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone and roller assembly.

6. Pull the hub and rotor assembly off the wheel spindle.

7. Remove the grease retainer, (Fig. 10) and the inner bearing cone and roller assembly from the hub.

8. Clean the lubricant off the inner and outer bearing cups with solvent and inspect the cups for scratches, pits, excessive wear, and other damage. If the cups are worn or damaged, remove them with the tools shown in Fig. 11.

9. Soak a new grease retainer in light engine oil at least 30 minutes before installation. Thoroughly clean the inner and outer bearing cones and rollers with solvent, and dry them thoroughly. **Do not spin the bearings dry with compressed air.**

Inspect the cones and rollers for wear or damage, and replace them if necessary. The cone and roller assemblies and the bearing cups should be replaced as a set if damage to either is encountered.

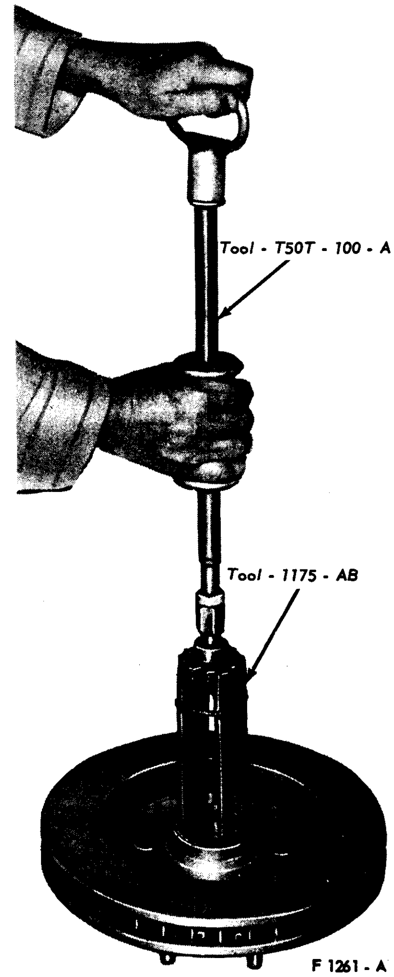


FIG. 10—Removing Grease Retainer

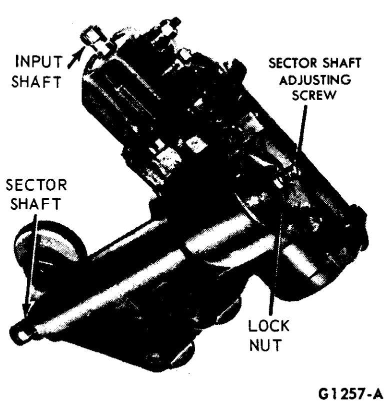


FIG. 9—Steering Gear Adjustment

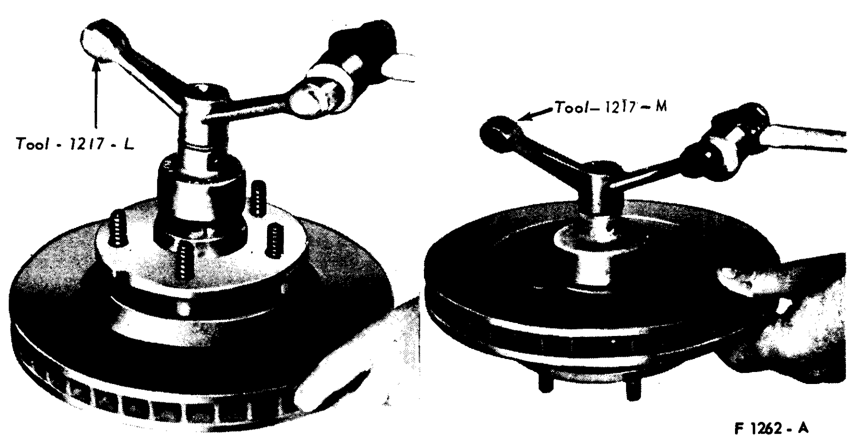


FIG. 11—Front Wheel Bearing Cup Removal

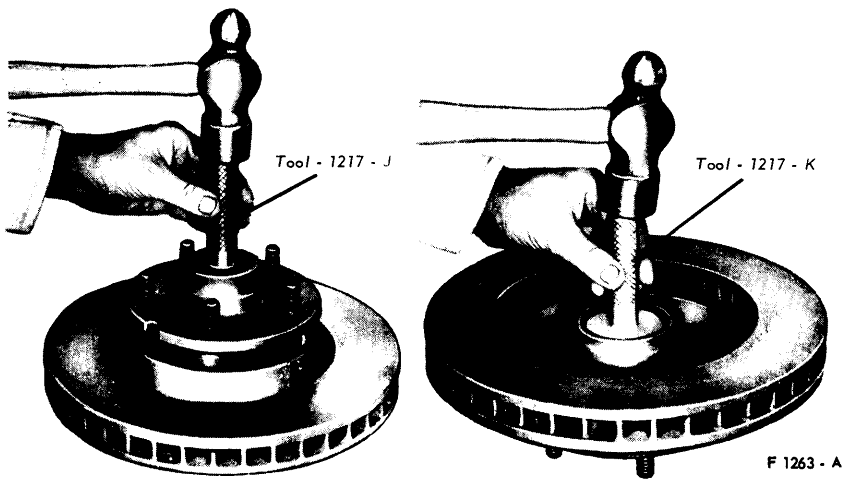


FIG. 12—Front Wheel Bearing Cup Installation

10. Thoroughly clean the spindle and the inside of the hub with solvent to remove all old lubricant.

Cover the spindle with a clean cloth, and brush all loose dust and dirt from the splash shield. **To prevent getting dirt on the spindle, carefully remove the cloth from the spindle.**

11. If the inner and/or outer bearing cup(s) were removed, install the replacement cup(s) in the hub with the tools shown in Fig. 12. **Be sure to seat the cups properly in the hub.**

12. Pack the inside of the hub with the specified wheel bearing grease. Add lubricant to the hub only until the grease is flush with the inside diameter of both bearing cups. **All old grease should be completely cleaned from the bearings before repacking with new grease.**

13. Pack the bearing cone and roller assemblies 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.

14. Place the inner bearing cone and roller assembly in the inner cup, and install the new grease retainer with the tool shown in Fig. 13. **Be sure the retainer is properly seated.**

15. Install the hub and rotor assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

16. Install the outer bearing cone and roller assembly and the flat

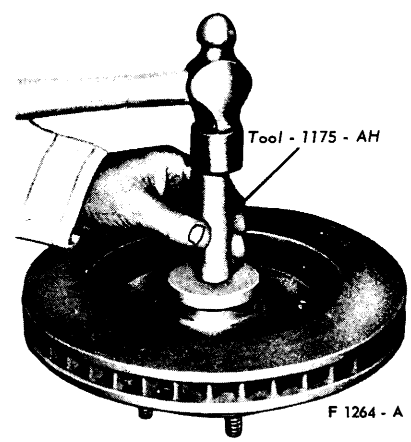


FIG. 13—Grease Retainer Installation

washer on the spindle, then install the adjusting nut.

17. Adjust the wheel bearings and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference wih the radio static collector in the grease cap. Install the grease cap.

18. Install the caliper to the spindle and tighten the retaining bolts to specifications. Check for the correct flexible hose routing (Part 2-2).

19. Install the wheel and tire on on the hub.

20. Install the wheel cover.

CLEANING AND INSPECTION

FRONT BRAKES

1. Remove the wheel and tire assembly, caliper splash shield, and the shoe and lining assemblies.

2. Make three thickness measurements with a micrometer across the middle section of the shoe and lining. Take one reading at each side and one in the center. If the assembly has worn to a thickness of 0.195 inch (shoe and lining together) or 0.030 inch (lining material only) at any one of the three measuring locations, replace all (4) shoe and lining assemblies on both front wheels.

3. With the shoe and lining assemblies installed, insert a feeler gauge between the lining and rotor. If the clearance is not within 0.002-0.010 inch, check for shoe and lining assemblies not being properly seated on the caliper bridges, for a piston pushed back in the cylinder bore, for a seized piston, or for malfunction of a piston seal.

Ordinarily, the clearance should be 0.002-0.010 inch. However, if the vehicle was stopped by a brake application just prior to checking the clearance, the brakes may drag slightly.

4. To check rotor runout, first eliminate the wheel bearing end play by tightening the adjusting nut. After tightening the nut check to see that the rotor can still be rotated.

5. Clamp a dial indicator to the caliper housing so that the stylus contacts the rotor at a point approximately 1 inch from the outer edge. Rotate the rotor and take an indicator reading. If the reading exceeds 0.002 inch total indicator runout, replace the rotor. **Do not attempt to refinish a rotor that indicates runout in excess of specification.**

When the runout check is finished be sure to adjust the bearings as outlined in Group 3, in order to prevent bearing failure.

6. Check the rotor for scoring. Minor scores can be removed with a fine emery cloth. If the rotor is excessively scored replace it.

7. Visually check the caliper. If it is cracked or if excess leakage is evident, it should be replaced. Slight leakage or seized pistons indicate removal and disassembly.

8. If upon disassembly the caliper is found to be distorted or damaged, or if the cylinder bores are scored or excessively worn, replace the assembly.

The two halves of the caliper assembly should never be separated. Damage or failure of one requires replacement of both as a unit.

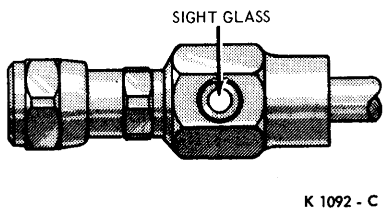


FIG. 14—Sight Glass Installation

CHECK BRAKE LINES AND LINING

1. Raise all four wheels. Remove one of the rear brake drums, and inspect the drum and 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 sets (primary and secondary). **Under no circumstances replace one lining only, or one wheel set. Both rear wheel sets should be replaced whenever a respective lining or shoe is worn or damaged.** If the drum braking surface is excessively scored, refinish it.

2. 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.**

3. Check all brake lines for leakage or physical damage and replace or repair as required.

4. Lower the car.

CHECK AIR CONDITIONING SYSTEM

A quick test of the refrigerant supply can be made by observing the flow of refrigerant through the sight glass (Fig. 14).

To check the refigerant supply, place a large fan in front of the radiator to aid in cooling the engine. Set the servo control for maximum cooling and the blower on high. Operate the engine at 1300 rpm. and observe the sight glass while the compressor is operating. There should be no bubbles in the sight glass after the start of the compressor. Bubbles will appear when the compressor starts but should clear after a few moments.

CHECK FRONT WHEEL ALIGNMENT AND LINKAGE AND ADJUST AS REQUIRED

Do not attempt to check and adjust front wheel alignment without first making a preliminary inspection of the front-end parts.

Check all the factors of front wheel alignment except the turning angle before making any adjustments. The turning angle should be checked only after caster, camber and toe-in have been adjusted to specifications.

The front wheel alignment specifications given in Part 3-5 are correct only when the car is at "Curb Height". Before checking or adjusting the alignment factors, the suspension alignment spacers must be installed to obtain the Curb Height.

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.

Alignment height spacers (Figs. 15 and 16) are used to check caster, camber and toe-in. If the car is operated under abnormal load conditions, the spacers should be omitted when checking toe-in.

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. 17). **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. With the car in position for the front end alignment inspection and adjustment, install the suspension alignment spacers as follows to establish the curb height.

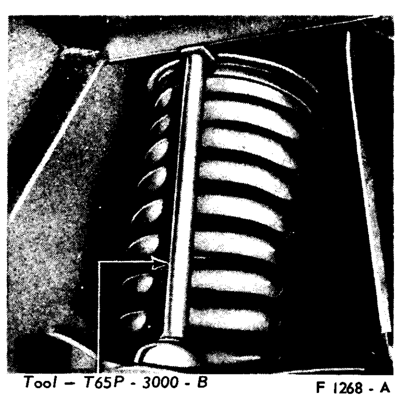


FIG. 15—Alignment Spacer Installation—Front

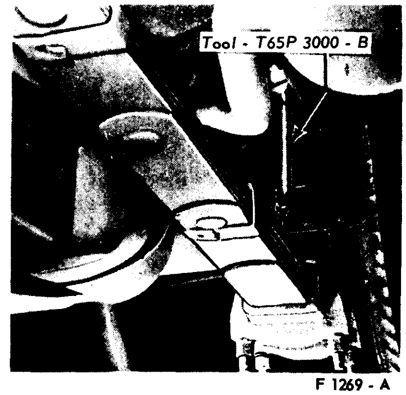


FIG. 16—Alignment Spacer Installation—Rear

Lift the front of the car and position the suspension alignment spacers between the suspension upper arm and the edge of the frame spring pocket as shown in Fig. 15. The lower end of the alignment spacers should be placed over the head of the ball joint retaining nut. Position the alignment spacers for the rear of the car between the rear axle and the frame side rail as shown in Fig. 16. Lower the rear of the car so that the weight of the body will hold the alignment spacers in place.

3. 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.

CASTER

Check the caster angle at each front wheel. Caster is the forward or rearward tilt at the top of the wheel spindle (Fig. 18). If the spindle tilts

FIG. 17—Typical Straight-Ahead Position Marks

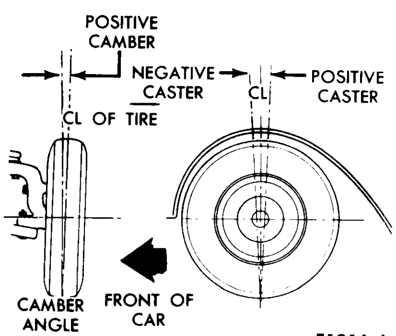


FIG. 18—Caster and Camber Angles

to the rear, caster is positive. If the spindle tilts to the front, caster is negative. The correct caster angle, or tilt, is specified in Part 3-5.

The maximum difference between both front wheel caster angles should not exceed ½°. However, a difference of not more than ¼° is preferred.

CAMBER

Check the camber angle at each front wheel. The camber angle is the amount the front wheels are tilted at the top (Fig. 18). If a wheel tilts outward, camber is positive. If a wheel tilts inward, camber is negative. The correct camber angle, or outward tilt, is specified in Part 3-5. 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

Alignment height spacers are used on all cars to check and adjust toe-in, except on those operated under abnormal conditions. Toe-in should only be checked and adjusted after the caster and camber has been adjusted to specifications.

Check the toe-in with the front wheels in the straight-ahead position. Measure the distance between the extreme front and also between the extreme rear of both front wheels. The difference between these these two distances is the toe-in.

Correct toe-in, or inward pointing of both front wheels at the front is specified in Part 3-5.

FRONT WHEEL TURNING ANGLE

When the inside wheel is turned 20°, the turning angle of the outside wheel should be as specified in Part 3-5. The turning angle cannot be adjusted directly, because it is a result of the combination of caster, camber, and toe-in adjustments and should, therefore, be measured only after these adjustments have been made. If the turning angle does not measure specifications, check the spindle or other suspension parts for a bent condition.

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.**

CAMBER

Adjust the camber by removing or installing shims between the pivot bracket of the front suspension lower arm and the mounting bracket on the underbody in the engine compartment (Fig. 19).

The removal of shims between the mounting and pivot brackets will move the lower ball joints inward. The installation of shims between the mounting and pivot brackets will move the lower ball joint outward. Camber adjusting shims are available in several standard shim thicknesses. A 1/16 inch change of shim thickness will change the camber angle ⅛°. The total shim stack thickness should not exceed 11/16 inch.

CASTER

The caster adjustment is made by repositioning the strut on the lower arm as shown in Fig. 19. Adjust the caster by loosening the rearward washers, nuts and bolts. Lift the strut so that the strut serrations will be free from the serrations on the lower arm. Lengthen the distance between the strut forward mount and the side of the lower arm (Fig. 19, dimension "A") to decrease the caster angle. Decrease the distance between the strut forward mount and the side of the lower arm (Fig. 19, dimension "A") to increase the caster angle. Tighten the rearward nuts that retain the strut to the lower arm. Check the caster, camber,

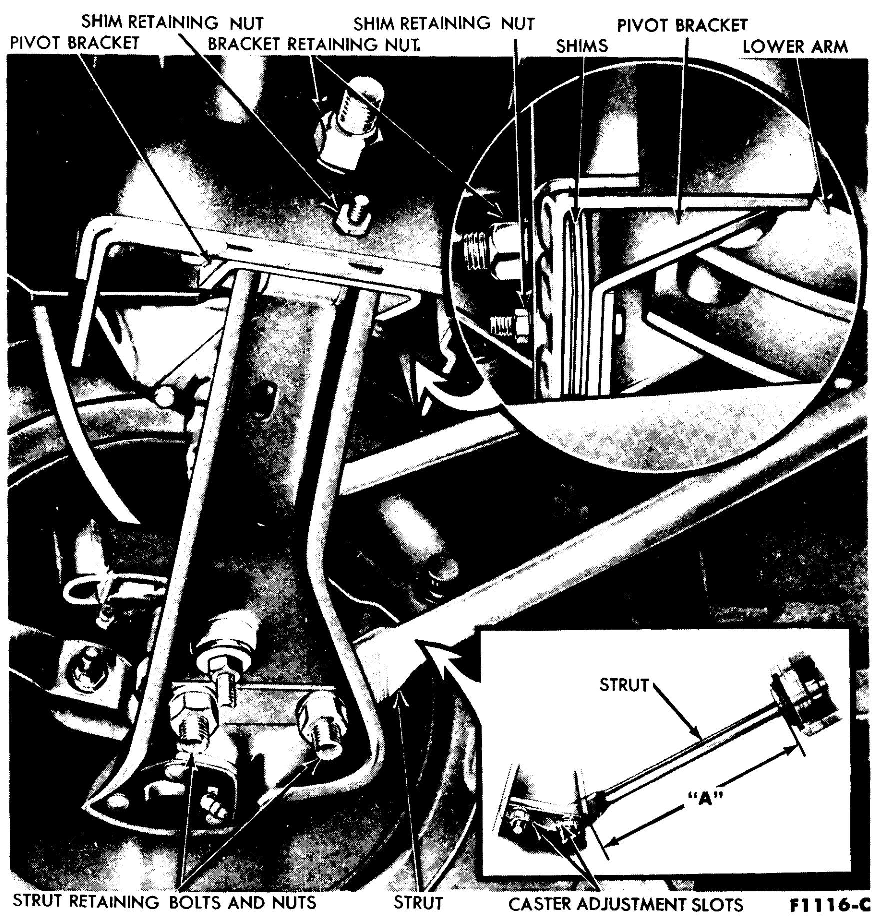


FIG. 19—Caster and Camber Adjustments

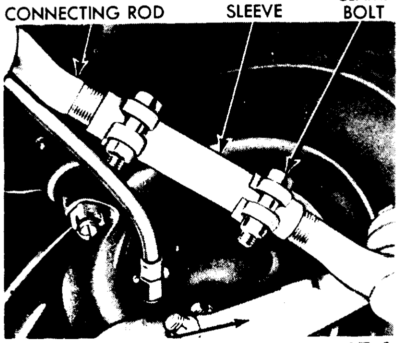


FIG. 20—Spindle Connecting Rod Sleeve

and toe-in alignment for the correct settings listed in the specifications. Remove the suspension alignment spacers.

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. The toe-in specification is specified in Part 3-5.

1. Loosen the two clamp bolts on each spindle connecting rod sleeve (Fig. 20).

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. 21). 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. 22).

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. 22).

4. When toe-in and steering wheel spoke alignment are both correct, torque the clamp bolts on both connecting rod sleeves to specifications.

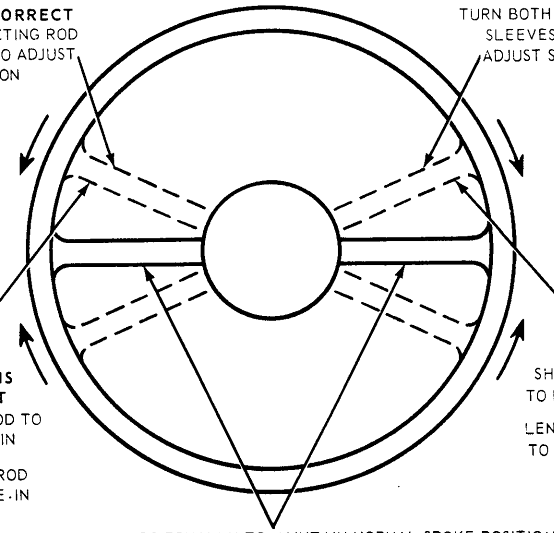


FIG. 22—Toe-In and Steering Wheel Spoke Adjustments

FRONT END GENERAL 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 four tires.

2. Raise the front of the car off the floor. Shake each front wheel grasping the upper and lower surfaces of the tire. Check the front suspension ball joints and mountings for looseness, wear, and damage. Check the brake caliper attaching bolts. Torque all loose nuts and bolts to specifications. Replace all worn parts as outlined in Part 3-2.

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 as outlined in Part 3-3.

4. Check the front wheel bearings. If any in-and-out free play is noticed, adjust the bearings to specification. Replace worn or damaged bearings as outlined in Part 3-4.

5. Spin each front wheel with a wheel spinner, and check and balance each wheel as required.

6. Check the action of the shock absorbers. 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.

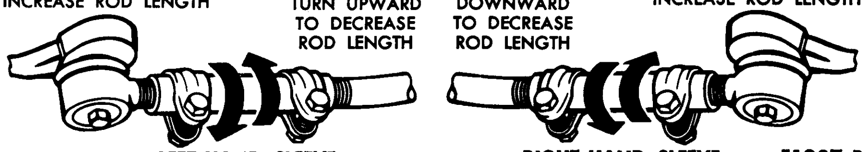


FIG. 21—Spindle Connecting Rod Adjustments

WHEEL INSPECTION

Wheel hub nuts should be inspected and tightened to specification at predelivery. Loose wheel hub nuts may cause shimmy and vibration. Elongated stud holes in the wheels may also result from loose hub nuts.

Keep the wheels and hubs clean. Stones wedged between the wheel and rotor or rear 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.

CHECK TIRE PRESSURES

Check all tires for specified pressures.

CHECK BATTERY FLUID LEVEL

The battery is mounted under the hood at the right front side of the engine compartment.

Keep the fluid in each battery cell up to the level of the ring in the bottom of the filler well. Generally, tap water may be added unless it has a high mineral content or has been stored in a metal container.

4 BODY

BODY LUBRICATION

Apply Rotunda Silicone Lubricant R113-A (Ford Specification M99C40-A or B) to the following points as required:

Door Hinges and Hinge Checks: Hood Hinge Pivots; Luggage Compartment Hinge Pivots; Hood Latch; Hood Auxiliary Latch; Fuel Filler Door Hinges.

Operate the components after lubricating, to be sure the lubricant has "worked-in".

Apply Rotunda Lock Lubricant R117-A (Ford Specification M2C20) sparingly to the following lock cylinders:

Door Locks; Luggage Compartment Lock.

Insert the key and operate the lock several times to work the lubricant into the lock.

CHECK CONVERTIBLE TOP OPERATION

MECHANICAL CHECKS

Improper top operation can be caused by bent or misaligned linkage, binding linkage pins, and/or broken pivot bushings. Should the electrical and hydraulic systems be functionally correct and unsatisfactory operation of the top persists, check and adjust or replace the mechanical components as required.

HYDRAULIC CHECKS

Faulty hydraulic system operation can be caused by lack of fluid, leaks, air in the system, obstruction or kinks in the hoses, or faulty operation of a cylinder or the pump.

FLUID LEVEL CHECK

1. Erect the top.
2. Remove the spare tire for access to the hydraulic pump and reservoir.
3. Place absorbent cloths below the filler plug.
4. Remove the filler plug, and check the fluid level. It should be level with the bottom edge of the hole.
5. If the level is low, check the system for leaks, adding Automatic Transmission Fluid as necessary. Check system for leaks.
6. Install the spare tire.

LIFT CYLINDER OPERATION CHECK

Operate the top control switch and observe the operation of the lift cylinders for the following:

If the movement of the piston rods is sluggish or uneven, check the hoses from the pump to the cylinder for kinks.

If one piston rod moves more slowly than the other, the cylinder with the slower rod is defective and should be replaced.

If both rods move slowly, or do not move at all, disassemble and repair the pump.

CLEAN BODY DRAIN HOLES

Inspect the rubber drain valves in the door sills and body rocker panels to make sure they are open and operating. Periodically check any removable rubber plugs for moisture or dust accumulation and for security of installation.

REPLACE WINDSHIELD WIPER BLADES

Wiper blade replacement intervals will vary with the amount of use, type of weather, chemical reaction from road tars or salts and the age of the blades. Be sure that the windshield glass surface is not contaminated with oil, tree sap or other foreign substance which cannot be easily rubbed off.

Generally, if the wiper pattern across the glass is still uneven and streaked after these tests, replace the blades.

LUBRICANT CHARTS AND SPECIFICATIONS

GROUP 21

LUBRICANT SPECIFICATIONS

ITEM	FORD PART NO.	PART NAME
Body Hinges	C4AZ-19584-A, R-138-B	Lifetime Body Grease
Brake Master Cylinder	B7AZ-19542-A, R-103-A	Rotunda Heavy Duty Brake Fluid
Front Suspension Ball Joints and Steering Linkage	C1AZ-19590-B	FoMoCo Ball Joint Grease
Front Wheel Bearings	C2AZ-19585-A	FoMoCo Wheel Bearing Grease
Hood Latch & Safety Catch	C4AZ-19584-A, R-138-B	Lifetime Body Grease
Lock Cylinders	B4A-19587-A	Rotunda Lock Lubricant
Rear Axle	C1AZ-19580-E or F	FoMoCo Hypoid Gear Lube
Equa Lock Axles use 1 oz. per pint of C1A-19580-E or F	C1AA-19B546-A	Equa-Lock Additive
Steering—Power (Pump Reservoir)	C1AZ-19582-A, R-106-A	Rotunda Automatic Transmission Fluid
Convertible Top Reservoir	C1AZ-19582-A, R-106-A	Rotunda Automatic Transmission Fluid
Transmission (Automatic)	C1AZ-19582-A, R-106-A	Rotunda Automatic Transmission Fluid
Universal Joints	C1AZ-19586-B	FoMoCo Universal Lube
Engine Crankcase Oil		MS Sequence tested SAE 10W-30 above —10°F. SAE 5W-20 for sustained temperatures below —10°F.
Engine Oil Filter	C1AZ-6731-A, R1-A	Rotunda Oil Filter—6,000 mile type

ENGINE CRANKCASE OILS

Use of SAE 10W-30 oil will provide the proper viscosity for all normal ranges of outside temperatures. For operation at sustained outside temperatures below —10°F. a 5W-20 oil should be used.

Oil Quality

Use only oils which have been tested and certified by the maker as saitsfying automobile manufacturers specifications for Engine Operating Sequence Tests for Service M.S. The Ford Motor Company specification covering these tests is M2C27. These tests are defined by ASTM committee D2 for Section G-IV of technical committee B and are published in the SAE Handbook.

These tests cover oil characteristics as follows:

Sequence I — Low Temperature Wear Prevention—(Cold Starts)

Sequence II — High Speed — High Temperature Wear Prevention

Sequence III — High Temperature Deposit Formation—(Varnish)

Sequence IV—Corrosion and Rust Prevention

Sequence V — Sludge Formation

If engine oils are used which do not meet these requirements, it will be necessary to change oil more frequently than every 6,000 miles.

If it is necessary to use an "MS" oil which is not certified by the marketer as having passed the Engine Operating Sequence Tests, the addition of Rotunda Oil Conditioner to the oil will satisfy the requirements.

Oil Filter

Use of the right oil filter is also essential to good engine life and operation. For 6,000-mile filter change intervals, filters must meet Ford Specification ES-COAE-6714-A.

The genuine Rotunda Oil Filter meets this requirement.

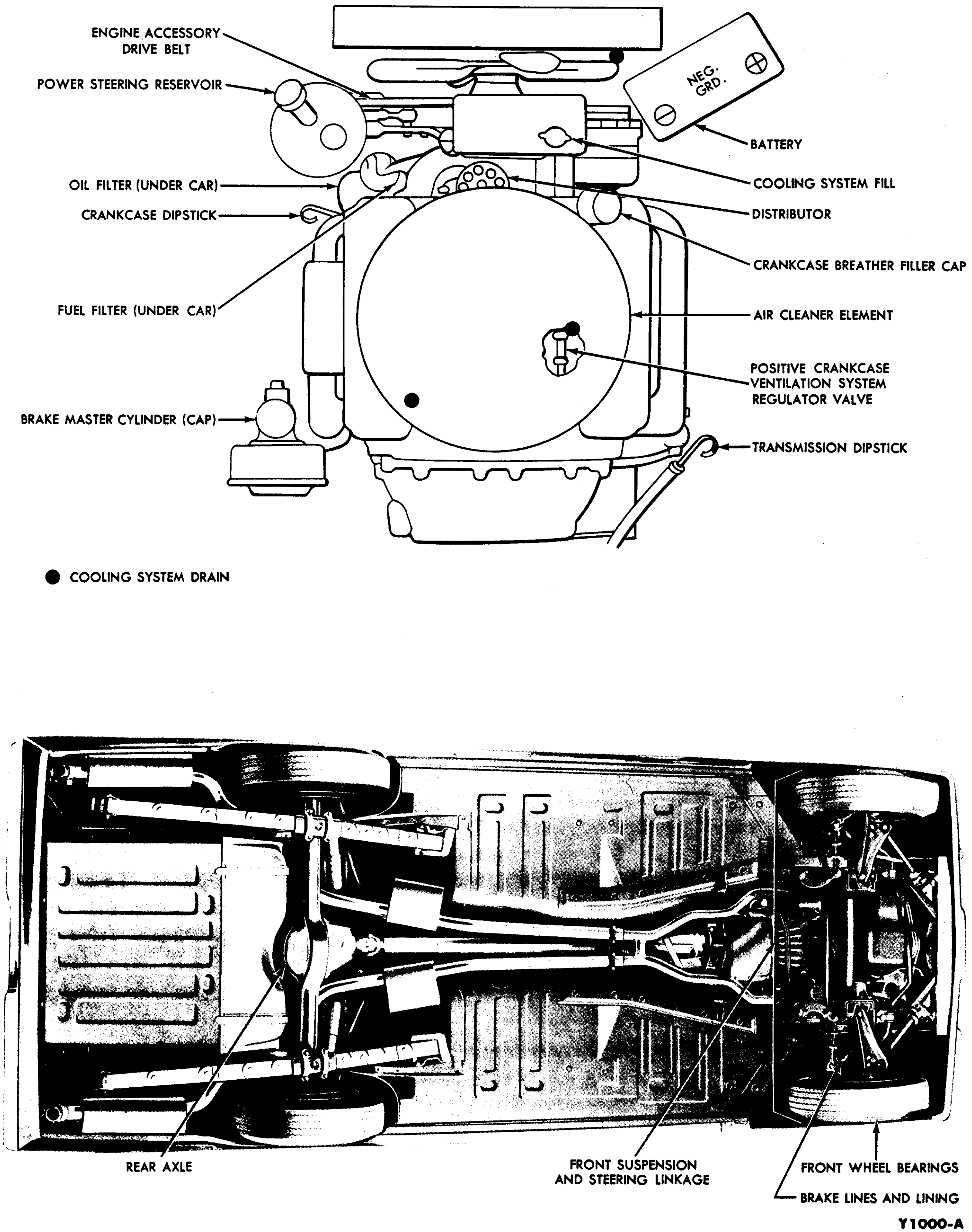
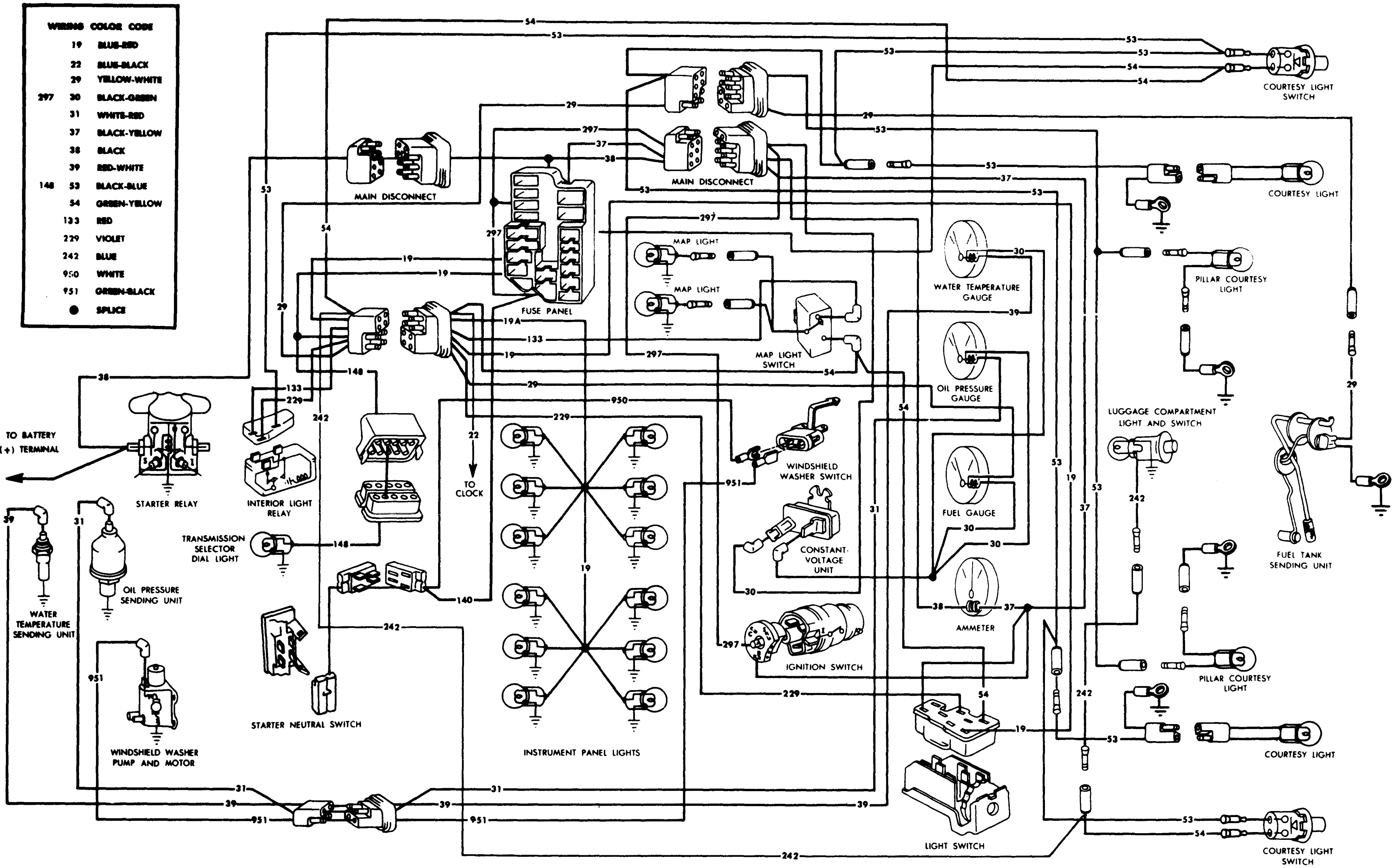


FIG. 1–Typical Lubrication Chart

1965 THUNDERBIRD SHOP MANUAL

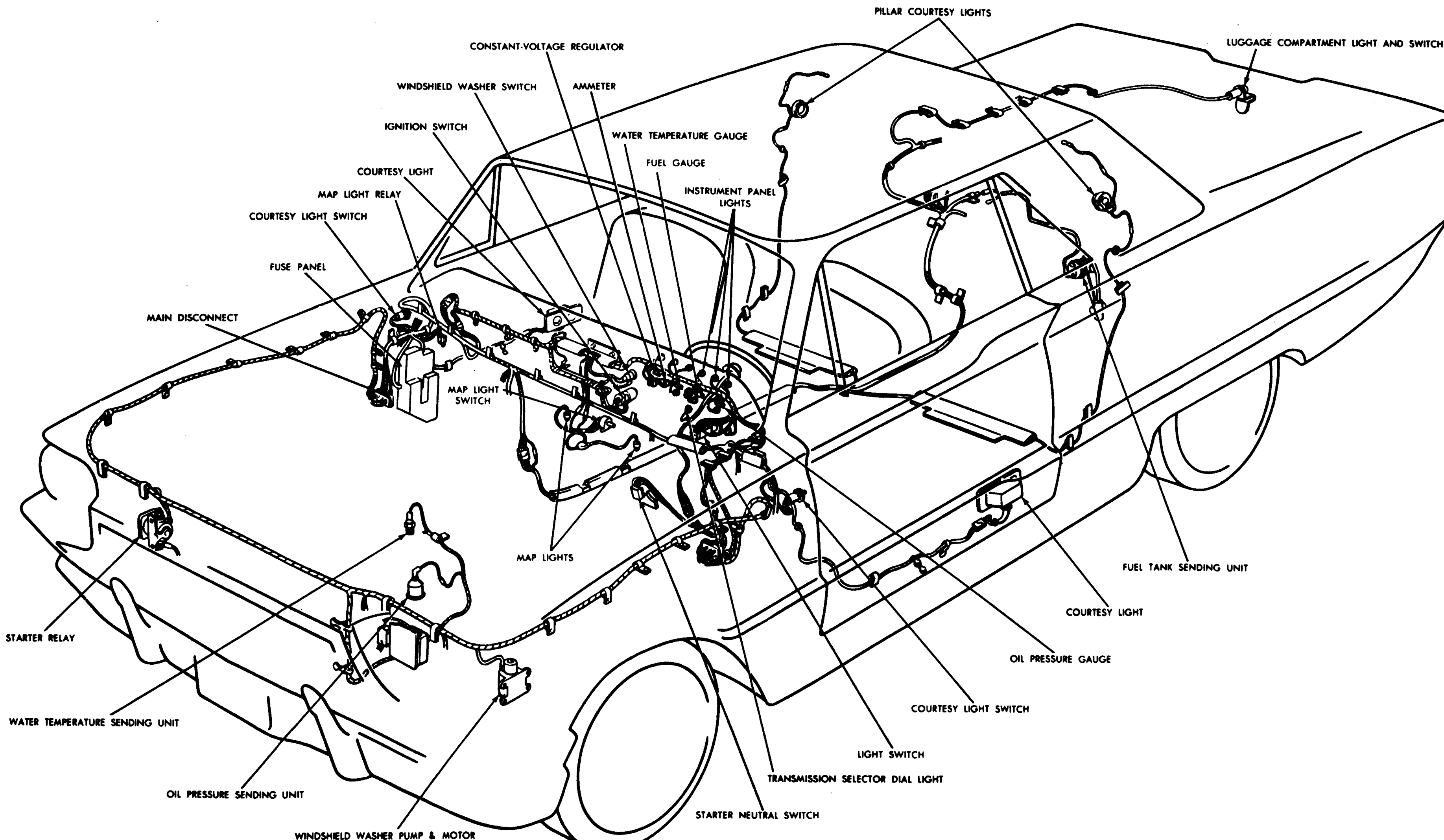
INDEX



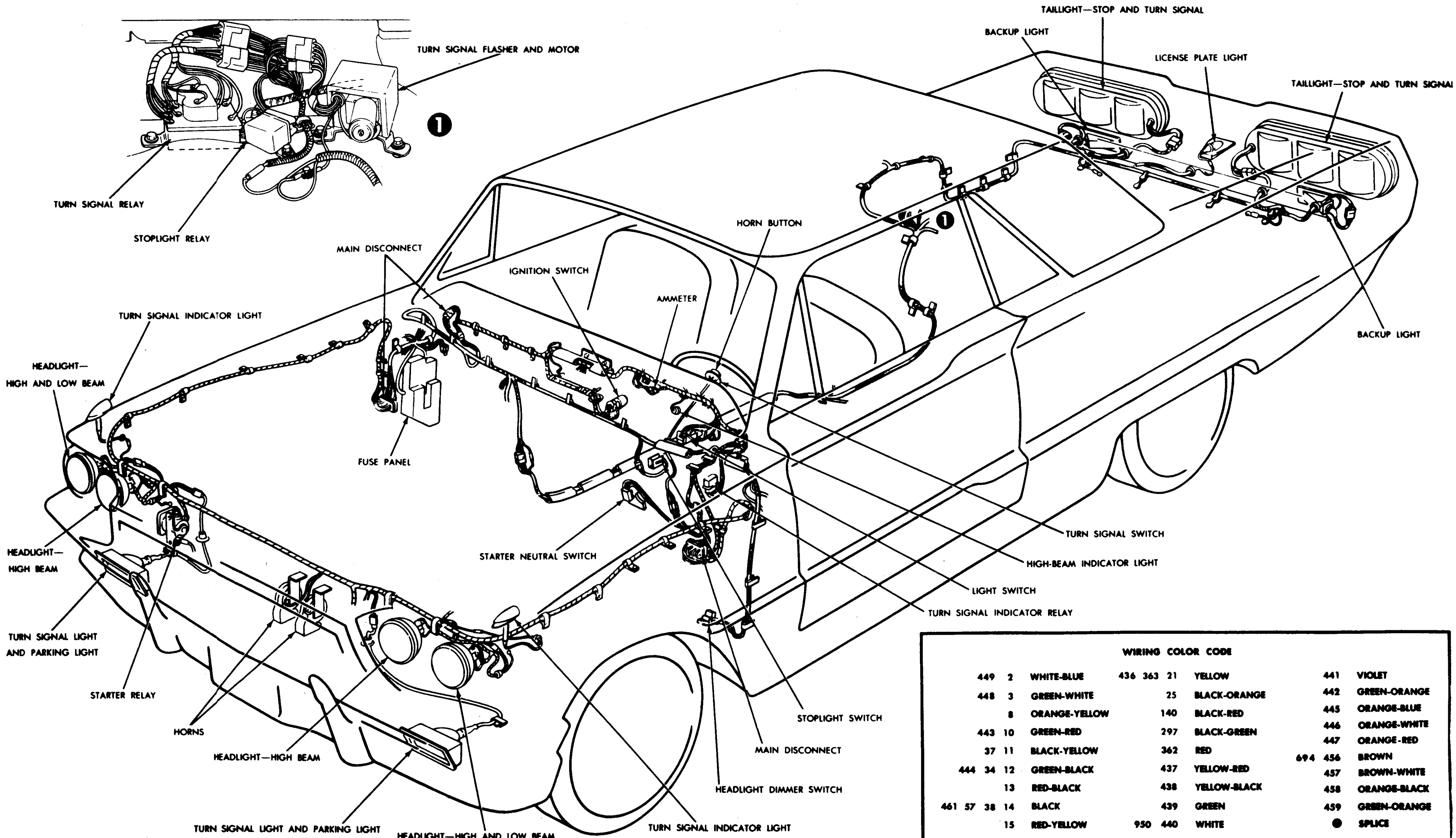
WIRING COLOR CODE

	19	BLUE-RED
	22	BLUE-BLACK
	29	YELLOW-WHITE
297	30	BLACK-GREEN
	31	WHITE-RED
	37	BLACK-YELLOW
	38	BLACK
	39	RED-WHITE
148	53	BLACK-BLUE
	54	GREEN-YELLOW
	133	RED
	229	VIOLET
	242	BLUE
	950	WHITE
	951	GREEN-BLACK
	●	SPLICE

1965 THUNDERBIRD INTERIOR LIGHTING, WINDSHIELD WASHER AND GAUGES



1965 THUNDERBIRD INTERIOR LIGHTING, WINDSHIELD WASHER AND GAUGES



WIRING COLOR CODE

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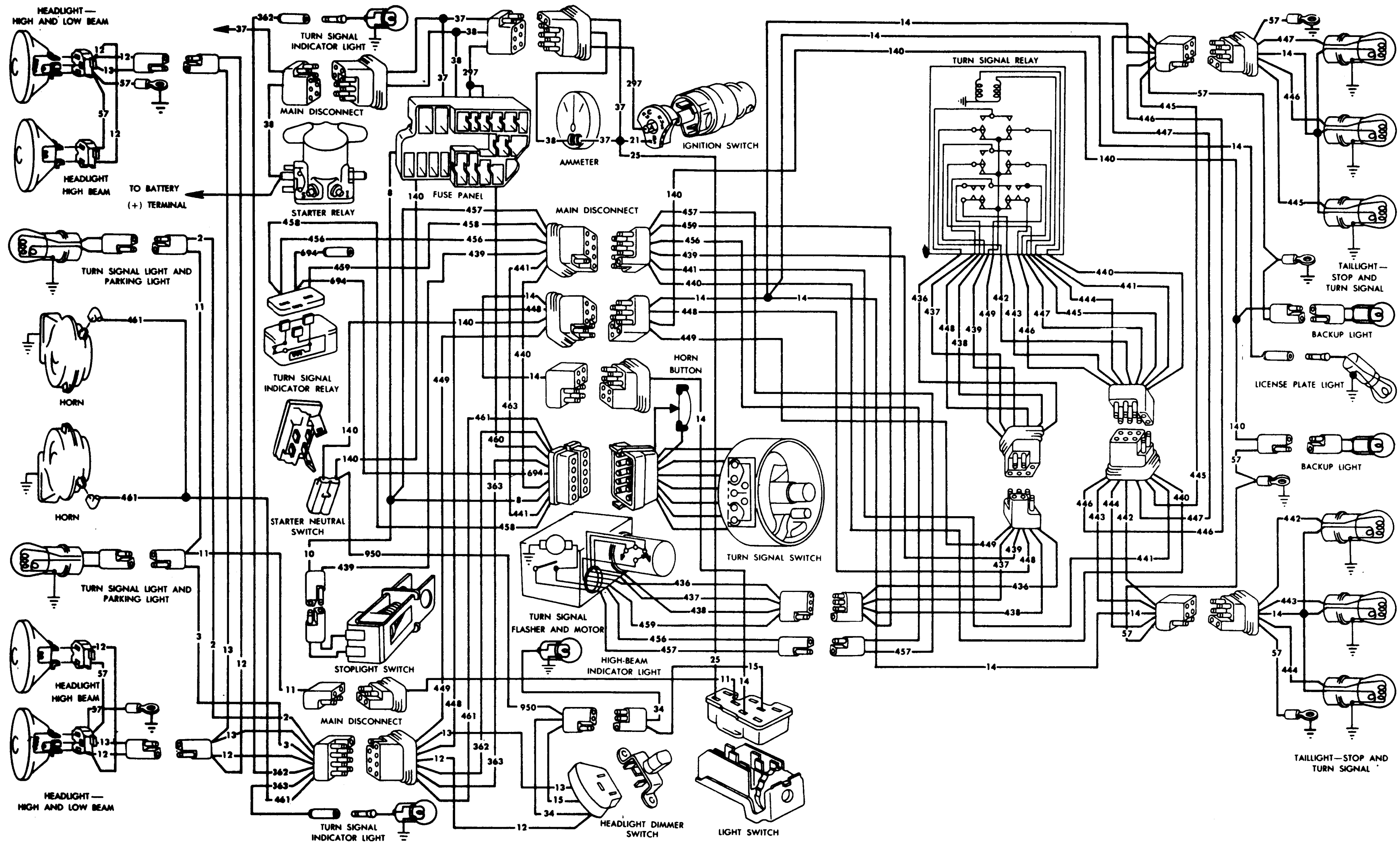
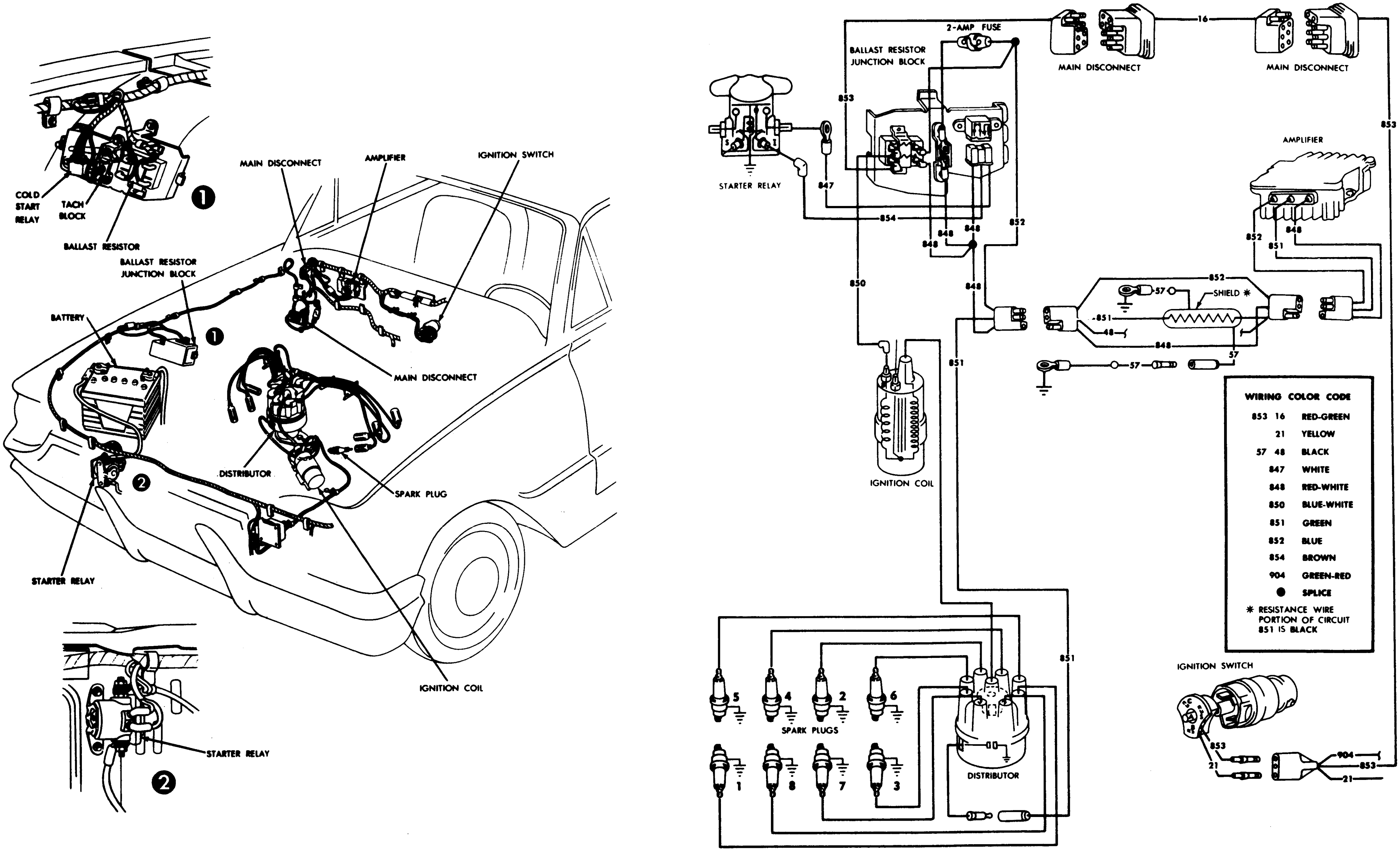
		448	3	GREEN-WHITE			25	BLACK-ORANGE		442	GREEN-ORANGE
			8	ORANGE-YELLOW			140	BLACK-RED		445	ORANGE-BLUE
		443	10	GREEN-RED			297	BLACK-GREEN		446	ORANGE-WHITE
		37	11	BLACK-YELLOW			362	RED		447	ORANGE-RED
	444	34	12	GREEN-BLACK			437	YELLOW-RED	694	456	BROWN
			13	RED-BLACK			438	YELLOW-BLACK		457	BROWN-WHITE
461	57	38	14	BLACK			439	GREEN		458	ORANGE-BLACK
			15	RED-YELLOW		950	440	WHITE		459	GREEN-ORANGE
										●	SPLICE

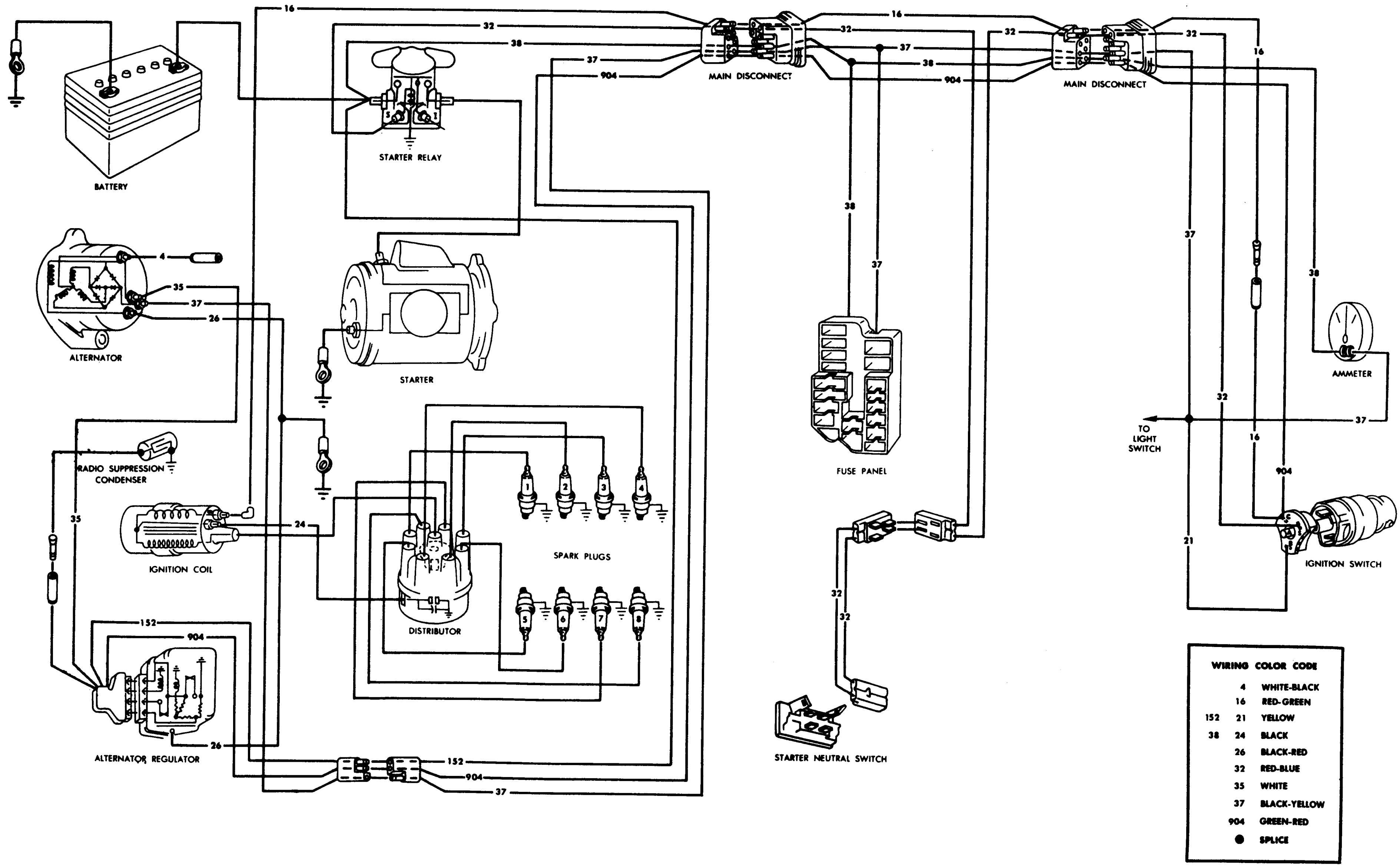
1965 THUNDERBIRD EXTERIOR LIGHTING, TURN SIGNALS AND HORNS



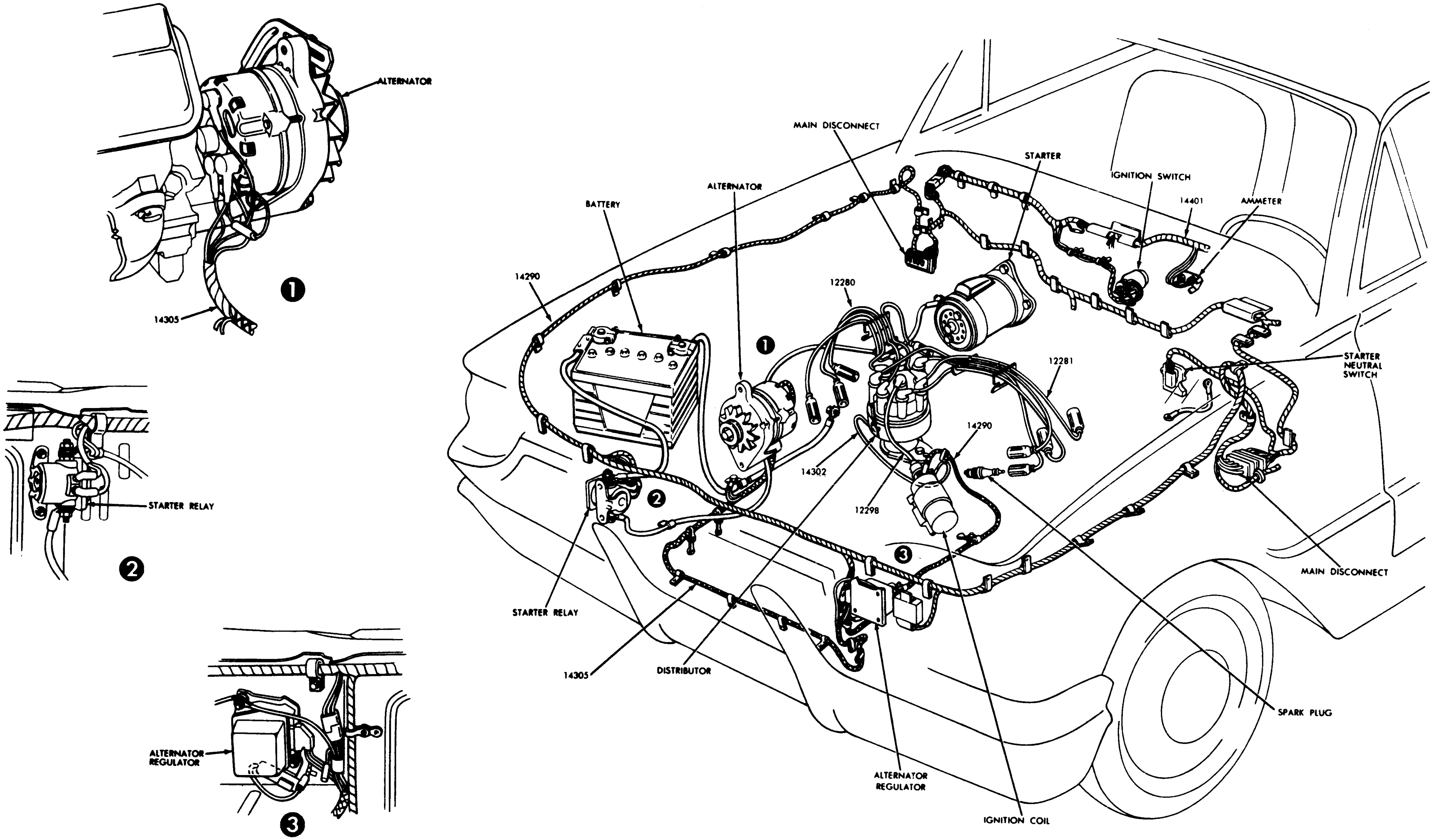
1965 THUNDERBIRD EXTERIOR LIGHTING, TURN SIGNALS AND HORNS



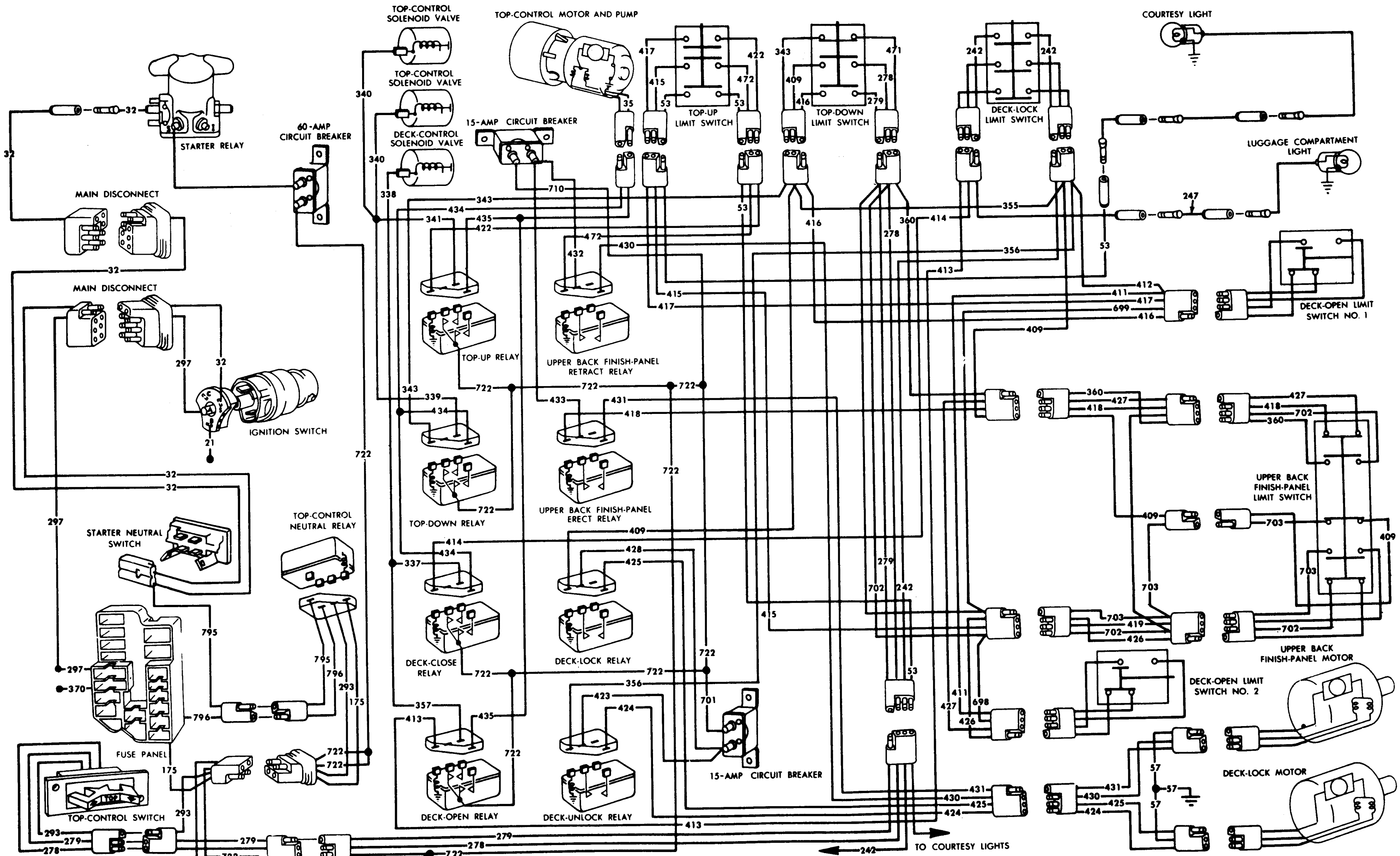
1965 THUNDERBIRD TRANSISTORIZED IGNITION



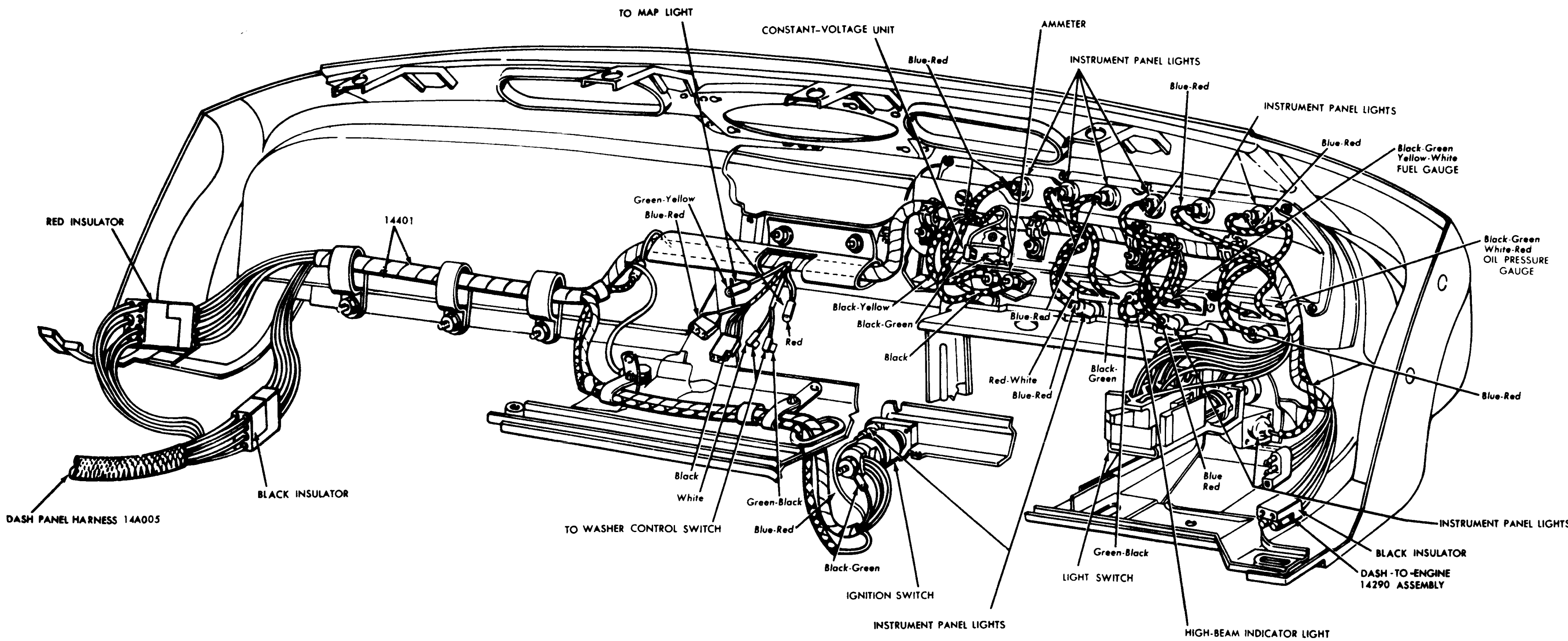
1965 THUNDERBIRD IGNITION, STARTING AND CHARGING



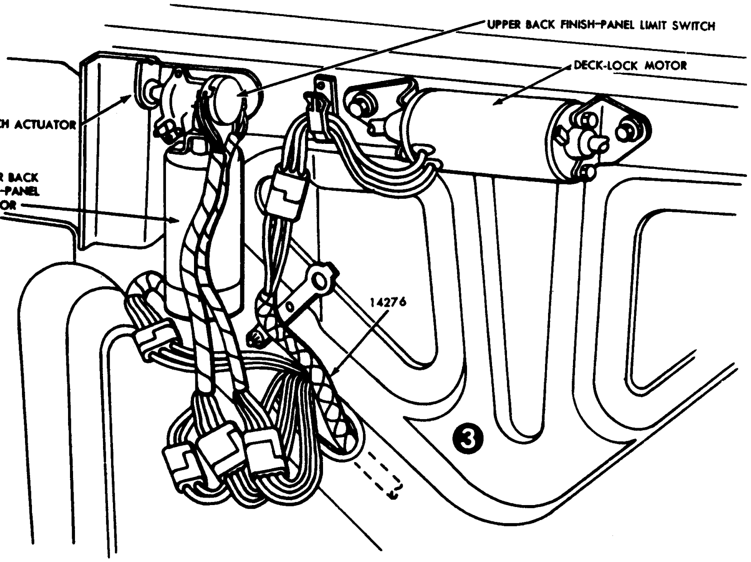
1965 THUNDERBIRD IGNITION, STARTING AND CHARGING

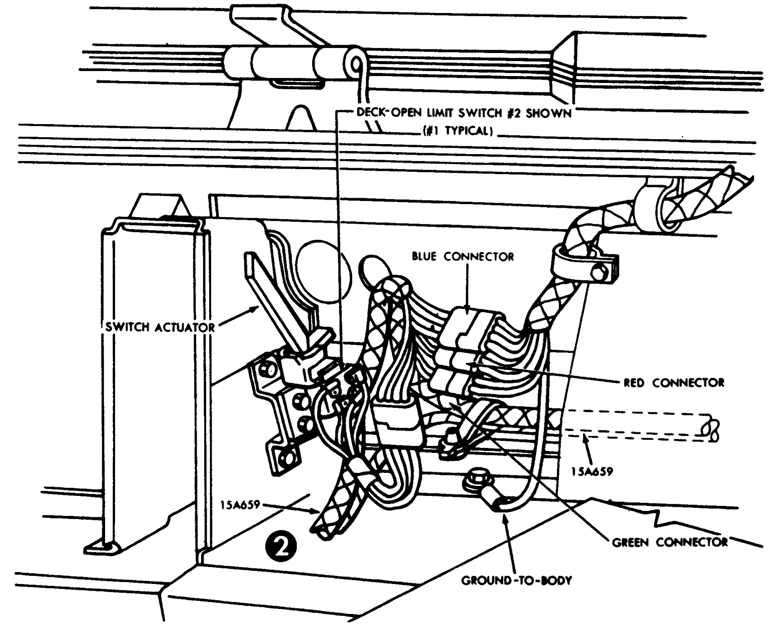


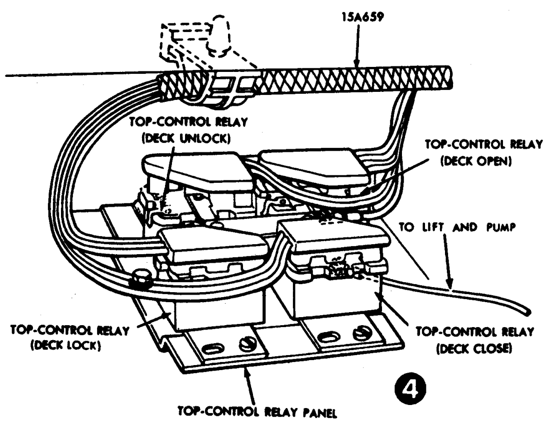
1965 THUNDERBIRD POWER TOP



1965 THUNDERBIRD INSTRUMENT PANEL







WIRING COLOR CODE

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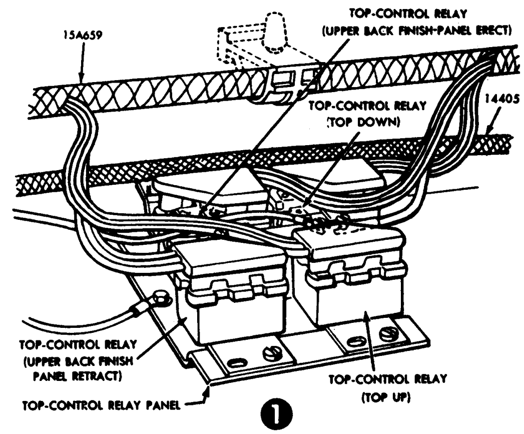
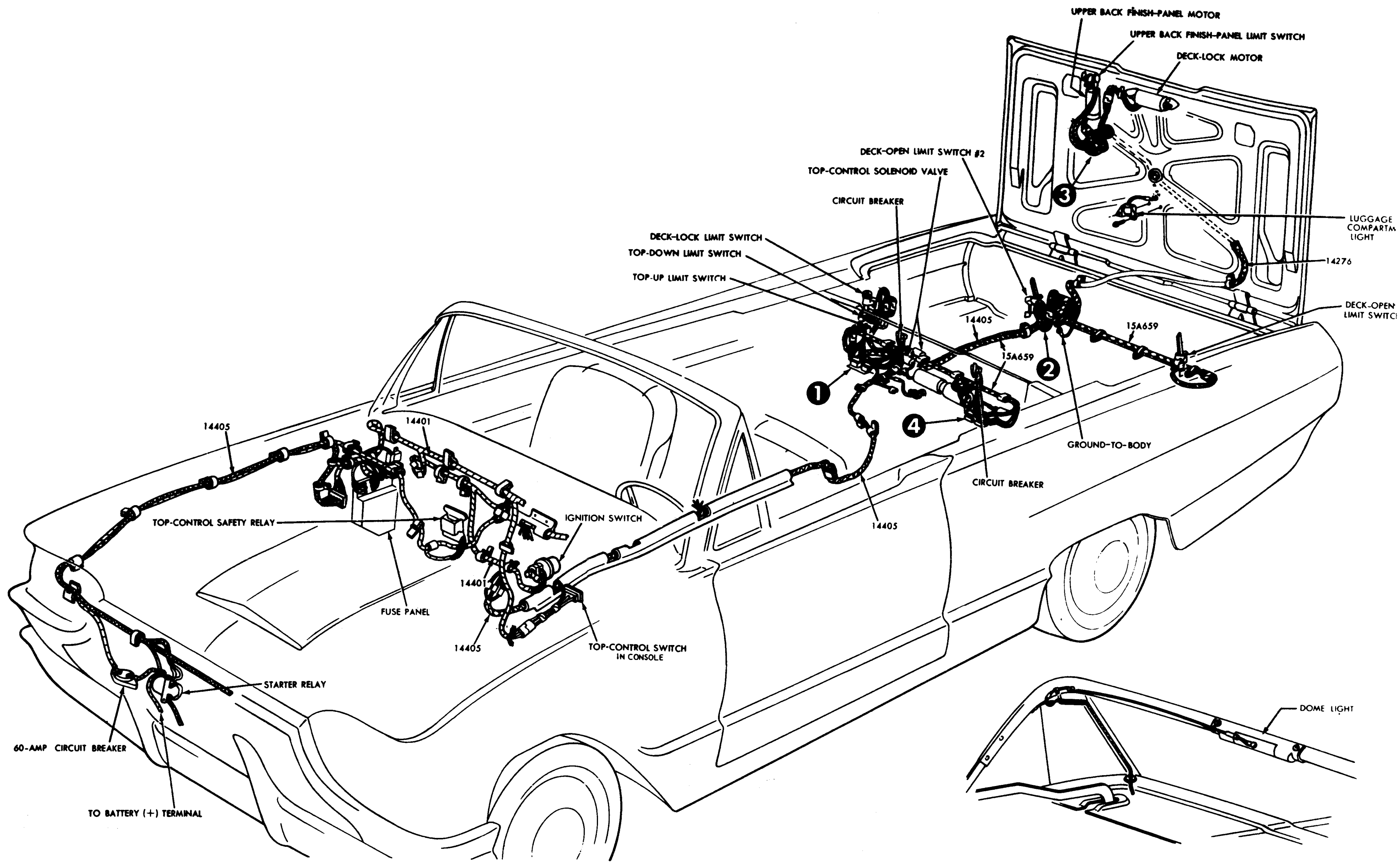
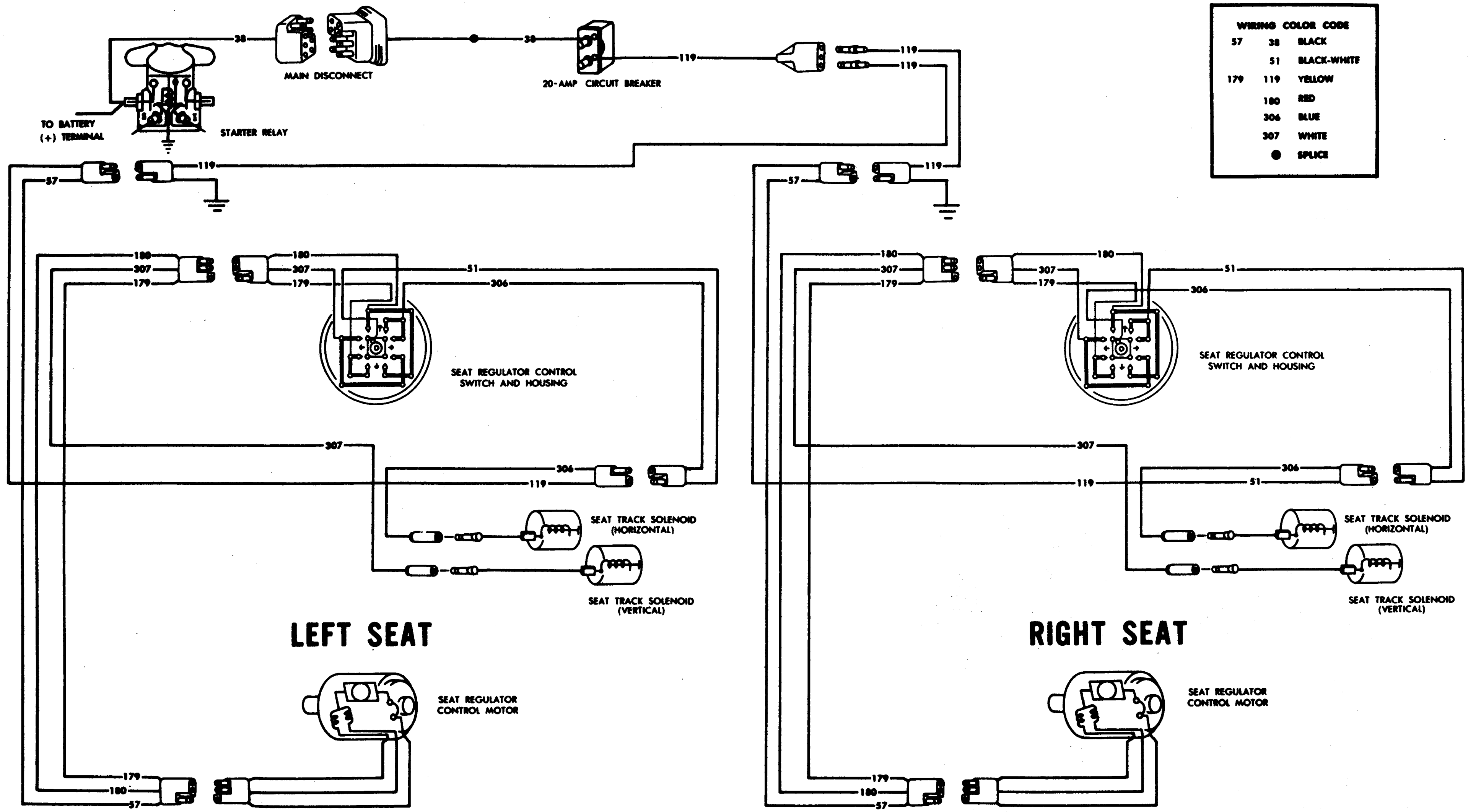
				339	35	WHITE	471	342	RED-GREEN	422	GREEN
				418	53	BLACK-BLUE		343	YELLOW-WHITE	424	RED-YELLOW
		796	426	175	57	BLACK		355	VIOLET-WHITE	425	YELLOW-RED
		722	357	337	242	BLUE		356	ORANGE-BROWN	427	GRAY
		703	699	435	279	RED		360	YELLOW-BLUE	431	BLUE-WHITE
				409	293	VIOLET		411	ORANGE	472	RED-WHITE
				414	297	BLACK-GREEN		413	YELLOW-VIOLET	701	BLUE-GREEN
					338	BLUE-RED	419	415	GREEN-WHITE	●	SPLICE



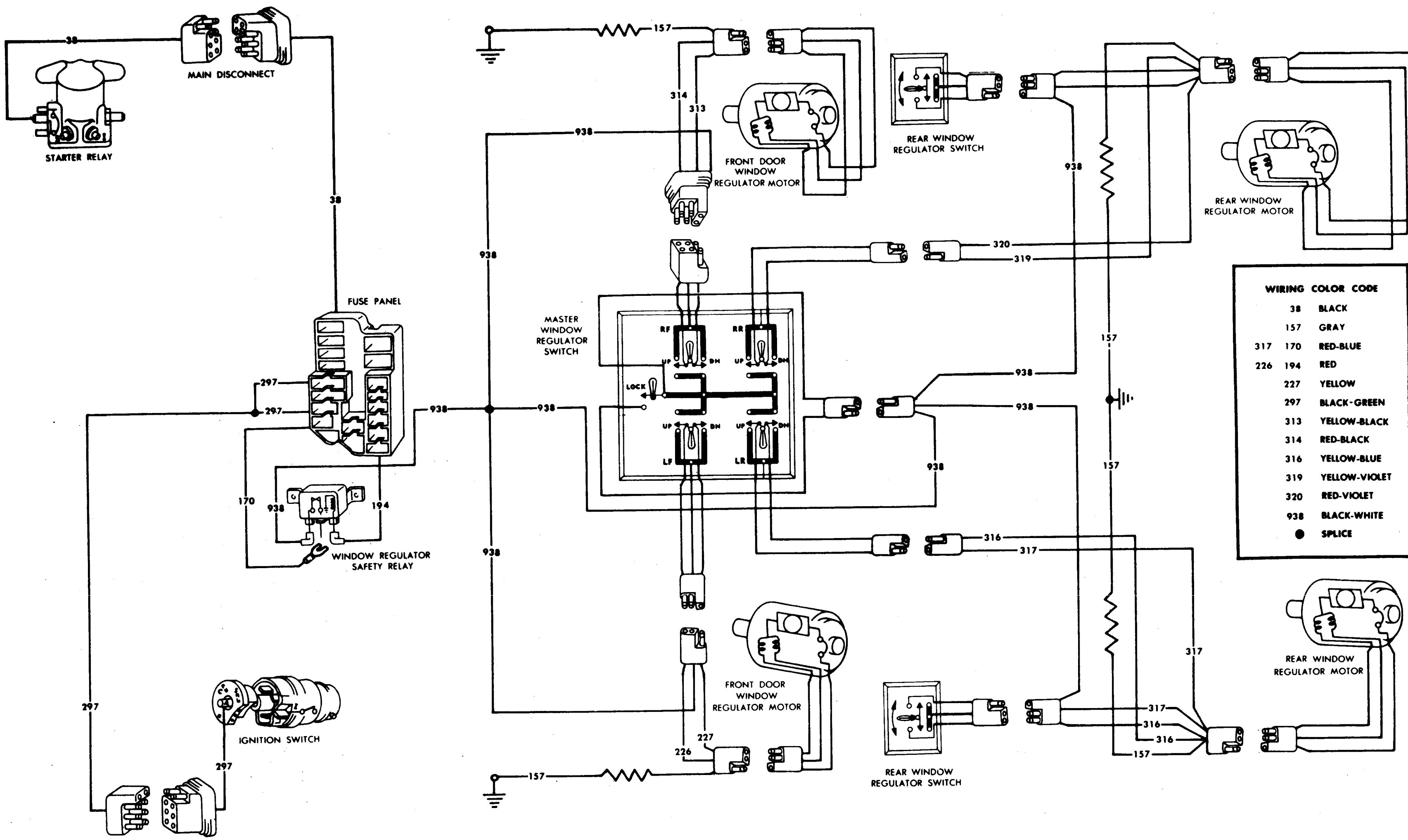
1965 THUNDERBIRD POWER TOP DETAILED VIEWS



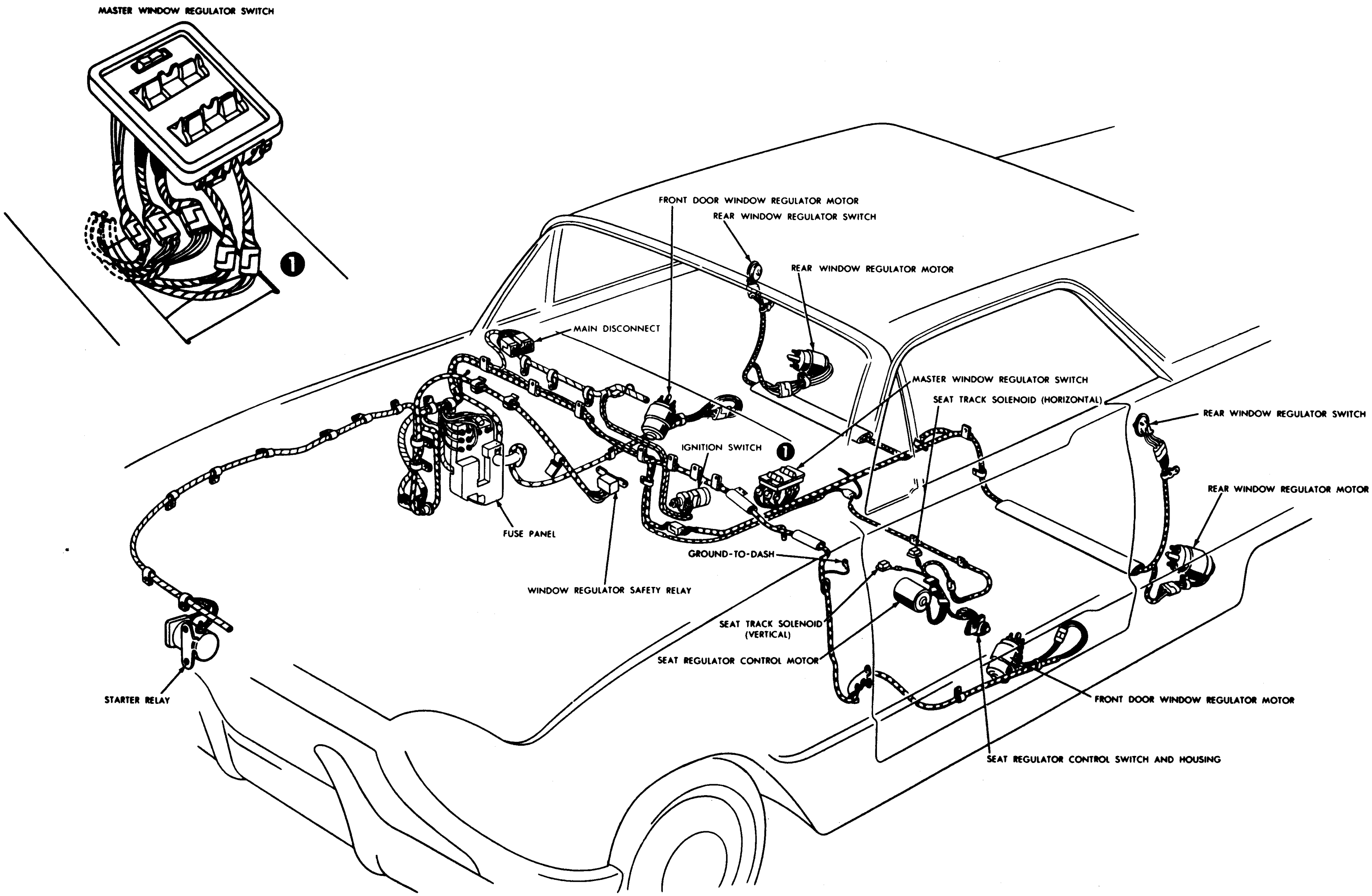
1965 THUNDERBIRD POWER TOP



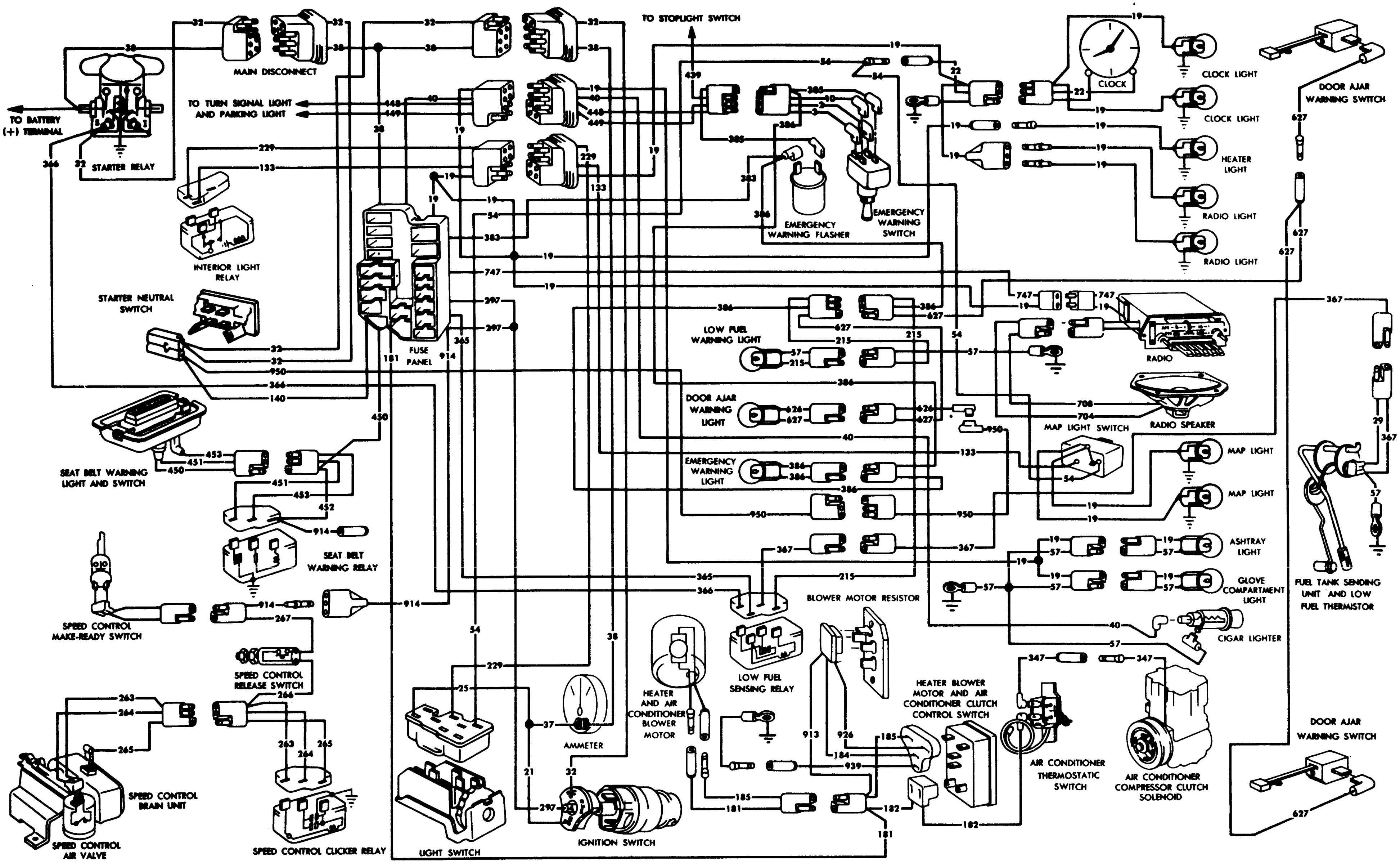
1965 THUNDERBIRD POWER SEAT (4-WAY)



1965 THUNDERBIRD POWER WINDOWS



1965 THUNDERBIRD POWER WINDOWS AND SEAT



1965 THUNDERBIRD ACCESSORIES

WIRING COLOR CODE

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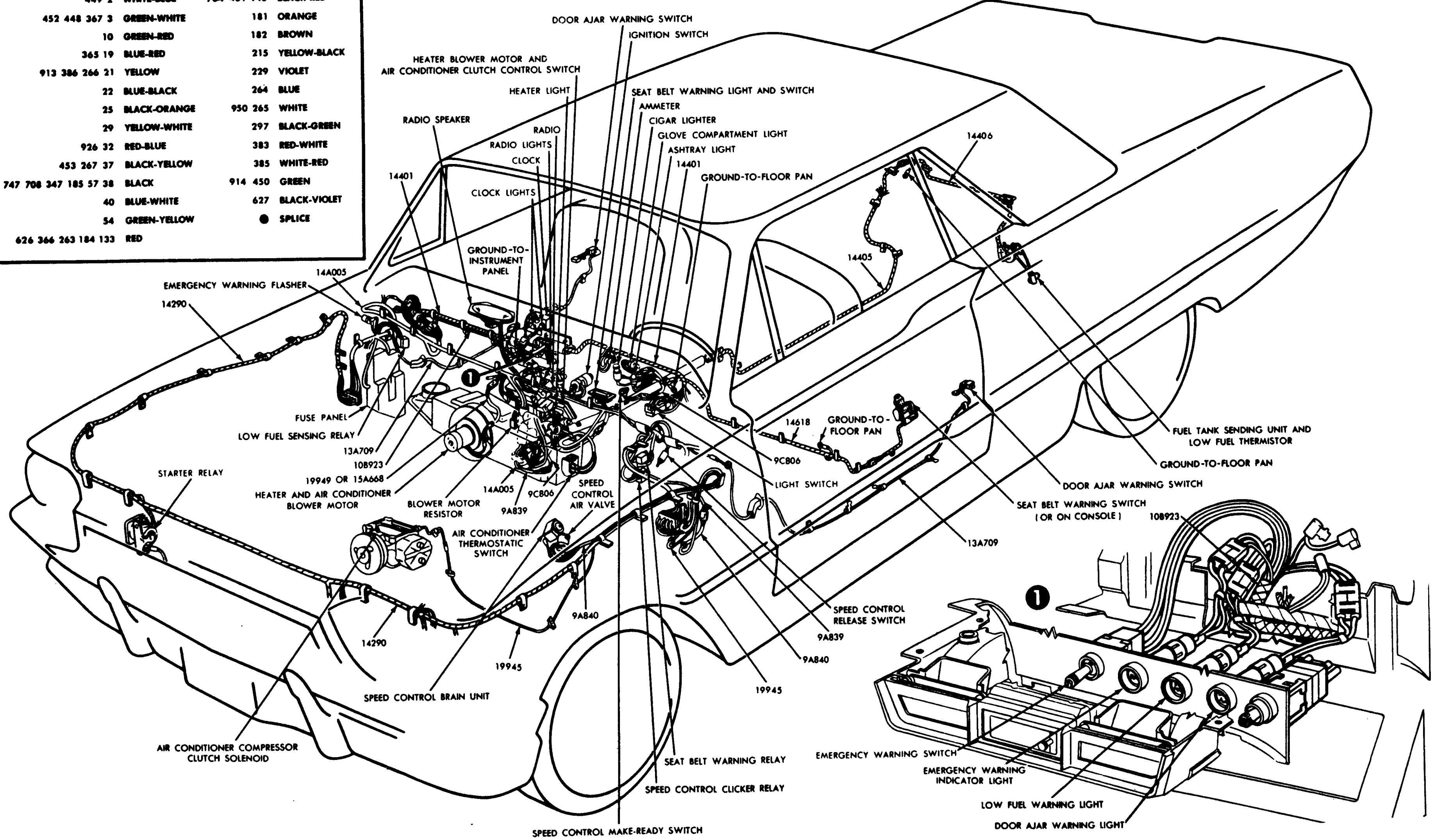
452 448 367 3	GREEN-WHITE	181	ORANGE
10	GREEN-RED	182	BROWN
365 19	BLUE-RED	215	YELLOW-BLACK
913 386 266 21	YELLOW	229	VIOLET
22	BLUE-BLACK	264	BLUE
25	BLACK-ORANGE	950 265	WHITE
29	YELLOW-WHITE	297	BLACK-GREEN
926 32	RED-BLUE	383	RED-WHITE
453 267 37	BLACK-YELLOW	385	WHITE-RED
939 747 708 347 185 57 38	BLACK	914 450	GREEN
40	BLUE-WHITE	627	BLACK-VIOLET
54	GREEN-YELLOW	●	SPLICE
626 366 263 184 133	RED		



1965 THUNDERBIRD ACCESSORIES