

# 1968 FORD

# *Thunderbird*



# SHOP MANUAL SUPPLEMENT



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## **1968 Ford Thunderbird Shop Manual**

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Forel Publishing Company, LLC

3999 Peregrine Ridge Ct.

Woodbridge, VA 22192

Email address: [webmaster@ForelPublishing.com](mailto:webmaster@ForelPublishing.com)

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# 1968

# FORD THUNDERBIRD

## SHOP MANUAL SUPPLEMENT

## GROUP INDEX

VEHICLE IDENTIFICATION	1
BRAKES	2
SUSPENSION, STEERING, WHEELS AND TIRES	3
REAR AXLE	4
DRIVE SHAFT AND CLUTCH	5
MANUAL SHIFT TRANSMISSION (Not Applicable)	6
AUTOMATIC TRANSMISSION	7
ENGINE	8
IGNITION SYSTEM	9
FUEL SYSTEM	10
COOLING SYSTEM	11
EXHAUST SYSTEM	12
CHARGING SYSTEM	13
STARTING SYSTEM	14
LIGHTING SYSTEM, HORNS AND INSTRUMENTS	15
VENTILATING, HEATING AND ACCESSORIES	16
BODY, DOORS AND WINDOWS	17
TRIM, SEATS AND CONVERTIBLE TOP	18
SPECIFICATIONS	19



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## FOREWORD

*This shop manual supplement, when used with the 1967 shop manual, provides the Service Technician with information for the proper servicing of the 1968 Thunderbird.*

*All testing, adjustment and repair procedures that are new for 1968, as well as specifications, and recommended special tools, are included in this manual.*

*The maintenance schedule and procedures for maintenance operations are published in the 1968 Passenger Car Maintenance and Lubrication Manual.*

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



# Vehicle Identification

**GROUP**  
1

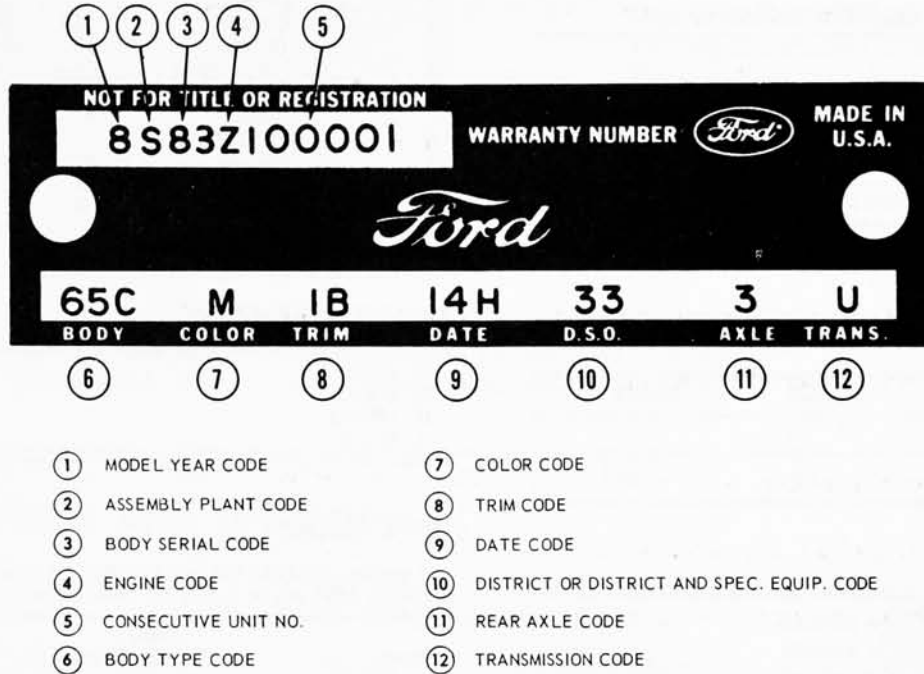


Fig. 1—Warranty Plate—Thunderbird

N1588-B

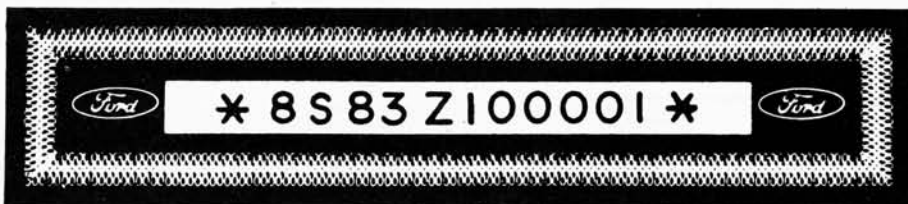


Fig. 2—Thunderbird Vehicle Identification Number (VIN) Tab

N1699-A

### VEHICLE WARRANTY NUMBER

The vehicle warranty number is the first line of numbers and letters appearing on the Warranty Plate (Fig. 1). The Warranty Plate is riveted to the left front door lock face panel. The first number indicates the model year. The letter following the model year number indicates the manufacturing assembly plant. The next two numbers designate the Body Serial Code followed by a letter expressing the Engine Code. The group of six digits remaining on the first line indicate the Consecutive Unit Number.

### VEHICLE DATA

The vehicle data appears on the second or lower line on the Warranty Plate. The first two numbers and a letter identify the Body Style. A letter or a number appears next indicating the Exterior Paint Color followed by a number-letter combination designating the Interior Trim. To the right of this Code appears the Date Code indicating the date the car was manufactured. The digit number next designates the district in which the car was ordered. The letter following the date code appears in conjunction with a Domestic Special Order or Foreign Order. The last two spaces indicate the type of transmission (manual for locking-types) and the type of transmission (automatic).

### MODEL YEAR CODE

The number 8 designates 1968

### ASSEMBLY PLANT CODES

Code Letter	Code Letter
A..... Atlanta	L..... Michigan Truck
B..... Oakville (Canada)	N..... Norfolk
C..... Ontario Truck	P..... Twin Cities
D..... Dallas	R..... San Jose
E..... Mahwah	S..... Pilot Plant
F..... Dearborn	T..... Metuchen
G..... Chicago	U..... Louisville
H..... Lorain	W..... Wayne
J..... Los Angeles	X..... St. Thomas
K..... Kansas City	Y..... Wixom
	Z..... St. Louis

### 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 model.

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WARRANTY NUMBER will be stamped on an identification panel close to the driver's door on the passenger side of the car and will be visible from outside (Fig. 2).

**CONSECUTIVE UNIT NUMBER**

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

**ENGINE CODES**

CODE	TYPE
N	8 Cyl. 429 Cu. In. (4V)

**TRANSMISSION CODE**

CODE	TYPE
U	C6 Dual Range Automatic

**REAR AXLE RATIO CODES**

A number designates a conventional axle, while a letter designates a locking differential.

CODE	RATIO	CODE	RATIO
0	2.50:1	—	—
3	2.80:1	C	2.80:1
5	3.00:1	E	3.00:1

**THUNDERBIRD**

Body Serial Code	Body Style Code	Body Type
83	65C	2-Door Hardtop
84	65D	2-Door Landau
87	57C	4-Door Landau

**EXTERIOR PAINT COLOR CODES**

Code	"M" Spec. No.	Color
A	1724-A	Black
B	3059-A	Maroon
E	2045-A	Med. Beige Met.
H	2067-A	Diamond Green
J	3080-A	Dk. Aqua Met.
L	3060-A	Dk. Green
M	1619-A	White
O	2040-A	Lt. Green
N	921-A	Diamond Blue
P	2065-A	Pewter Met.
Q	1624-A	Med. Blue Met.
R	3067-A	Dk. Green Met.
T	2008-A	Red
U	1070-A	Med. Aqua Met.
V	3062-A	Lt. Blue
W	3120-A	Yellow
X	3061-A	Dk. Blue Met.
Y	3073-A	Med. Gold Met.
Z	2044-A	Dk. Gray Met.
6	1631-A	Lt. Beige

Code	District	Code	District
16	Philadelphia	54	Omaha
17	Washington	55	St. Louis
21	Atlanta	61	Dallas
22	Charlotte	62	Houston
24	Jacksonville	63	Memphis
25	Richmond	64	New Orleans
27	Cincinnati	65	Oklahoma City
28	Louisville	71	Los Angeles
32	Cleveland	72	San Jose
33	Detroit	73	Salt Lake City
34	Indianapolis	74	Seattle
35	Lansing	75	Phoenix
37	Buffalo	81	Ford of Canada
38	Pittsburgh	83	Government
41	Chicago	84	Home Office Reserve
42	Fargo	85	American Red Cross
43	Milwaukee	89	Transportation Services
44	Twin Cities	90-99	Export
45	Davenport		

**FORD OF CANADA**

B1 Central	B4 Midwestern
B2 Eastern	B6 Western
B3 Atlantic	B7 Pacific
I1 thru I7	Export

**DATE CODES**

A number signifying the date precedes the month code letter. A second-year code letter will be used if the model exceeds 12 months.

Month	Code First Year	Code Second 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

**INTERIOR TRIM SCHEMES**

Code	Trim Scheme
1A	Black Cloth and Black Vinyl
1B	Dk. Blue Cloth and Dk. Blue Vinyl
1D	Dk. Red Cloth and Dk. Red Vinyl
1G	Dk. Ivy Gold Cloth and Dk. Ivy Gold Vinyl
1K	Lt. Aqua Cloth and Lt. Aqua Vinyl
1Y	Lt. Nugget Gold Cloth and Lt. Nugget Gold Vinyl
2A	Black Vinyl
2B	Dk. Blue Vinyl
2D	Dk. Red Vinyl
2F	Med. Saddle Vinyl
2G	Dk. Ivy Gold Vinyl
2K	Lt. Aqua Vinyl
2U	Pastel Parchment Vinyl
2Y	Lt. Nugget Gold Vinyl
3A	Black Cloth and Black Vinyl
3B	Dk. Blue Cloth and Dk. Blue Vinyl
3D	Dk. Red Cloth and Dk. Red Vinyl
3G	Dk. Ivy Gold Cloth and Dk. Ivy Gold Vinyl
3K	Lt. Aqua Cloth and Lt. Aqua Vinyl
3Y	Lt. Nugget Gold Cloth and Lt. Nugget Gold Vinyl
4A	Black Vinyl
4B	Dk. Blue Vinyl
4F	Med. Saddle Vinyl
4U	Pastel Parchment Vinyl
4Y	Lt. Nugget Gold Vinyl
8A	Black Leather
8F	Med. Saddle Leather

**DISTRICT CODES (DSO)**

Units built on a Domestic Special Order, Foreign Special Order, or other orders will have the complete order number in this space. Also to the right of this space is the two-digit code number of the District which ordered the vehicle. The District code number is the last two digits of the Vehicle Identification Number.

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# Brakes

GROUP  
**2**

Section	Page	Section	Page
1 Description and Operation . . . . .	2-1	Disc Brake Rotor Splash Shield . . . . .	2-5
2 Cleaning and Inspection . . . . .	2-2	Parking Brake Linkage Adjustment . . . . .	2-5
3 In-Vehicle Adjustments and Repairs . . . . .	2-3	Pressure Differential Valve Assembly . . . . .	2-5
Disc Brake Shoe and Lining Replacement . . . . .	2-3	4 Major Repair Operations . . . . .	2-6
Disc Brake Caliper Assembly . . . . .	2-4	Disc Brake Caliper . . . . .	2-6
Front Wheel Hub and Rotor Assembly—			
Disc Brakes . . . . .	2-4		

The information contained in this manual covers features which are new in the 1968 Thunderbird. For

service procedures covering rear drum brakes as well as other brake components, refer to the 1967

Thunderbird Shop Manual.

## 1 DESCRIPTION AND OPERATION

### DISC BRAKES

Disc brakes are standard equipment for the front wheels. The rear hydraulic brake system employs single anchor, internal expanding and self-adjusting drum brake assemblies.

A vacuum booster is also standard equipment.

The master cylinder converts physical force from the brake pedal and the booster into hydraulic pressure against the piston in each caliper (disc brakes) and the wheel cylinders (rear drum brakes). The pistons in turn convert hydraulic pressure back into physical force at the brake shoes.

### RELATION AND FUNCTION OF COMPONENT PARTS

The disc brake is a floating caliper, single piston, ventilated disc-type, actuated by a hydraulic system (Fig. 1).

The caliper assembly is made up of a floating caliper assembly and an anchor plate. The anchor plate is bolted to the wheel spindle arm by two bolts. The floating caliper is attached to the anchor plate through two flexible steel stabilizers. The floating caliper slides on two locating pins which also attach to the stabilizers.

A single hydraulic piston is fitted into a bore in the inner portion of

the caliper housing (Fig. 2). A square section seal is fitted into an annular groove in the caliper bore and a rubber boot is used to seal the piston and caliper bore against road splash contamination. The rubber piston seal returns the piston to the released position when the hydraulic pressure is released.

The inboard and outboard shoe and lining assemblies are mounted in two different ways. The outboard shoe and lining is fixed to the floating caliper and is retained by two pins and spring clips. The inboard shoe and lining rests on the anchor plate abutments and is retained by two spring clips (Fig. 5). The shoe and lining

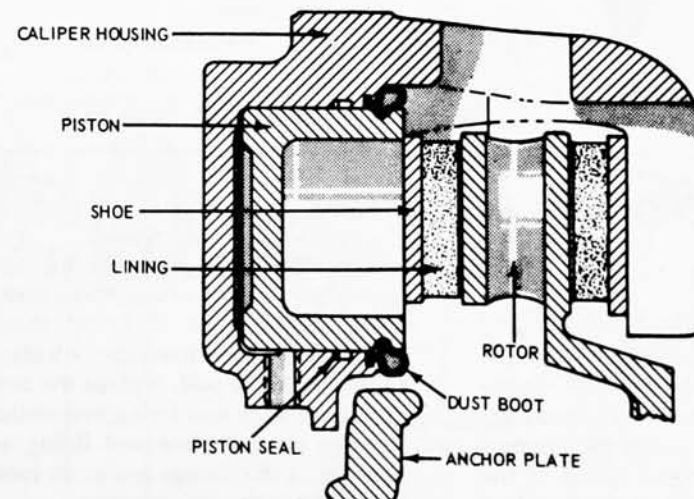
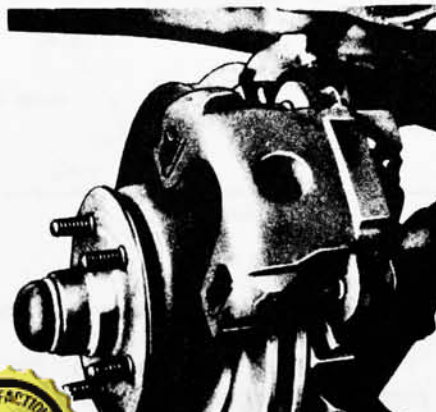


Fig. 2—Caliper Assembly—Sectional View

H 1568-B

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assembly consists of friction material bonded to a metal plate called the shoe. It is replaced as a unit (Fig. 3).

The cast iron disc is of the ventilated rotor type incorporating forty fins and is attached to, and rotates with the wheel hub. The outside diameter of the rotor is 11¾ inches and the inside diameter is 7¾ 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. The wheel provides protection for the outboard surface of the rotor.



H 1578-A

Fig. 3—Inner Brake Shoe and Lining Assembly

As the brake pedal is depressed, hydraulic pressure from the master cylinder forces the piston out of the bore. The inboard shoe and lining, resting against the piston, is forced against the rotor. When the inboard shoe is against the rotor hydraulic pressure equalizes and moves the entire floating caliper assembly inward. The outboard shoe and lining assembly attached to the floating caliper assembly is thereby forced against the rotor. Hydraulic pressure forcing the inboard shoe and lining outward and the caliper-mounted shoe and lining inward creates a squeezing action against the rotor, effecting braking action.

During braking action the piston seal distorts as the piston moves outward (Fig. 4). When hydraulic pressure is released the seal relaxes and pulls the inboard shoe and lining away from the rotor. When brakes are applied, hydraulic pressure moves the floating caliper, distorting the caliper locating pin insulators. When hydraulic pressure is released, the insulators relax moving the caliper back to its normal position. Since the outboard shoe and lining is attached to the caliper it is moved away from the

rotor. In addition, inherent rotor run-out will aid in maintaining running clearance between the rotor and the shoe and lining assemblies. Automatic adjustment is accomplished by the piston sliding in the seal 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 has no residual check valve in the front brake section.

A proportioning valve located between the master cylinder and the rear brake wheel cylinders provides balanced braking action between the front and the rear brakes under a wide range of braking conditions. 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.**

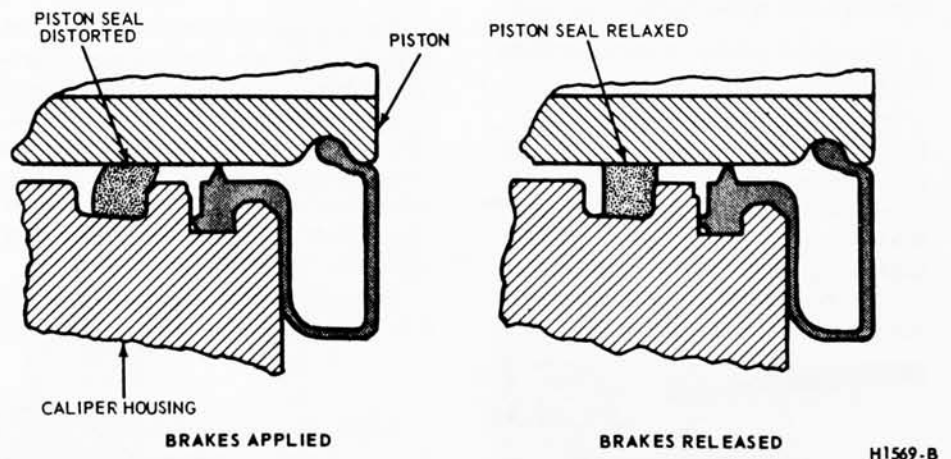


Fig. 4—Function of Piston Seal

## 2 CLEANING AND INSPECTION

### DISC BRAKES

Remove the wheel and tire and shoe and lining assemblies as out-

gether) or 0.030-inch (lining material only) at any one of three measuring locations or if lining shows evidence of contamination which is causing a brake pull, replace the contaminated shoe and lining assemblies. Replace all (4) shoe and lining assemblies if the linings are worn more than .030 inch.

3. Check the caliper to spindle at-

taching bolts torque. Torque them to specifications, if required.

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 spindle so that the stylus contact the rotor at a point approximately 1 inch

Remove the wheel and tire and shoe and lining assemblies as out-

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from the outer edge. Rotate the rotor and take an indicator reading. If the reading exceeds 0.002 inch total lateral runout on the indicator, replace or resurface the disc brake rotor. **The following requirement must be met when resurfacing disc brake rotors:**

Rotunda Disc Brake Attachment FRE-2249-2 is the only approved tool to be used to refinish the disc brake rotors. The step-by-step resurfacing procedure provided with the

tool must be adhered to.

The finished braking surface of the rotor must be flat and parallel within 0.0007 inch; lateral runout must not exceed 0.002 inch total indicator reading, and the surface finish of the braking surface are to be 15-80 micro inches.

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

in step 5 or replace the rotor, if required.

7. Visually check the caliper and if leakage is evident, it should be replaced. Any leakage around the dust boot indicates the need for removal and disassembly.

8. Check the brake hoses for signs of cracking, leaks or abrasion. Replace them if necessary.

### 3 IN-VEHICLE ADJUSTMENTS AND REPAIRS

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

#### DISC BRAKE SHOE AND LINING REPLACEMENT

##### DISC BRAKE SERVICE PRECAUTIONS

1. Grease or any other foreign material must be kept off the caliper assembly, surfaces of the rotor and external surfaces of the hub during service operations. Handling of the rotor and caliper assemblies should be done in a way to avoid deformation of the brake rotor and nicking or scratching of brake linings.

2. If the piston is removed for any reason, the piston seal must be replaced.

3. During removal and installation of a wheel assembly, exercise care not to interfere with and damage the caliper splash shield of the bleeder screw fitting.

4. Front wheel bearing end play is critical and must be within specifications.

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

6. The proportioning valve should not be disassembled or adjustments attempted on it.

7. The wheel and tire must be removed separately from the brake ro-

tor, unlike drum brakes where the wheel, tire and drum are removed as a unit.

8. The caliper assembly must be removed from the spindle prior to removal of the shoe and lining assemblies.

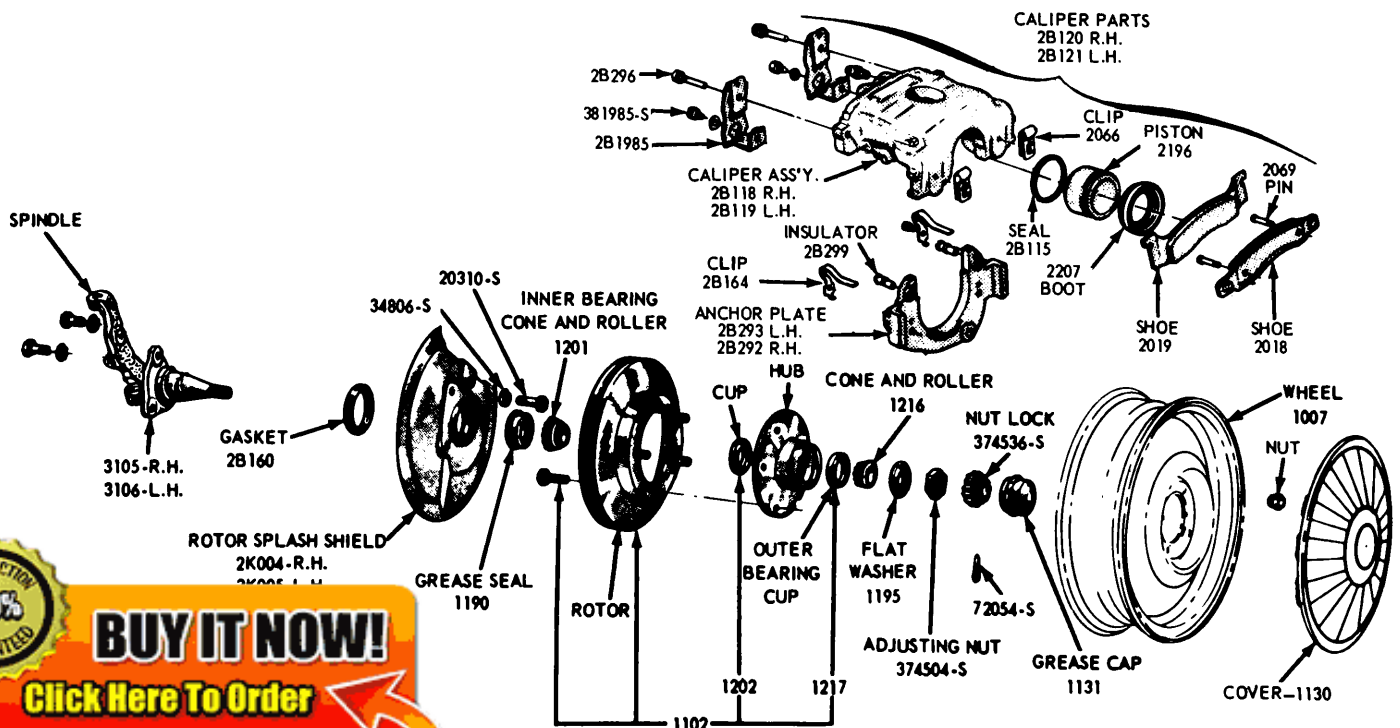
9. Do not attempt to clean or restore oil or grease soaked brake linings. When contaminated linings are found or if the brake linings are worn more than .030 inch, they must be replaced in complete axle sets.

#### REMOVAL

Refer to Fig. 5.

1. Remove the wheel and tire from the hub and rotor assembly.

2. Disconnect the flexible hose from the caliper by removing the through



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bolt from the caliper at the flexible hose connector. Cap the hose to prevent the brake fluid from leaking from the master cylinder.

3. Remove the safety wire from the caliper to spindle attaching bolts, then remove the bolts.

4. Carefully lift the caliper assembly off the hub and rotor.

5. Remove the two outer shoe retaining clips from the retaining pins (Fig. 5).

6. Remove the two retaining pins from the outer shoe, then remove the shoe from the caliper.

7. Slide the inner brake shoe outward until it is free of the hold-down clips, then remove the brake shoe.

8. Remove the caliper locating pins and stabilizer attaching bolts, then remove the stabilizers.

9. Remove the locating pin insulators from the anchor plate and remove the caliper from the anchor plate.

## INSTALLATION

Refer to Fig. 5.

1. Install new locating pin insulators in the anchor plate.

2. Position the caliper assembly on the anchor plate.

3. Position the stabilizers and install the caliper locating pins to engage approximately four threads.

**If the caliper locating pins are rusted or corroded they should be replaced.**

**Apply water or isopropyl alcohol (M-8B7-B fluid supplied in the lining kit) to the caliper locating pins before installation. Oil or grease must not be used on the locating pins.**

4. Position the outer brake shoe and lining assembly on the caliper with the brake shoe stamped projections fitting into the outboard caliper slots.

5. Insert the two outer brake shoe hold-down pins outward through the brake shoe and caliper and install the spring clips.

6. Install the inner brake shoe and assembly with the ears on top

## DISC BRAKE CALIPER ASSEMBLY

### REMOVAL

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

2. Disconnect the flexible hose from the caliper by removing the through bolt from the caliper at the flexible hose connector. Cap the hose to prevent the brake fluid from leaking from the master cylinder.

3. Remove the safety wire and the two bolts that attach the caliper assembly to the spindle.

4. Lift the caliper assembly off the rotor and place it on the bench.

### INSTALLATION

1. Position the caliper assembly on the rotor, and mate the mounting bolt holes in the caliper with those in the spindle. It is necessary to push the caliper piston into the cylinder bore to obtain clearance between the shoe and lining assembly and the rotor when new shoe and lining assemblies are installed.

2. Install the caliper to spindle attaching bolts finger tight and torque them to specification. **The upper bolt must be tightened first.** Install the safety wire on the bolts and twist the wire ends at least five turns. Push the wire ends outboard to prevent interference with the brake hoses.

3. Position the brake hose fitting with a new copper washer on each side of the fitting on the caliper assembly. Install the bolt and torque to specification.

4. Bleed the brake system and centralize the differential valve as outlined in Part 2-1. Check the master cylinder fluid level and add the specified fluid, as required. **Pump the brake pedal several times to actuate the piston seals and to position the shoe and lining assemblies.**

5. With moderate pressure applied to the brake pedal, torque the stabilizer attaching screws and caliper guide pins to specifications.

6. Install the wheel and tire assembly and the wheel cover.

7. Road test the vehicle.

## FRONT WHEEL HUB AND ROTOR ASSEMBLY—DISC BRAKES

### REMOVAL

1. Remove the wheel and tire from the hub (Fig. 5). **Be careful to avoid damage or interference with the bleeder screw fitting.**

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 vehicle. 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 piston from coming out of the cylinder bore while the caliper is removed.

**Handle the rotor and caliper assemblies in such a way as to avoid deformation of the rotor and nicking, scratching or contamination 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 (CIAZ 19590-B), and install the inner bearing cone and roller assembly in the inner cup. Pack grease lightly between the lips of a new grease seal and install the seal (Fig. 5).

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 seal are lubricated and in good condition, and that the rotor braking surfaces are clean.

2. Install the hub and rotor assembly on the spindle. **Use care to avoid rubbing the grease seal across the spindle threads.**

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,**

follow the procedure in Group 3.

5. Mount the caliper assembly on the spindle following the Disc Brake Caliper Assembly Installation Procedure in this section.

**DISC BRAKE ROTOR SPLASH SHIELD**

**REMOVAL**

1. Remove the caliper and the hub and rotor assembly as outlined under Removal in the foregoing procedure (it is not necessary to disconnect hydraulic connections).

2. Remove the three bolts that attach the splash shield to the spindle (Fig. 5).

3. Remove and discard the splash shield to spindle gasket.

**INSTALLATION**

1. If the shield is bent, straighten it out before installation. Position a new splash shield to spindle gasket and the splash shield to the mounting bracket. Install the attaching bolts, nuts, and torque them to specification (Fig. 5).

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

**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. Depress the parking brake pedal approximately 1¼ inches.

3. Raise the vehicle. With the transmission in neutral, turn the adjusting nut forward against the equalizer (Fig. 6) until a moderate drag is felt when turning the rear wheels (approximately 100 lbs of force at the outside diameter of the tire is required to turn the rear wheels).

4. Release the parking brake, and check to make sure that the brake shoes return to the fully released position.

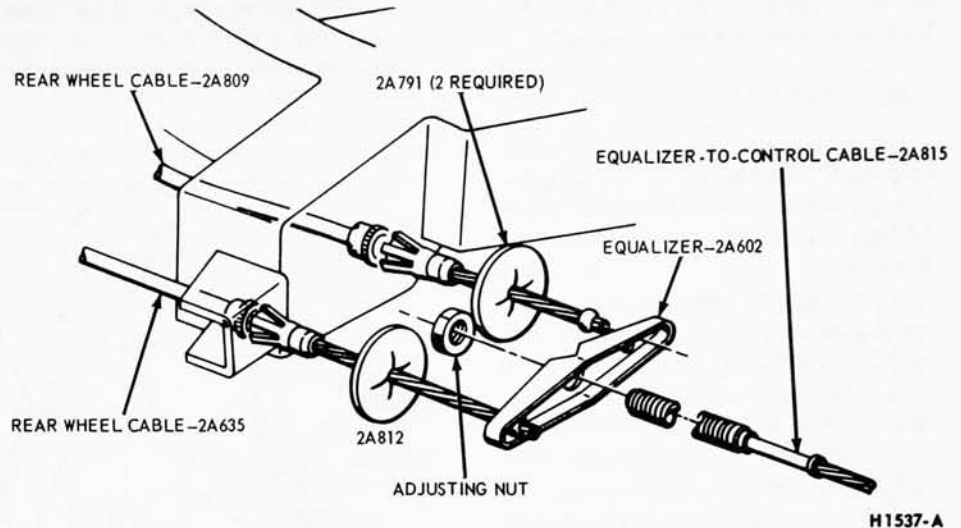


Fig. 6—Parking Brake Linkage

**PRESSURE DIFFERENTIAL VALVE ASSEMBLY**

**REMOVAL**

1. Disconnect the brake warning light wire from the pressure differential valve assembly switch (Figs. 7 and 8). **To prevent damage to the brake warning switch wire connector, expand the plastic lugs to allow removal of the shell-wire connector from the switch body.**

2. Loosen the tube nut connecting the primary (front brake) system inlet tube at the top of the pressure differential valve assembly and disconnect the tube.

3. Disconnect the primary system left front brake outlet tube from the top side of the pressure differential valve assembly.

4. Disconnect the primary system right front brake outlet tube from the top side of the differential valve assembly.

5. Disconnect the secondary (rear brake) system inlet tube at the lower side of the pressure differential valve assembly.

6. Disconnect the secondary system rear brake outlet tube from the lower side pressure differential valve assembly.

7. Remove the screw retaining the pressure differential valve assembly to the frame side rail and remove the valve assembly.

8. Place the pressure differential valve assembly and mounting bracket in a vise. Loosen the proportioning valve tube nuts at the differential valve and at the proportioning valve. Remove the proportioning valve from the mounting bracket.

9. If the differential valve is to be replaced, remove the brake warning lamp switch and install the switch in the new differential valve. **The pressure differential valve assembly and the brake warning lamp switch**

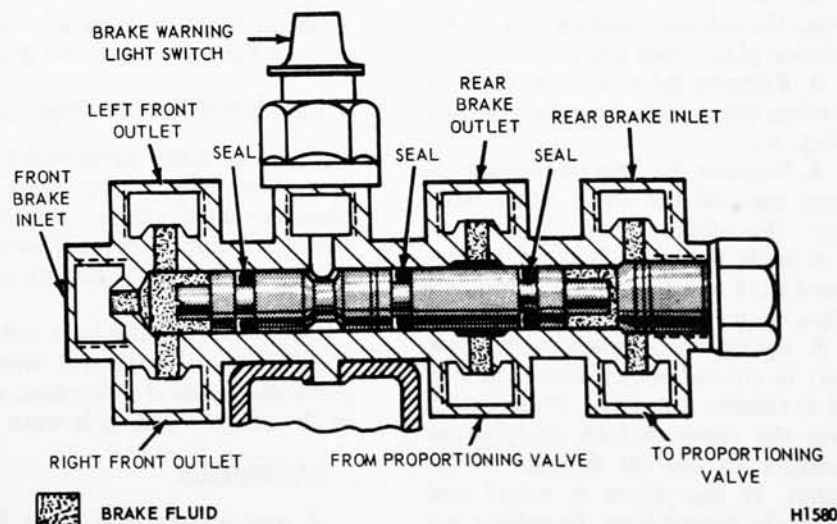


Fig. 7—Pressure Differential Valve

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are separate units and each is serviced as a separate assembly only.

### INSTALLATION

1. Connect the proportioning valve inlet and outlet tubes to the proportioning valve and differential valve bodies. Tighten the tube nuts to specification.

2. Mount the pressure differential valve assembly on the frame side rail and tighten the attaching screw.

3. Connect the rear brake system inlet tube to the pressure differential valve assembly and tighten the tube nut to the specified torque.

4. Connect the rear brake system outlet tube to the pressure differential valve assembly. Tighten the tube nut to the specified torque.

5. Connect the front brake system inlet tube to the pressure differential valve assembly and tighten the tube nut to the specified torque.

6. Connect the right front brake outlet tube to the pressure differential valve assembly. Tighten the tube nut to the specified torque.

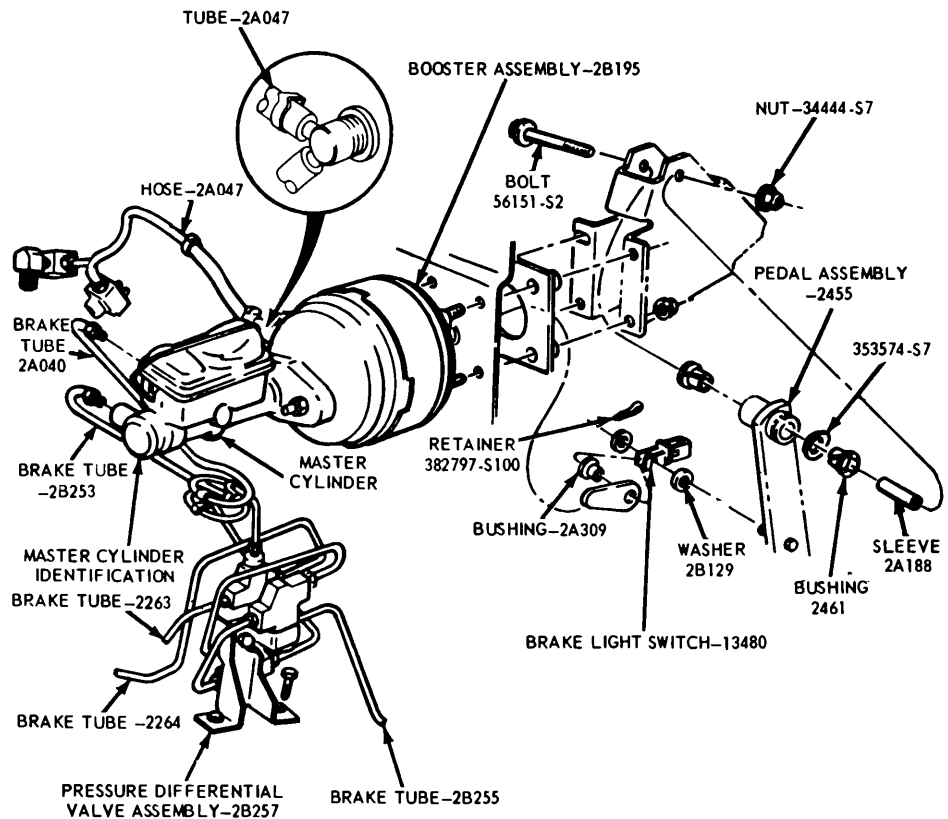
7. Connect the left front brake outlet tube to the pressure differential valve assembly. Tighten the tube nut to the specified torque.

8. Connect the shell-wire con-

ductor to the brake warning lamp switch. Make sure the plastic lugs on the connector hold the connector

securely to the switch.

9. Bleed the brakes and centralize the pressure differential valve.



H1583-A

Fig. 8—Brake Control System

## 4 MAJOR REPAIR OPERATIONS

### DISC BRAKE CALIPER

#### DISASSEMBLY

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

2. Remove the caliper locating pins from the caliper assembly and lift the anchor plate from the caliper.

3. Remove the two outer shoe retaining clips from the retaining pins (Fig. 9).

4. Remove the two retaining pins, then remove the outer brake shoe from the caliper.

5. Slide the inner brake shoe outward until it is free of the hold-down clips, then remove the brake shoe.

Apply air pressure to the fluid in the caliper as shown in Fig.

ing air pressure. Care should be taken because the piston can develop considerable force due to pressure build-up.

7. Remove the dust boot from the caliper assembly.

8. Remove the rubber piston seal from the cylinder using a knife point to raise the piston seal and discard it.

#### CLEANING AND INSPECTION

Clean all metal parts with alcohol. Use clean, dry, compressed air to clean out and dry the grooves. Be sure that the caliper bore and component parts are completely free of any foreign material.

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

#### ASSEMBLY

A new caliper seal must be flat, round and not twisted. Discard any

new seals that have been distorted in shipping or storage. Installation of a distorted seal may result in seal leakage.

1. Apply a film of clean C6AZ-195-42-A brake fluid to the new caliper piston seal and install it in the cylinder bore. Be sure the seal does not become twisted and that it is seated fully in the groove.

2. Install a new dust boot by seating the flange squarely in the outer groove of the caliper bore.

3. Coat the outside diameter of the piston with clean C6AZ-19542-A brake fluid and install it in the cylinder bore with the open end of the piston and boot retaining groove facing outward. Spread the dust boot over the piston as the piston is installed using care not to disturb the boot in the caliper groove. Locate the piston squarely in the bore and apply a firm hand pressure. If the piston does not fit smoothly into the caliper bore, remove the piston and thoroughly in-

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spect the caliper bore and seal installation. Insert the piston again and rotate slowly while applying a steady hand pressure against the piston. **Under no circumstances should the piston be installed using other than a firm hand pressure.** Seat the dust

boot in the piston groove and fully seat the piston in the caliper bore.

4. Position the outer brake shoe and lining assembly against the caliper housing legs and install the two brake shoe hold-down pins. Secure the brake shoe hold-down pins with

the two pin retainer spring clips.

5. Position the inner brake shoe so that the ears of the shoe rest on the top of the anchor plate bosses and beneath the hold-down clips.

6. Install new caliper locating pin insulators in the anchor plate.

7. Position the caliper on the anchor plate.

8. Clean the caliper locating pins with isopropyl alcohol or water and install them loosely in the anchor plate. **Be sure the locating pins are free of oil, grease or dirt.**

9. Install the caliper on the spindle as outlined under Disc Brake Caliper Assembly Installation, in Section 3.

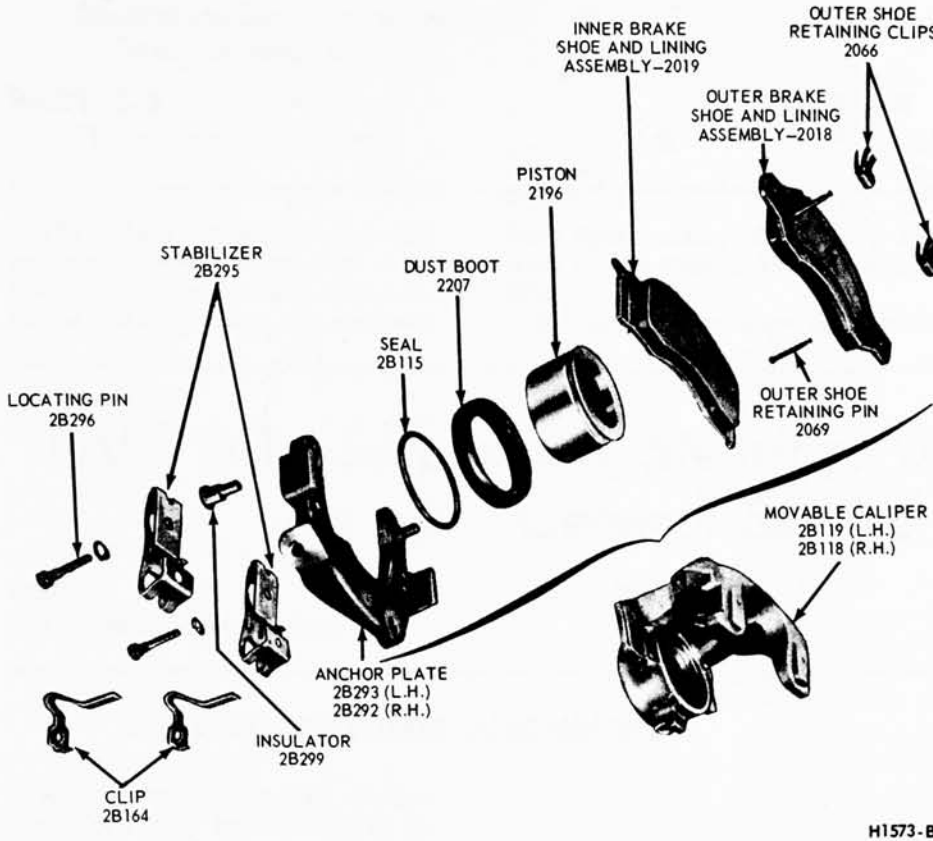


Fig. 9—Caliper Assembly—Disassembled

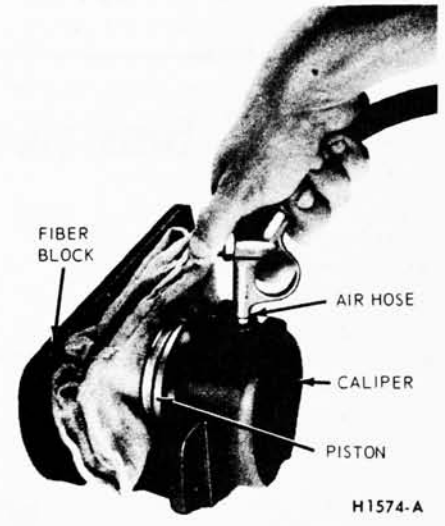


Fig. 10—Removing Piston from Caliper

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# Suspension, Steering, Wheels and Tires

GROUP

3

PART 3-1	PAGE	PART 3-3	PAGE
Suspension, Steering, Wheels and Tires—General Service . . . . .	3-1	Tilt Steering Column . . . . .	3-4
PART 3-2		PART 3-4	
Fixed Steering Column . . . . .	3-2	Front Wheel Bearing . . . . .	3-7

The 1968 Thunderbird suspension and steering with the exception of the energy-absorbing steering column removal, installation and alignment and

front wheel bearing adjustment is the same as that used in 1967 Thunderbirds.

All service operations other than

those that follow should be performed as detailed in Group 3 of the 1967 Thunderbird Shop Manual.

## PART 3-1—Suspension, Steering, Wheels and Tires—General Service

Section	Page
1 Steering Column Alignment . . . . .	3-1

### 1 STEERING COLUMN ALIGNMENT

A condition of high shift or steering efforts may be experienced on 1968 Thunderbirds caused by improper alignment of the energy absorbing steering column. The following procedures outline the steps necessary to correctly re-align either fixed or tilt columns.

It is recommended that before attempting realignment, the toe plate (column retainer) to dash panel fastener holes be inspected for a binding or misaligned condition.

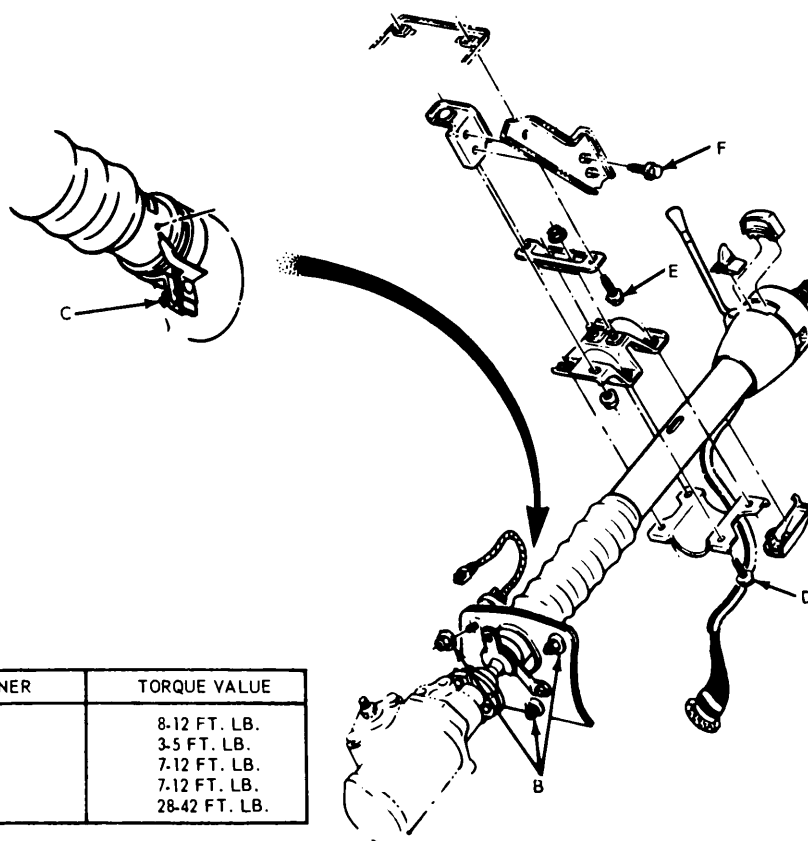
If the conditions described above could be attributed to this area, file or ream the dash panel holes for greater clearance.

The column alignment procedures:

1. Loosen the nuts retaining the toe plate (column retainer) to the dash panel (B in Fig. 1).

2. Loosen to fingertight the bolt and nut located on the toe plate retaining clamp (C in Fig. 1).

Remove trim at instrument



RETAINER	TORQUE VALUE
B	8-12 FT. LB.
C	3-5 FT. LB.
D	7-12 FT. LB.
E	7-12 FT. LB.
F	28-42 FT. LB.

Fig. 1—Steering Column Alignment Locations and Torque Specifications

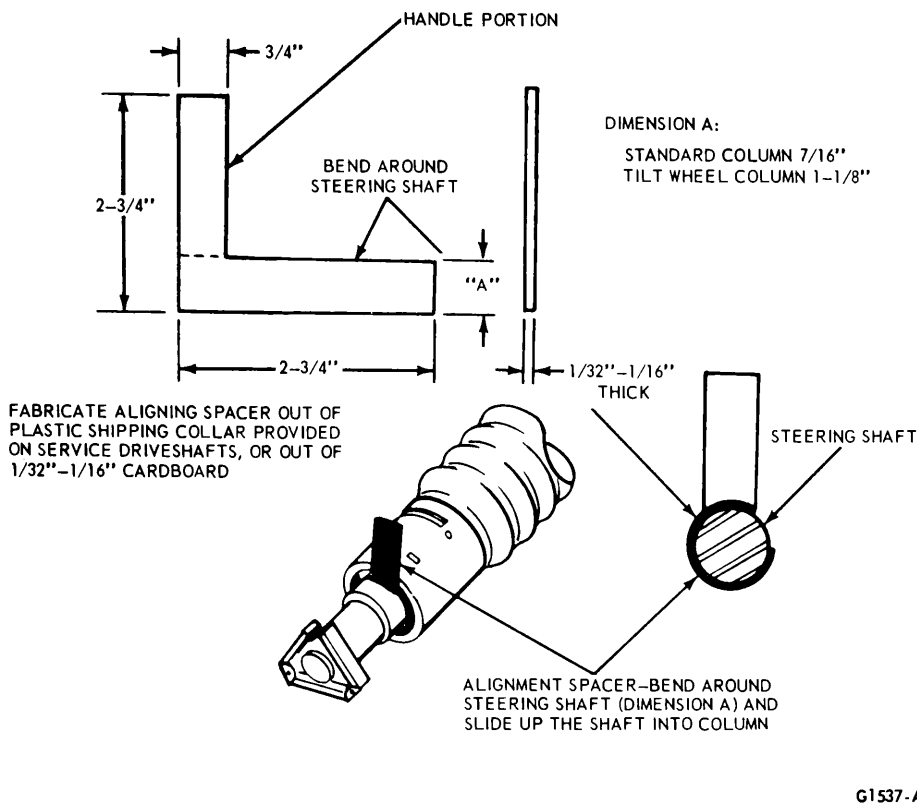
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FABRICATE ALIGNING SPACER OUT OF PLASTIC SHIPPING COLLAR PROVIDED ON SERVICE DRIVESHAFTS, OR OUT OF 1/32"–1/16" CARDBOARD

ALIGNMENT SPACER—BEND AROUND STEERING SHAFT (DIMENSION A) AND SLIDE UP THE SHAFT INTO COLUMN

G1537-A

Fig. 2—Aligning Spacer Fabrication and Insertion

- 5. Loosen to fingertight the bolts or nuts which retain the column brackets to the brake pedal support bracket (E).
- 6. Loosen to fingertight the bolt which controls lateral adjustment of the steering column (F in Fig. 1).
- 7. Disconnect the transmission shift rod at the shift tube.

- 8. Working under the hood, install the aligning spacer (Fig. 2) around the visible portion of the steering shaft and slide it up the shaft into the steering column. It may be necessary to move the shaft back and forth to completely install the spacer.
- 9. At this point the steering column assembly, being loose, may have

dropped toward the steering gear grounding the steering shaft on the steering gear input shaft. To properly establish the steering shaft to steering gear clearance, insert a 1/8 diameter rod or drill through the opening in the upper half of the flex coupling.

10. Tighten to a snug fit (approximately 2-3 ft-lb) the nuts retaining the toe plates to the dash panel (B in Fig. 1).

11. If the aligning spacer cannot be rotated freely, the dash panel holes must be filed or reamed for greater travel (as mentioned in the second paragraph at the beginning of this procedure).

12. Tighten all nuts and bolts (noted as C, D and E in Fig. 1) in the passenger compartment to a snug fit (approximately 2-3 ft-lb). Again check aligning spacer for looseness. Perform these tightening operations in alphabetical order.

13. Tighten the lateral adjustment bolt (F in Fig. 1) to snug fit. Again check the aligning spacer for looseness.

14. Tighten all bolts and nuts to the proper torque value (listed in Fig. 1) in alphabetical order.

15. Remove the steering shaft aligning spacer.

16. Remove the 1/8 diameter rod or drill previously inserted in the flex coupling.

17. Reinstall the trim at the instrument panel to steering column mounting.

## PART 3-2—Fixed Steering Column

Section	Page	Section	Page
1 Description .....	3-2	2 Removal and Installation .....	3-4

### 1 DESCRIPTION

The standard, fixed steering column is similar to that used in previous models except as follows:

The steering column is of the collapse type to lessen the possibility

The shift tube and the steering shaft are provided with nylon dowels and will shear and allow them to collapse in proportion to the shift tube upon impact.

Once the steering column has been collapsed, a complete new column must be installed.

The turn signal switch control lever has a neutral (cancel On-Off) position from which the lever can be

moved upward to indicate right turns, downward to indicate left turns. As the turn signal control lever is moved slightly up or down when changing lanes, contact is made in the turn signal switch actuating the indicating system prior to reaching detent for full turn self-cancelling. The lever is held in this position and released when lane changing is completed, returning the lever to neutral position.

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The full travel of the lever to detent is for a complete left or right turn and automatically cancels on return of the steering wheel to straight-ahead position.

An emergency warning flasher system is integrated with the turn signal switch system. A control knob is located on the right side of the column just below the steering wheel and op-

posite the turn signal control lever. The emergency warning flasher system is ON when the control knob is pushed in and OFF when the knob is pulled out. When the system is ON the parking lights, stop lights and instrument panel turn indicating lights all flash simultaneously.

The flex coupling incorporates a large and a small drive lug so that it

may only be assembled in one position.

The neutral start switch is mounted on the steering column tube below the instrument panel and should be adjusted as detailed in Group 7 of this manual. Procedures for servicing the back-up light switch and turn signal switch are detailed in Group 15 of this manual.

## 2 REMOVAL AND INSTALLATION

### REMOVAL

1. Remove the instrument panel lower outer finish panel, instrument panel steering column plate and cover.

2. Disconnect the battery cable from the negative post.

3. Disconnect the turn signal switch wires at the connector.

4. Disconnect the neutral start switch wires and back-up light switch wires from the switches.

5. Disconnect the transmission control rod from the lever at the lower end of the column.

6. Remove the bolt that secures the flex coupling to the steering gear (Fig. 1).

7. Remove the four screws that secure the column retainer to the dash panel.

8. While supporting the steering

column, remove the four bolts that secure the lower clamp to the upper clamp.

9. Remove the clamp from the steering column.

10. Lift the steering column and wheel from the vehicle.

### INSTALLATION

1. Position the steering column in the vehicle. Make certain that the wheels are in the straight ahead position and that the steering wheel spokes are in a horizontal position when the flex coupling engages the input shaft splines.

2. Place the lower clamp on the column and install but do not tighten the four attaching bolts.

3. Install the column retainer to the dash panel (Fig. 1). Do not tighten

the five attaching screws. Position the clamp to center the steering shaft in the steering column tube, then tighten the attaching screws. Aligning procedures are detailed in Part 3-1.

4. Tighten the clamp-to-instrument panel attaching screws.

5. Install and tighten the flex coupling-to-steering gear attaching bolt.

6. Connect and adjust the transmission control rod.

7. Connect the starter neutral switch and back-up light switch wires to their respective terminals.

8. Connect the turn signal switch wires.

9. Connect the negative battery cable to the battery.

10. Install the instrument panel steering column plate and cover and the instrument panel lower outer finish panel.

# PART 3-3—Tilt Steering Column

Section	Page	Section	Page
1 Description .....	3-4	2 Removal and Installation .....	3-6

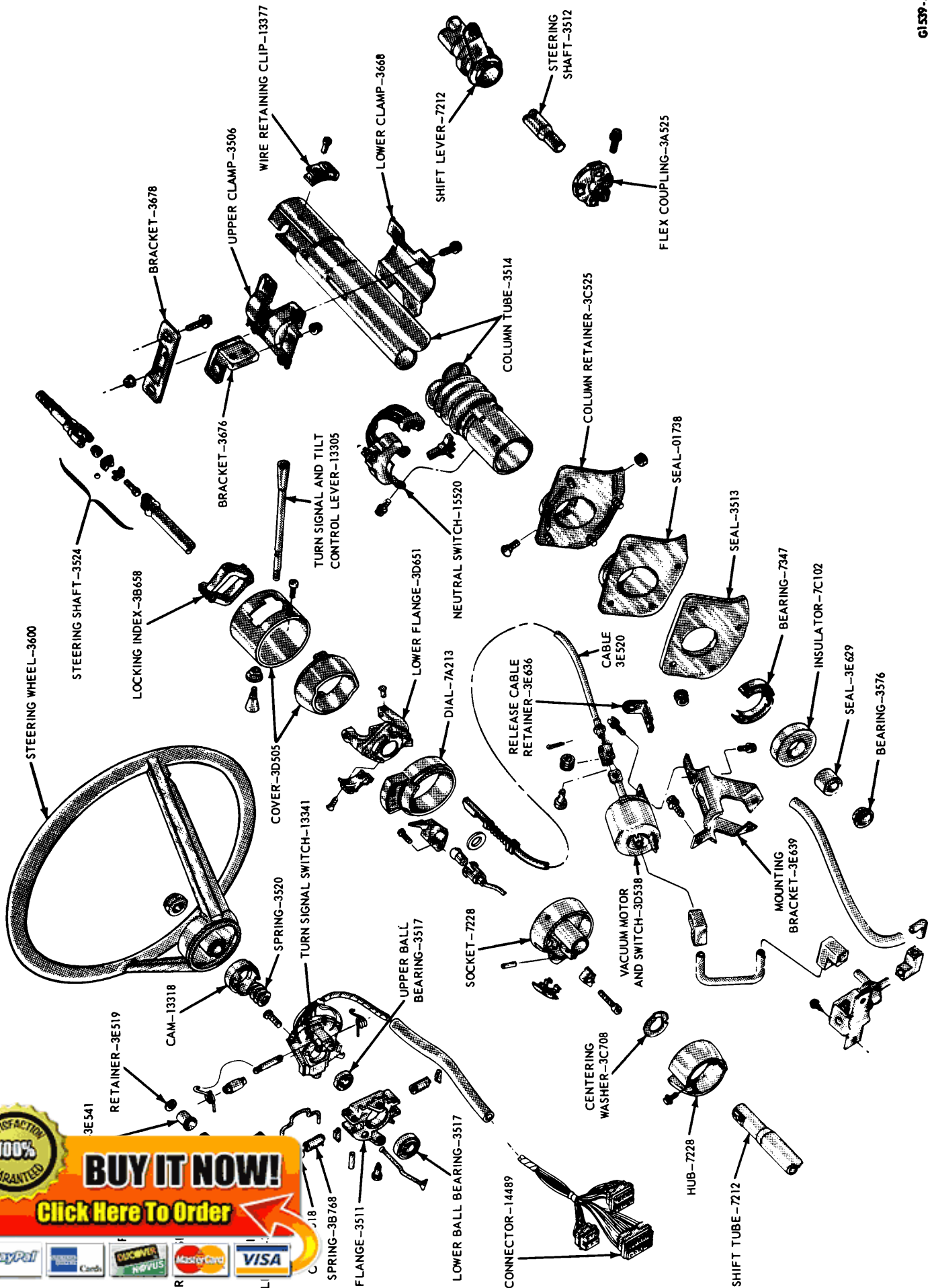
## 1 DESCRIPTION

The optional tilt steering column features nine driving positions (four up and four down from a center position) and a tilt-away position that is automatically accomplished when the key is turned to the OFF position and the left door is opened.

right of the steering column. The vacuum release valve is connected to a vacuum reservoir located on the right fender apron below the battery tray in the engine compartment and to a vacuum motor mounted on the same bracket as the valve on the instrument panel (Fig. 1). Each component of the system is interconnected by a rubber hose. When the vacuum release valve is energized electrically, it opens a valve and allows reservoir vacuum to act on

the vacuum motor diaphragm to pull the locking pawl out of the lower flange at the upper end of the column. Spring tension then moves the steering wheel upward and to the right at approximately a 45 degree angle (tilt-away position) at the steering shaft universal joint. The column will remain in the tilt-away position until the driver manually moves the column to the drive position after the left door has been closed.

**The column will not move out of**



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Fig. 1—Tilt Steering Column Disassembled

the driving position until the key is turned to the OFF position and the left door is opened, either operation first as long as both operations are performed.

Changing the column and steering wheel from one driving position to another can be made at any time by depressing the turn indicator control lever and holding it while selecting the desired driving position for the steering wheel. This releases the spring loaded steering column locking lever from the steering column locking index. The column and wheel are locked in position when the turn signal control lever is allowed to return rearward, with spring tension, to its neutral position. This indexes the lug on the steering column locking lever with the closest tooth on the locking index for the selected steering wheel position.

The column also features a turn signal switch with a lane-changer position, turn indicating position and emergency warning flasher control knob.

A starter safety switch located in the vacuum motor prevents the engine from being started while the steering wheel is in the tilt-away position. The starter safety switch is actu-

ated by the vacuum motor. When the steering wheel is placed in the drive position, the vacuum motor piston closes the switch.

The vacuum reservoir has a capacity to operate (cycle) the steering column for approximately three times after the engine has been shut down.

The turn signal switch control lever has a neutral (cancel On-Off) position from which the lever can be moved upward to indicate right turns, downward to indicate left turns and forward to release the steering column lock when adjusting the steering wheel to a desired driving position. As the turn signal control lever is moved slightly up or down when changing lanes, contact is made in the turn signal switch actuating the indicating system prior to reaching detent for full turn self-cancelling. The lever is held in this position and released when lane changing is completed, returning the lever to neutral position. The full travel of the lever to detent is for a complete left or right turn and automatically cancels on return of the steering wheel to straight-ahead position.

An emergency warning flasher system is integrated with the turn signal switch system. A control knob is located on the right side of the column

just below the steering wheel and opposite the turn signal control lever. The emergency warning flasher system is ON when the control knob is pushed in and OFF when the knob is pulled out. When the system is ON the parking lights, stop lights and instrument panel turn indicating lights all flash simultaneously.

The steering column is of the collapsible type to lessen the possibility of injury to the driver of the vehicle should he become involved in an accident. The lower end of the steering column tube at the bellows area (Fig. 1) will collapse approximately six inches upon an impact of 1800 lbs.

The shift tube and the steering shaft are provided with nylon dowels and will shear and allow them to collapse in proportion to the shift tube upon impact.

Once the steering column has been collapsed, a complete new column (less undamaged tilt head components) must be installed along with mounting brackets which will also shear away during impact.

**When replacing the tilt head mechanism, it is mandatory to replace the attaching bolts with new bolts. Attaching bolts, removed for any reason, must be replaced.**

## 2 REMOVAL AND INSTALLATION

### REMOVAL

1. Remove the instrument panel lower outer finish panel, instrument panel steering column plate and cover.
2. Disconnect the negative cable from the battery.
3. Remove the bolt that attaches the flexible coupling to the steering shaft.
4. Disconnect the shift rod from the lever at the lower end of the column.
5. Remove the four screws that attach the column retainer to the dash panel.
6. Working from the underside of the instrument panel disconnect the steering column tilt-control cable from the vacuum motor and mount-  
et (Fig. 1).

attach the lower clamp to the upper clamp (Fig. 1). Lift the column from the vehicle.

### INSTALLATION

1. Position the column in the vehicle making sure that the steering shaft engages the flex coupling.
2. Install the column retainer-to-dash panel attaching screws, but do not tighten them.
3. Install the lower clamp and the attaching nuts. Tighten the nuts fingertight.
4. Move the lower flange as required to center the steering shaft in the tube. Aligning procedures are detailed in Part 3-1. Tighten the lower flange attaching nuts when the shaft is centered.
5. Connect the shift rod to the shift lever at the lower end of the column.
6. Install and tighten the flex coupling attaching bolt.
7. Tighten the instrument panel-to-clamp attaching nuts.

8. Connect the turn signal and emergency flasher switch wires at the multiple connectors. Connect the wires to the neutral start switch. Adjustments for the neutral start switch are detailed in Group 7 of this manual.

9. Connect the tilt-column control cable to the release cable retainer and vacuum motor. To remove cable slack, loosen the bracket attaching screw and pull it slightly toward the column, then tighten the screw. If difficulty in adjusting this control is experienced, the retainer slot may be filed to gain additional travel.

10. Install the instrument panel steering column plate and cover and the instrument panel lower outer finish panel.

11. Connect the negative cable to the battery.

12. Start the engine and check the operation of the steering column and switches.



# PART 3-4—Front Wheel Bearing

Section

Page

1 Adjustment ..... 3-7

## 1 ADJUSTMENT

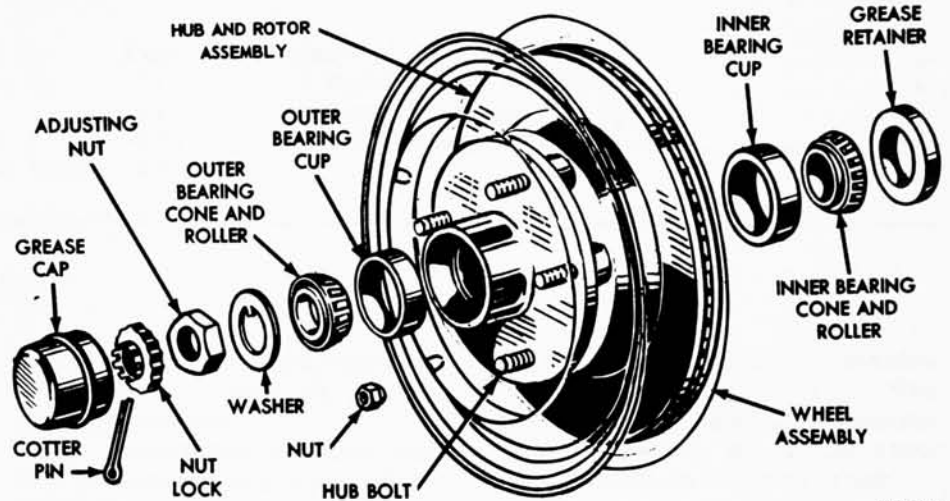
The front wheel bearings should be adjusted if the wheel is loose on the spindle or if the wheel does not rotate freely. The following procedures will bring the bearing adjustment to specification.

1. Raise the vehicle 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. Loosen the bearing adjusting nut three turns. Then, rock the wheel, hub, and rotor assembly in and out several times to push the shoe and linings away from the rotor.
5. While rotating the wheel hub, and rotor assembly, torque the adjusting nut 17-25 ft-lbs to seat the bearings (Fig. 2).
6. Back the adjusting nut off one half turn. Then, retighten the adjusting nut to 10-15 in-lbs with a torque wrench or fingertight.
7. 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.
8. Install a new cotter pin, and bend the ends of the cotter pin around the castellated flange of the nut lock.
9. Check the front wheel rotation. 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.

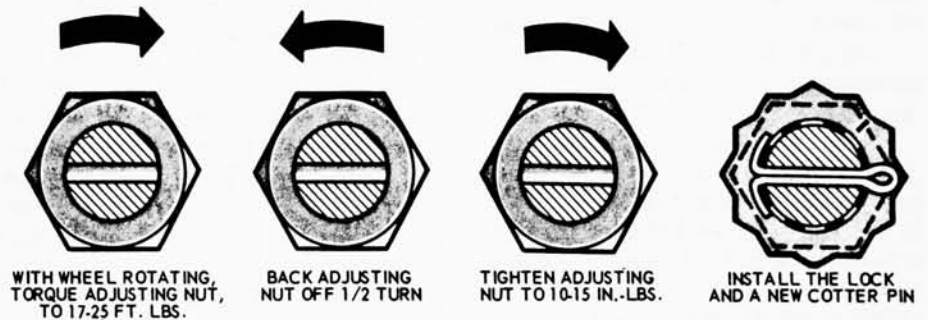
10. Before driving the vehicle, pump the brake pedal several times

to obtain normal brake lining to rotor clearance and restore normal brake pedal travel.



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Fig. 1—Front Hub and Rotor Bearing and Grease Retainer Disc Brakes



F1417-A

Fig. 2—Front Wheel Bearing Adjustment

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# Rear Axles

GROUP

4

<b>PART 4-1</b>	<b>PAGE</b>	<b>PART 4-2</b>	<b>PAGE</b>
Rear Axle .....	<b>4-1</b>	Specifications .....	<b>4-4</b>

## PART 4-1—Rear Axle

Section	Page	Section	Page
1 Diagnosis and Testing .....	4-1	3 Removal and Installation .....	4-3
Acceptable Tooth Patterns .....	4-1	Rear Axle Companion Flange	
2 In-Vehicle Adjustments and Repairs .....	4-3	Removal and Installation .....	4-3
Rear Axle Companion Flange Runout Check ..	4-3		

### 1 DIAGNOSIS AND TESTING.

Diagnosis and testing procedures, other than those which follow, remain the same as outlined in the 1967 Thunderbird Shop Manual.

#### ACCEPTABLE TOOTH PATTERNS (ALL AXLES)

Figure 1 shows acceptable tooth patterns for all axles. Any combination of drive and coast patterns will be acceptable.

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 fairly well centered on the tooth.
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 to be acceptable.

Any combination of drive and coast patterns shown in Fig. 1 are acceptable.

#### HUNTING GEAR SET

In a hunting-type gear set, any one

several revolutions of the ring gear are required to make all possible gear combinations.

Any combination of drive and coast patterns shown in Fig. 1 will be acceptable.

#### NON-HUNTING GEAR SET

In a non-hunting type gear set, any one pinion gear tooth comes into contact with only a few ring gear teeth. In this type, only one revolution of the ring gear is required to make all possible tooth contact combinations. Any combination of drive and coast patterns shown in Fig. 1 will be acceptable.

#### 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 ring gear teeth, but more than one revolution of the ring gear is required to make all possible gear tooth combinations. Any combination of drive and coast patterns shown in Fig. 1 will be acceptable.

#### SHIM AND BACKLASH CHANGES

Since each gear set rolls a characteristic pattern, the patterns shown

in Fig. 1 are considered acceptable and should be used as a guide. 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 shimming can be summarized as follows:

1. A thicker shim with the backlash set to specifications moves the pinion further from the ring gear.
2. A thinner shim with the backlash set to specifications moves the pinion closer to the ring gear.

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 of a non-hunting or partial non-hunting gear set, be sure that the marked tooth on the pinion indexes between the marked teeth on the ring gear (Fig. 41, Part 4-2) 1967 Thunderbird Shop Manual. Refer to Pinion and Ring Gear Tooth Contact Adjustment, Section 2 of the 1967 Thunderbird Shop Manual.

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# 1967 FORD

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# 1967

# THUNDERBIRD

# SHOP MANUAL

## GROUP INDEX

VEHICLE IDENTIFICATION	1
BRAKES	2
SUSPENSION, STEERING, WHEELS AND TIRES	3
REAR AXLE	4
DRIVE SHAFT AND CLUTCH	5
MANUAL SHIFT TRANSMISSION (Not Applicable)	6
AUTOMATIC TRANSMISSION	7
ENGINE	8
IGNITION SYSTEM	9
FUEL SYSTEM	10
COOLING SYSTEM	11
EXHAUST SYSTEM	12
CHARGING SYSTEM	13
STARTING SYSTEM	14
LIGHTING SYSTEM, HORNS AND INSTRUMENTS	15
VENTILATING, HEATING AND ACCESSORIES	16
BODY, DOORS AND WINDOWS	17
TRIM, SEATS AND CONVERTIBLE TOP	18
SCHEMATICS	19

SPECIFICATIONS AND SPECIAL SERVICE TOOLS  
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## FOREWORD

*This shop manual provides the Service Technician with information for the proper servicing of the 1967 Thunderbird.*

*The maintenance schedule and procedures for maintenance operations are published in the 1967 Passenger Car Maintenance and Lubrication Manual.*

*The information in this manual 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.*



# Vehicle Identification

GROUP  
**1**

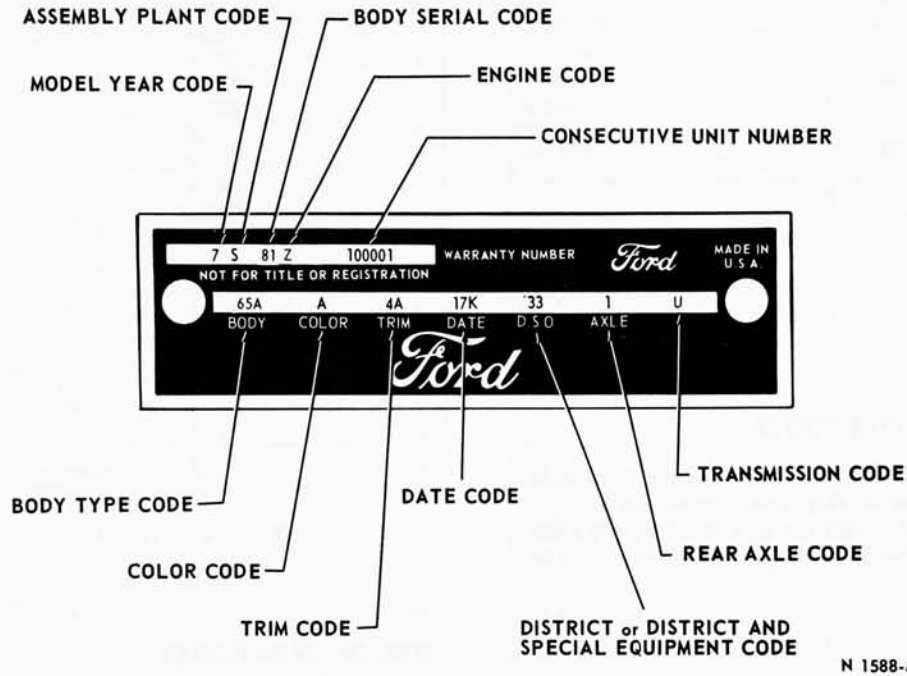


FIG. 1—Typical Warranty Plate—Thunderbird

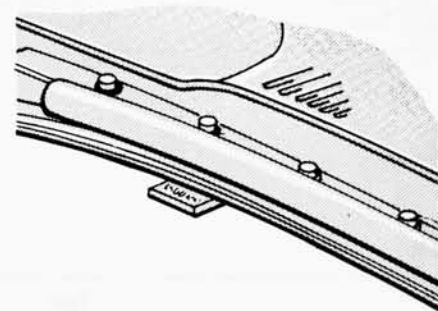
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### VEHICLE WARRANTY NUMBER

The vehicle warranty number is the first 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 number indicates the manufacturing assembly plant. The next two numbers designate the Body Serial Code followed by a letter expressing the Engine Code. The group of six digits remaining on the first line indicate the Consecutive Unit Number.

### VEHICLE DATA

The vehicle data appears on the second or lower line on the Warranty Plate. The first two numbers and a letter identify the Body Style. A letter or a number appears next indicating the Exterior Paint Color followed by a number-letter combination designating the Interior Trim. To the right of this code appears the Date Code indicating the date the car was manufactured. A two-digit number next designates the district in which the car was ordered and may appear in conjunction with a Domestic Special Order or Foreign Special Order number when applicable. The final two spaces indicate the Rear Axle (for regular color letters for locking-types) and the Trans-



N 1526 - A

FIG. 2—Thunderbird Identification Number Location



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### VEHICLE IDENTIFICATION NUMBER

For title and registration purposes, the identification number is located on the front and side of center in the en-



**MODEL YEAR CODE**

The number 7 designates 1967

**ASSEMBLY PLANT CODES**

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

**CONSECUTIVE UNIT NUMBER**

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

**EXTERIOR PAINT COLOR CODES**

Code	M-30-J M-32-J	
A.....	1724-A.....	Black
B.....	1734-A.....	Lt. Aqua
C.....	1900-A.....	Dk. Gray Met.
E.....	2045-A.....	Med. Beige Met.
F.....	1226-A.....	Lt. Blue
H.....	2067-A.....	Diamond Green
K.....	1903-A.....	Dk. Blue Met.
M.....	1619-A.....	White
N.....	921-A.....	Platinum
P.....	2065-A.....	Pewter Met.
Q.....	1624-A.....	Med. Blue Met.
R.....	1879-A.....	Dk. Green Met.
T.....	2008-A.....	Red
U.....	1070-A.....	Med. Turquoise Met.
V.....	2066-A.....	Bronze Met.
X.....	1632-A.....	Maroon Met.
Z.....	1915-A.....	Med. Gold Met.
2.....	1633-A.....	Yellow
4.....	1901-A.....	Med. Gray Met.
6.....	1631-A.....	Lt. Beige

**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 Date, which consists of a two-digit number with a letter suffix. The following chart lists the Body Serial Codes, Body Style Codes and the model.

**THUNDERBIRD**

Body Serial Code	Body Style Code	Body Type	
81	65A	2-Door Hardtop	Painted Roof
82	65B	2-Door Hardtop	Vinyl Roof-Landau
84	57B	4-Door Sedan	Vinyl Roof

**ENGINE CODES**

Code	Type
Z.....	8 Cyl. 390 Cu. In. (4V)
C.....	8 Cyl. 428 Cu. In. (4V)
	8 Cyl. 428 Cu. In. (4V) ①

**INTERIOR TRIM CODES**

Code	Trim Schemes
2A.....	Black Vinyl
2B.....	Blue Vinyl
2D.....	Red Vinyl
2F.....	Saddle Vinyl
2G.....	Ivy Gold Vinyl
2K.....	Aqua Vinyl
2U.....	Parchment Vinyl W/Black
4A.....	Black Vinyl ①
4B.....	Blue Vinyl ①
4D.....	Red Vinyl ②
4G.....	Ivy Gold Vinyl ①
4K.....	Aqua Vinyl ①
4L.....	Lt. Silver Cloth and Lt. Silver Vinyl
4U.....	Parchment Vinyl W/Black ①
5A.....	Black Cloth and Black Vinyl
5U.....	Parchment Cloth and Parchment Vinyl
8A.....	Black Vinyl ①
8B.....	Blue Vinyl ①
8D.....	Red Vinyl ①
8G.....	Ivy Gold Vinyl ①
8K.....	Aqua Vinyl ①
8L.....	Lt. Silver Cloth and Lt. Silver Vinyl
8U.....	Parchment Vinyl ①
HA.....	Black Leather
LA.....	Black Leather

① Combined with cloth

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**DATE CODES**

A number signifying the date precedes the month code letter. A second-year code letter will be used if the model exceeds 12 months.

Month	Code First Year	Code Second 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

**REAR AXLE RATIO CODES**

A number designates a conventional axle, while a letter designates a locking differential.

Code	Ratio	Code	Ratio
1	3.00:1	A	3.00:1
6	2.80:1	-	-

**TRANSMISSION CODE**

Code	Type
U	Automatic (C6)

**DISTRICT CODES (DSO)**

Units built on a Domestic Special Order, Foreign Special Order, or other special orders will have the complete order number in this space. Also to appear in this space is the two-digit code number of the District which ordered the unit. If the unit is a regular production unit, only the District code number will appear.

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

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# Brakes

GROUP  
**2**

PART 2-1	PAGE	PART 2-3	PAGE
General Brake Service .....	2-1	Specifications .....	2-26
<b>PART 2-2</b>			
Brake System .....	2-8		

## PART 2-1—General Brake Service

Section	Page	Section	PAGE
1 Diagnosis and Testing .....	2-1	Power Brake Master Cylinder Push Rod Adjustment .....	2-5
Brake Systems Tests .....	2-1	Hydraulic System Bleeding and Centralizing of the Differential Valve .....	2-6
Road Test .....	2-1	3 Cleaning and Inspection .....	2-7
Disc Brake Trouble Symptoms and Possible Causes .....	2-3	Front Brakes .....	2-7
Drum Brake Trouble Symptoms and Possible Causes .....	2-4	Rear Brakes .....	2-7
2 Common Adjustments and Repairs .....	2-5	Booster Unit .....	2-7
Parking Brake Linkage Adjustment .....	2-5		

### 1 DIAGNOSIS AND TESTING

#### BRAKE SYSTEM TESTS

##### BRAKE FLUID LEVEL AND HYDRAULIC SYSTEM

Always check the fluid level in the brake master cylinder reservoirs before performing the test procedures. If the fluid level is not within 1/4 to 1/2 inch of the top of the master cylinder reservoirs, add Rotunda Brake Fluid — Extra Heavy Duty — C6AZ19542-A (ESA-M6C25-A). The disc brake extra heavy duty brake fluid is colored for identification purposes. Do not mix low temperature brake fluids with the specified brake fluid.

1. Turn the ignition dual master cylinder brake system switch to the ACC or ON position. If the light on the brake warning lamp remains on, the condition may be caused by a defective switch, grounded switch wires or the differential pressure valve is not centered. Centralize the differential pressure valve as outlined under Bleeding the Brake System in this section.

2. If the brake warning lamp does not light when a pressure differential condition exists in the brake system, the warning lamp may be burned out, the warning lamp switch is inoperative or the switch to lamp wiring has an open circuit. Check the bulb and replace it, if required. Check the switch to lamp wires for an open circuit and repair or replace them, if required. If the warning lamp still does not light, replace the switch.

##### BRAKE PEDAL FREE HEIGHT AND TRAVEL MEASUREMENTS

With the engine running for full power brake operation, measure the brake pedal free height, and check the brake pedal travel with the use of the Brake Pedal Pressure Gauge, Tool WRE-500-50 as follows:

##### Brake Pedal Free Height Measurement

1. Insert a slender, sharp pointed prod through the carpet and sound deadener to the dash panel metal and measure the distance to the brake pedal (Fig. 1).

2. If the position of the pedal is not within specification, check the brake pedal linkage for missing bushings or loose attaching bolts and replace them, if required.

3. If the pedal free height is still out of specification, check the brake pedal booster or master cylinder to be sure the correct parts are installed. Replace the defective parts as necessary.

##### Brake Pedal Travel Measurement

1. Install a Brake Pedal Effort Gauge on the brake pedal pad (Fig. 2).

2. Hook a steel measuring tape to the brake pedal as shown in Fig. 1. Measure and record the distance from the brake pedal free height position to the reference point, which is at the six o'clock position on the steering wheel rim.

3. With the steel tape still hooked to the brake pedal depress the brake pedal by pressing downward on the brake pedal effort gauge. Apply a 50 pound load to the center of the pedal by observing the pressure gauge, and measure the distance from the brake pedal to the fixed reference point on the steering wheel rim parallel to the centerline of the steering column.

4. The difference between the brake pedal free height and the depressed pedal measurement under a 50 pound load should be within the specified maximum pedal travel service specification B in Fig. 1.

5. If the pedal travel is more than the specified maximum shown, in Fig. 1, dimension B, make several sharp reverse stops (equivalent to 50 pounds pedal pressure) with a forward stop before each. Move the vehicle in reverse and forward for a distance of approximately ten feet; then apply the brakes sharply and hold the brake pedal down until the vehicle is completely stopped. This will actuate the brake self-adjusters. If these stops do not bring the brake pedal travel within

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specification, make several additional forward and reverse stops as outlined above.

6. If the second series of stops do not bring the brake pedal travel within specification, remove the brake drums and check the brake adjusters to make sure they are functioning. Check the brake linings for wear or damaged parts and non-functioning adjusters. Adjust the brake lining outside diameter to the approximate inside diameter of the brake drum with Rotunda Tool HRE-8650 (Fig. 11, Part 2-2).

7. If all the brake adjusters, brake drums and linings are functional and the brake travel is not within specifications, check the pedal linkage for missing bushings or loose attachments. Bleed the brakes and centralize the differential valve.

**POWER BRAKE FUNCTIONAL TEST**

1. With the transmission in neutral, stop the engine and apply the parking brake. Depress the brake pedal several times to exhaust all vacuum in the system.

2. 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.

3. With the engine shut off and all vacuum in the system exhausted, 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.

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

**LOCKED WHEEL BRAKE**

Should one of the wheel brakes be locked and the vehicle 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 will not correct the cause of trouble.**

**VACUUM TESTS—VACUUM RELEASE PARKING BRAKES**

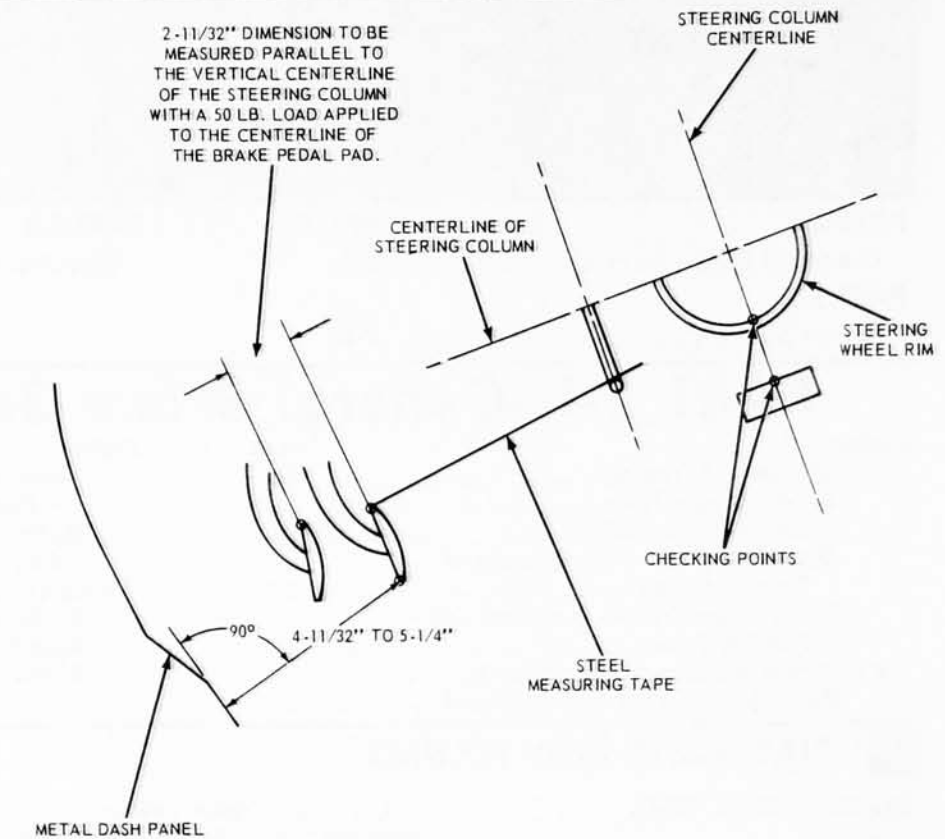
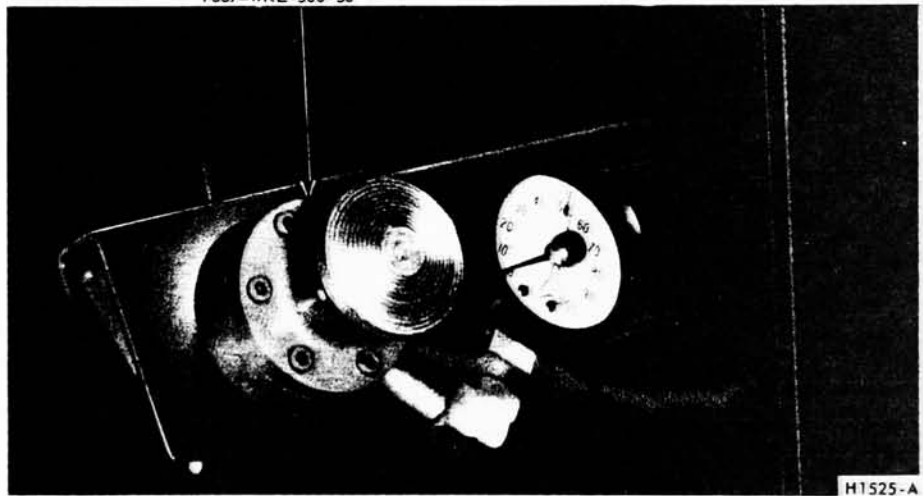


FIG. 1—Brake Pedal Height and Travel Measurements

H1536-A

Tool—WRE-500-50



H1525-A

FIG. 2—Brake Pedal Pressure Gauge Installed

age is operating properly or requires repair or adjustment due to inability of the parking brake to hold against moderate vehicle movement. Perform tests of the parking brake system and controls after making certain the linkage and manual controls operate properly.

Diagnosis of vacuum release systems is basically similar to electrical diagnosis. That is, the vacuum system must be complete from the source to the vacuum components. Any leaks, like a bad connection, will make the system inoperative. If a leak develops in one of the vacuum systems, one or all of the vacuum components may be-

come inoperative. This would be dependent on the location of the vacuum leak. If the leak is in the vacuum supply, all systems will become inoperative. If the leak is in the component side of the vacuum control for the specific system, all other systems will operate when the leaking system is off.

When testing a parking brake vacuum release system, a minimum of 10 inches of vacuum (Hg.) should be available at all points where vacuum is applied. This can be checked with a Rotunda Fuel Pump Tester Gauge (ARE 345) and two Distributor Tester hose adapters (Marked Q) connected to-

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**TROUBLE SYMPTOMS**

<b>POSSIBLE CAUSES OF TROUBLE</b>	Excessive Pedal Travel	Brake Roughness or Chatter (Pedal Pumping)	Excessive Pedal Effort	Pull	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	Brakes for the Respective System Do Not Apply	Pedal Gradually Moves Toward Floor or Dash Panel	Warning Lamp Stays Lit	Warning Lamp Does Not Light
Shoe and Lining Knock-back after Violent Cornering or Rough Road Travel	X												
Shoe and Lining Assembly not Properly Seated or Positioned	X				X				X				
Leak or Insufficient Fluid in System or Caliper	X		X						X		X		
Loose Wheel Bearing Adjustment	X			X									
Damaged or Worn Caliper Piston Seal	X						X		X				
Improper Master Cylinder Push Rod Adjustment	X												
Excessive Rotor Runout or Out-of-Parallel		X											
Incorrect Tire Pressure				X				X					
Frozen or Seized Pistons			X	X		X		X					
Brake Fluid, Oil or Grease on Linings		X	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		X				X					
Metering Valve Seal Leaks								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	X			X						
Bleeder Screw Still Open									X		X		
Caliper Out-of-Parallel with Rotor				X									
One Section Dual Brake System is Inoperative										X		X	
Differential Pressure Valve is Not Centered												X	
Wiring to Warning Lamp Switch is Grounded												X	
Warning Lamp Switch is Grounded												X	
Open Brake Light Switch Circuit													X
Shorted Brake Light Switch Circuit													X
Open Brake Light Switch Circuit													X
Shorted Brake Light Switch Circuit													X



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Symptoms and Possible Cause

TROUBLE SYMPTOMS

POSSIBLE CAUSES OF TROUBLE	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	Brakes For the Respective System Do Not Apply	Warning Lamp Stays Lit	Pedal Gradually Moves Toward Floor or Dash Panel	Warning Lamp Does Not Light
Mechanical Resistance at Pedal or Shoes		X	X														
Brake Line Restricted	X	X	X		X												
Leaks or Insufficient Fluid				X				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 Shoe Sideways											X						
Cracked Drum								X									
One Section Dual Brake System is Inoperative														X	X		
Pressure Valve is Not Centered															X		
															X		
															X		
																	X

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FIG. 4—Drum Brake (and General System) Trouble Symptoms and Possible Causes

gether with a coupling. This allows the Fuel Pump Tester Gauge to be adapted to any other vacuum hose or rubber connector in the vacuum systems.

Failure to maintain 10 inches of vacuum (Hg.) during vacuum system tests could be caused by a bad hose connection, resulting in a vacuum leak. When checking for vacuum between two points, trace the hose along the entire routing to be sure it is not crossed with another hose and connected to the wrong connection.

All of the vacuum parking brake release checks are to be performed with the engine running at idle speed.

Leaks in the parking brake hoses or a disconnected or improperly connected hose can usually be found by listening for a hissing sound along

the hose routings. **Under no circumstances should air pressure be applied to the vacuum system as the actuator diaphragm in the parking brake vacuum motor may be damaged.**

1. Start the engine and run it at idle speed. With the transmission shift control in neutral, depress the parking brake pedal and apply the parking brake. Move the transmission shift control to drive range and observe the parking brake pedal to see that the pedal moves upward and the parking brake releases. If the parking brake releases, the parking brake vacuum control is working properly.

2. If the parking brake does not release, start the engine. Test for vacuum at the steering column neutral switch port in the left junction block,

vacuum lines and the parking brake release vacuum motor. Use the Rotunda Vacuum and Fuel Pump Tester ARE 345. This can be accomplished by removing the hose from each component and attaching it to the vacuum gauge. Connect two distributor tester vacuum hose adapters together with a coupling as a connector to attach the gauge. A minimum of ten inches of vacuum is required to actuate the parking brake vacuum motor. **Do not remove any of the vacuum hoses from the junction block unless the junction block is being replaced, as the plastic nipples are thin and very brittle and damage may result.** If a minimum reading is not present when checking each of the aforementioned components, they must be replaced.

## 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 vehicle.

3. Depress the parking brake pedal 1 1/4 inch from its normal released position.

4. Turn the adjusting nut forward against the equalizer (Fig. 5) until a moderate drag is felt when turning the rear wheels (approximately 100 lbs of force at the outside diameter of the tire is required to turn the rear wheels).

5. Release the parking brake, and check to make sure that the brake shoes return to the fully released position.

6. Depress the parking brake pedal 1 1/2 inches. Under normal conditions, this will satisfactorily hold the vehicle.

7. Release the parking brake again, and check as in step 5.

8. Depress the pedal 1/2 inch. The brakes should not drag.

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

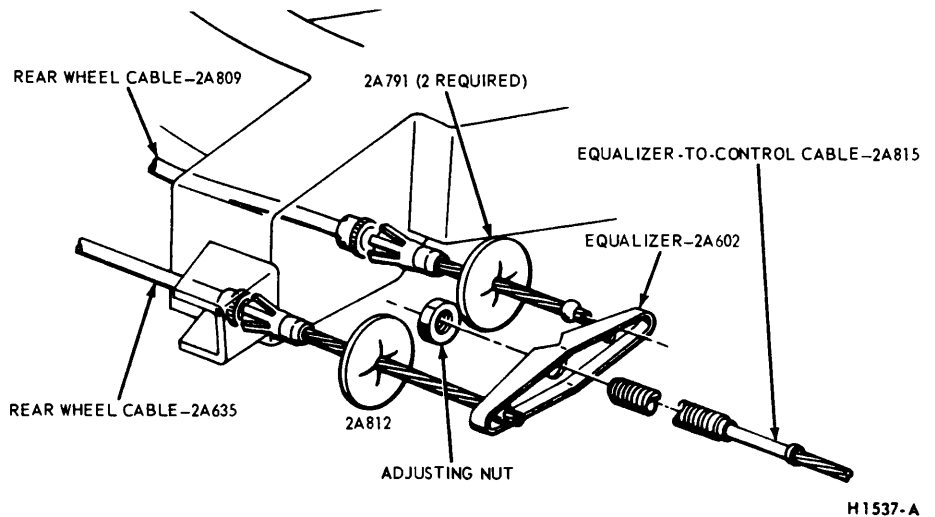


FIG. 5—Parking Brake Adjustment

rect 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. The distance from the end of the adjustment screw to the mounting surface of the booster body can be checked either with a micrometer depth gauge to a dimension of 0.980, 0.995 inch, or with a height gauge as shown in Fig. 6. The details for making a height gauge are given in Fig. 7.**

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

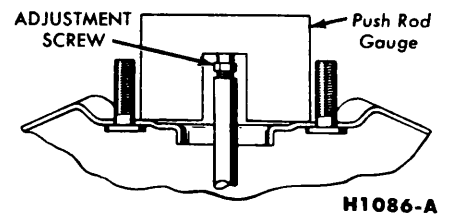


FIG. 6—Push Rod Adjustment

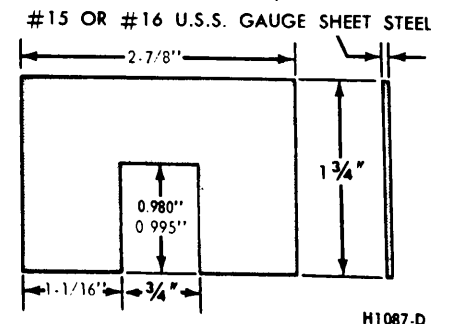


FIG. 7—Push Rod Gauge Dimensions

### POWER BRAKE MASTER CYLINDER PUSH ROD ADJUSTMENT



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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 AND CENTRALIZING OF THE DIFFERENTIAL VALVE

When any part of the hydraulic system has been disconnected for repair or replacement, air may enter the system and cause spongy pedal action. Bleed the hydraulic system after it has been properly connected, to be sure that all air is expelled.

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

After a brake hydraulic system malfunction has been corrected and the hydraulic system has been bled, the dual-brake warning lamp will usually continue to burn when the ignition switch is turned to ON. This is due to the pressure differential created during the bleeding operation, causing the valve to move to an off-center position (low pressure side). This depresses the warning lamp switch plunger, closing the contact points which turn on the brake warning light. The differential valve will remain off-center and the warning lamp will remain lit until the valve is centralized. When the valve is centralized the spring loaded switch plunger drops into the groove in the valve and the warning light switch continuity is broken at the switch contact points. To centralize the valve a pressure differential must again be created on the side opposite the brake hydraulic system that was bled last. For example: If the primary (front brake) system was bled last, the pressure differential (reduced pressure) required to centralize the valve will be created on the secondary system (rear brake) side of the differential valve.

#### PRESSURE BLEEDING

Bleed the longest lines first. The bleeder tank should contain enough new Rotunda Brake Fluid to complete the bleeding operation. Use Rotunda Extra Heavy Duty —

the hydraulic system. The tank should be charged with approximately 10 to 30 pounds of air pressure. **Never exceed 50 pounds pressure.**

1. Clean all dirt from the master cylinder reservoir cover.

2. Remove the master cylinder reservoir cover and rubber gasket, and fill the master cylinder reservoir with the specified brake fluid. Install the pressure bleeder adapter tool to the master cylinder, and attach the bleeder tank hose to the fitting on the adapter.

Master cylinder pressure bleeder adapter tools can be obtained from the various manufacturers of pressure bleeding equipment. Follow the instructions of the manufacturer when installing the adapter.

3. Loosen the bleed screw, located on the side of the master cylinder, and bleed the master cylinder until the fluid is free of air bubbles; then, tighten the bleed screw.

4. If the rear wheel cylinders and the secondary brake system is to be bled, position a 3/8 inch box wrench (Fig. 8) on the bleeder fitting on the right rear brake wheel cylinder. Attach a bleeder tube to the bleeder fitting. The end of the tube should fit snugly around the bleeder fitting.

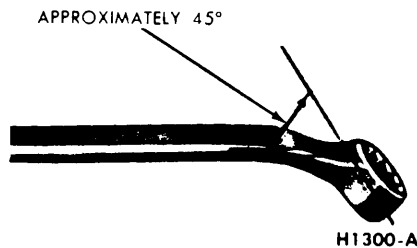


FIG. 8—Wrench for Bleeding Brake Hydraulic System

5. Open the valve on the bleeder tank to admit pressurized brake fluid to the master cylinder reservoir.

6. Submerge the free end of the tube in a container partially filled with clean brake fluid, and loosen the bleeder fitting.

7. When air bubbles cease to appear in the fluid at the submerged end of the bleeder tube, close the bleeder fitting and remove the tube.

8. Repeat steps 3 through 7 at the left wheel cylinder of the secondary system being bled.

9. If the primary (front brake) system is to be bled, remove the front wheel covers, and the front wheel and tire assemblies to gain access to the bleeder fittings on the disc brake calipers. Repeat steps 4 through 7, starting at the right front disc caliper and ending at the left front disc caliper.

10. When the bleeding operation

is completed, close the bleeder tank valve and remove the tank hose from the adapter fitting.

11. Be sure that the front brake pistons are returned to their normal positions and that the shoe and lining assemblies are properly seated by depressing the brake pedal several times until normal pedal height exists. Install the front wheel and tire assemblies on the front wheels, and torque the mounting bolts to specification. Install the wheel covers.

12. Remove the Pressure Bleeder Adapter Tool. Fill the master cylinder reservoirs to within 1/4 to 1/2 inch from the top. Install the master cylinder cover and gasket. **Be sure the diaphragm type gasket is properly positioned in the master cylinder cover.**

13. Centralize the pressure differential valve as follows:

#### CENTRALIZING THE PRESSURE DIFFERENTIAL VALVE

After a failure of the primary (front brake) or secondary (rear brake) system has been repaired and bled, the dual-brake warning light will usually continue to be illuminated due to the pressure differential valve remaining in the off-center position. Front wheel balancing operations can also cause a pressure differential in the primary (front) brake system, illuminating the brake warning light.

To centralize the pressure differential valve and turn off the warning light after a repair operation, a pressure differential or unbalance condition must be created in the opposite brake system from the one that was bled last.

1. Turn the ignition switch to the ACC or ON position. Loosen the differential valve assembly brake tube nut at the outlet port on the opposite side of the brake system that was wheel balanced, repaired and/or bled last. Depress the brake pedal slowly to build line pressure until the pressure differential valve is moved to a centralized position and the brake warning light goes out; then, immediately tighten the outlet port tube nut.

2. Check the fluid level in the master cylinder reservoirs and fill them to within 1/4 to 1/2 inch of the top with the specified brake fluid, if necessary.

3. Turn the ignition switch to the OFF position.

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

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### 3 CLEANING AND INSPECTION

#### FRONT BRAKES

1. Remove the wheel and tire, brake shoe retainers, and the shoe and linings 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 0.231 inch (Shoe and lining together) or 0.066 inch (Lining material only) at any one of the three measuring locations, or if the lining shows evidence of brake fluid or oil contamination, replace all (4) shoe and linings on both front wheels.

3. Check caliper to spindle attaching bolt and caliper bridge bolt torque. Torque them to specification if required.

4. To check rotor runout, first eliminate the wheel bearing end play by tightening the adjusting nut to 5 inch pounds torque. 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 lateral runout on the indicator, replace or resurface the disc brake rotor. **The following requirements must be met when resurfacing disc brake rotors:**

Rotunda Disc Brake Attachment FRE-2249-2 is the **only approved** tool to be used to refinish the disc brake rotors. The step-by-step resurfacing procedure provided with the tool must be adhered to.

The finished braking surfaces of the rotor must be flat and parallel within 0.0007 inch; lateral runout must not exceed 0.002 inch total indicator reading, and the surface finish of the braking surfaces are to be 85/15 micro inches. **The minimum limiting dimensions (Fig. 9) from the inboard bearing cup to the inboard rotor face (dimension B) and the outboard rotor surface and the inboard**

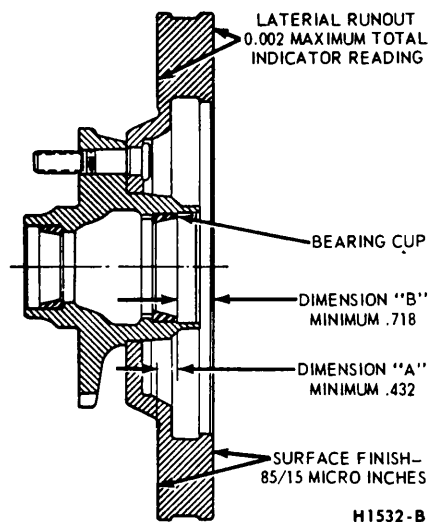


FIG. 9—Disc Brake Rotor Service Limits

bearing cup (dimension A) must be observed when removing material from the rotor braking surfaces.

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, refinish it as outlined in step 5 or replace the rotor, if required.

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

8. If upon disassembly the caliper is found to be 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.**

9. Check brake hoses for signs of cracking, leaks, or abrasion. Replace if necessary.

#### 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 backing 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 contaminated with oil, grease or brake fluid. Replace the lining in axle sets (4). Prior to relining in axle sets (4). Prior to replacement of the lining, the drum diameter should be checked to determine if over-size 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 and the parking brake cable 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

Check the booster operation as noted in Part 2-1, Section 1, Power Brake Functional Test. If the brake booster is damaged or is inoperative, the complete booster must be replaced.

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# PART 2-2—Brake System

Section	Page		
<b>1 Description and Operation</b> .....	2-8		
Dual-Master Cylinder Brake System .....	2-8		
Disc Brake Assemblies - Front Wheels .....	2-10		
Self Adjusting Brake Assemblies—Rear Wheels .....	2-11		
Booster System .....	2-12		
Parking Brakes .....	2-12		
<b>2 In-Car Adjustments and Repairs</b> .....	2-12		
Front (Disc) Brake Shoe and Lining Replacement .....	2-12		
Disc Brake Caliper Assembly .....	2-13		
Front Wheel Hub and Rotor Assembly .....	2-14		
Disc Brake Rotor Splash Shield .....	2-14		
Proportioning Valve .....	2-14		
Brake Shoe Adjustments—Rear Wheels .....	2-14		
Rear Brake Drum .....	2-14		
Rear Brake Shoe Replacement .....	2-15		
Rear Wheel Cylinder Repair .....	2-16		
Rear Wheel Cylinder Replacement .....	2-16		
Rear Brake Backing Plate Replacement .....	2-17		
		Hydraulic Lines .....	2-17
		Brake Hose Replacement .....	2-17
		<b>3 Removal and Installation</b> .....	2-19
		Dual-Master Cylinder—Power Brakes .....	2-19
		Pressure Differential Valve Assembly .....	2-19
		Brake Booster .....	2-20
		Brake Pedal .....	2-20
		Parking Brake Control Assembly .....	2-20
		Parking Brake Vacuum Power Unit .....	2-21
		Parking Brake Actuator-To-Control Assembly Cable .....	2-21
		Parking Brake Equalizer-To-Rear Wheel Cable .....	2-21
		Parking Brake Actuator-To-Equalizer Cable .....	2-21
		<b>4 Major Repair Operations</b> .....	2-23
		Brake Drum Refinishing .....	2-23
		Rotor Refinishing .....	2-23
		Rear Brake Shoe Relining .....	2-23
		Dual-Master Cylinder .....	2-23
		Disc Brake Caliper .....	2-24

## 1 DESCRIPTION AND OPERATION

The 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 dual-master cylinder and a booster as standard equipment.

### DUAL-MASTER CYLINDER BRAKE SYSTEM

The dual-master cylinder brake system has been incorporated in all vehicle models to provide increased vehicle safety. The system consists of a dual-master cylinder, pressure differential valve assembly and a switch. The switch on the differential valve activates a dual-brake warning light, located on the instrument panel.

The dual-master cylinder brake system is similar to a conventional (single) brake master cylinder system. In the dual-system, two master cylinders are combined in a single cast iron casting (Fig. 1). One portion actuates the primary (front) brake system and the other actuates the secondary (rear) brake system (Fig. 1). Hydraulic fluid leakage or failure of one of the systems does not impair the operation of the other portion of the dual-brake system. A dual-brake warning light indicates a failure of either the

bleed screws are located in the outboard side of the master cylinder casting.

The code letter A is stamped on the end of the master cylinder body casting for easy service identification.

A brake pressure differential valve assembly (Fig. 2) incorporating a hydraulically operated mechanical switch is utilized to operate a dual-brake warning light, located on the instrument panel to the right of the clock.

Brake tubes are connected from the dual-master cylinder front (primary) and rear (secondary) brake systems to the pressure differential valve.

The pressure differential valve is mounted vertically on the frame side rail. The primary (front) brake system outlet tubes are connected to the ports located in the upper side of the differential valve assembly and the secondary (rear) brake system outlet tubes are connected to the ports located in the lower side of the differential valve assembly.

Hydraulic pressure for both rear wheel brakes is provided from the single secondary (rear) brake outlet line, located opposite the secondary system inlet port of the differential valve. A proportioning valve is located in the secondary (rear) brake system line that leads to the brake hose bracket on the rear axle housing. The brake hose bracket serves as a junction point for the individual brake lines that lead to the wheel

cylinders of right and left rear brake components.

### OPERATION

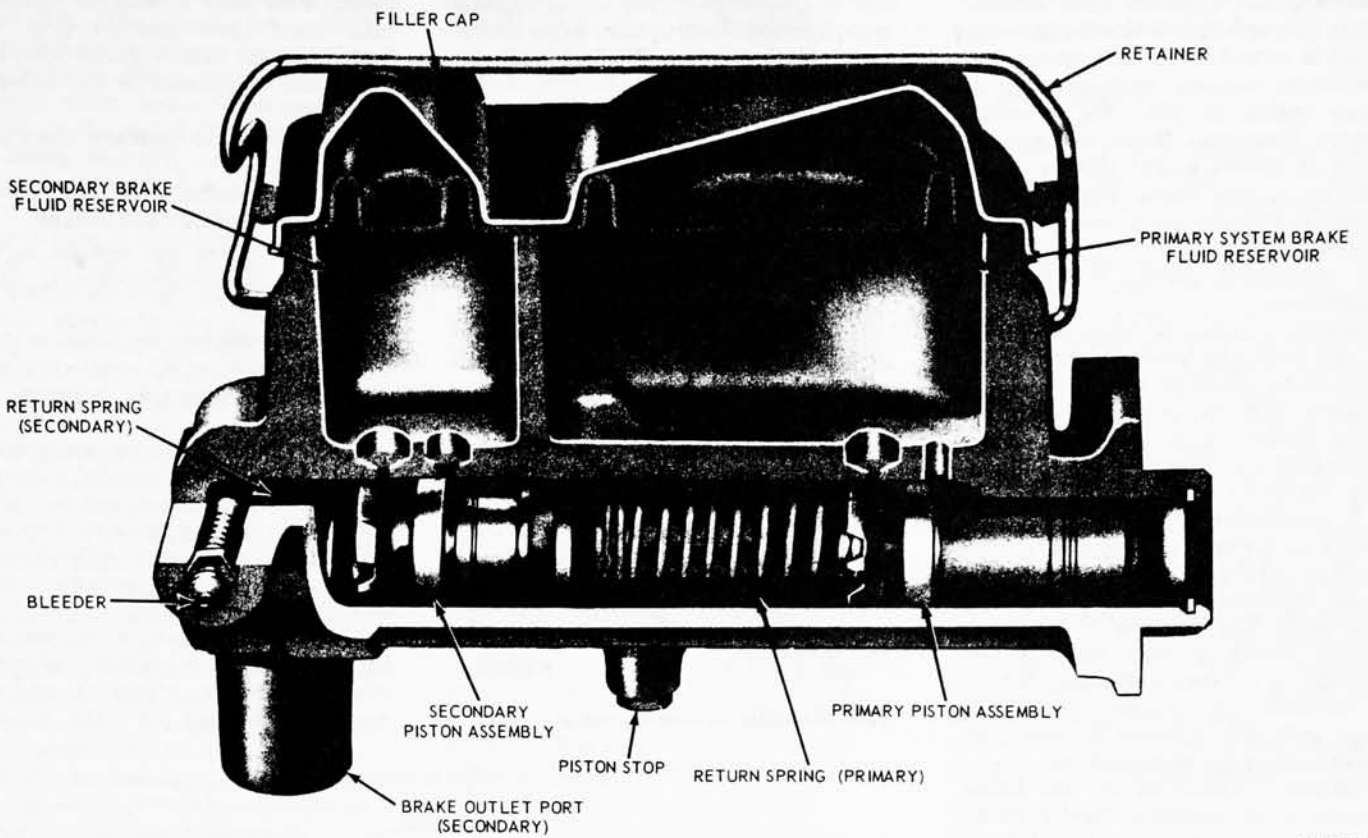
When the brake pedal is depressed, both the primary (front brake) and secondary (rear brake) master cylinder pistons are moved simultaneously to exert hydraulic fluid pressure on their independent hydraulic system. The fluid displacement of the dual-master cylinders is proportioned to fulfill the requirements of each of the two independent hydraulic brake systems (Fig. 1).

If a failure of the rear (secondary) brake system should occur, initial brake pedal movement causes the unrestricted secondary piston to bottom in the master cylinder bore. Primary piston movement displaces hydraulic fluid in the primary section of the dual-master cylinder to actuate the front brake system.

Should the front (primary) brake system fail, initial brake pedal movement causes the unrestricted primary piston to bottom out against the secondary piston. Continued downward movement of the brake pedal moves the secondary piston to displace hydraulic fluid in the rear brake system, actuating the rear brakes.

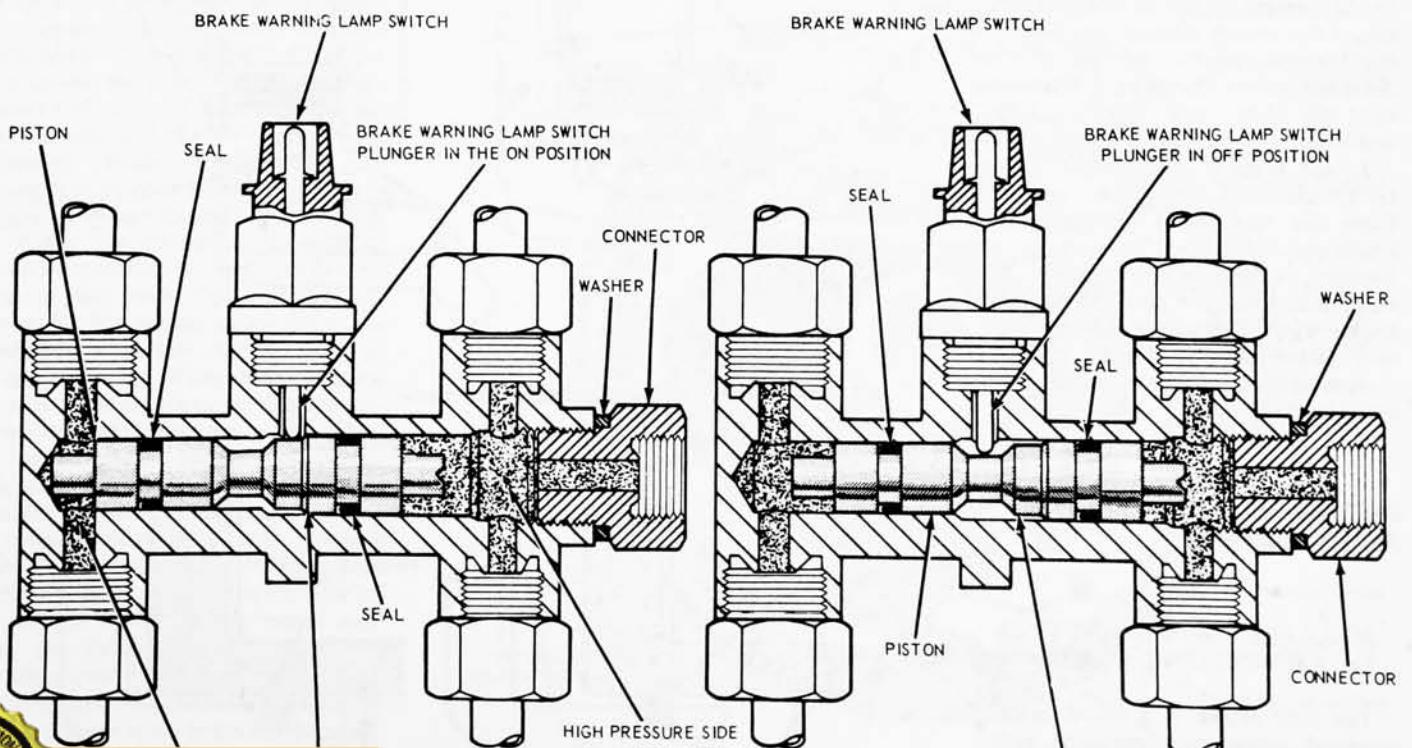
The increased pedal travel and the increased pedal effort required to compensate for the loss of the failed portion of the brake system provides





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FIG. 1—Dual-Master Cylinder



H1471-A

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... PRESSURE AREA... IS DEPRESSED... NG LAMP

BRAKE FLUID

VALVE PISTON IS CENTRALIZED. PRIMARY AND SECONDARY SYSTEM PRESSURES ARE EQUALIZED

... and Brake Warning Lamp Switch Operation — Typical

a warning that a partial brake system failure has occurred. When the ignition switch is turned to the **start** position a dual-brake warning light provides a visual indication that the warning lamp is functional. When the ignition switch is turned to the **ON** or **ACC** position, a dual-brake warning light on the instrument panel also provides a visual indication if one portion of the dual-brake system has become inoperative.

Should a failure of either the front or rear brake hydraulic system occur, the hydraulic fluid pressure differential resulting from the pressure loss of the failed brake system forces the valve toward the low pressure area to illuminate the brake warning light (Fig. 2).

A mechanically operated electrical switch is located on the side of the pressure differential valve assembly between the front and rear brake system inlet ports. The inner-end of the spring loaded switch plunger contacts the bottom of a tapered shoulder groove in the center of the valve (Fig. 2). O-ring seals are retained in seal ring lands near each end of the valve.

Should a failure of the rear brake system occur, hydraulic fluid pressure in the rear brake system would drop. During brake pedal operation the fluid pressure build-up of the front brake system forces the valve to move toward the low pressure area, or toward the rear brake system outlet port (Fig. 2). Movement of the differential valve forces the switch plunger upward over the tapered shoulder of the valve to close the switch electrical contacts and light the dual brake warning lamp, signalling a brake system failure.

In the event a front brake system failure should occur, greater pressure from the rear brake system during brake pedal operation forces the valve forward, moving the switch plunger upward onto the valve ramp to light the brake system warning lamp. However, **failure of either the front or rear system does not impair operation of the other brake system.**

ing two cylinder bores of 1 15/16 inch diameter. Each cylinder bore contains a piston with an attached molded

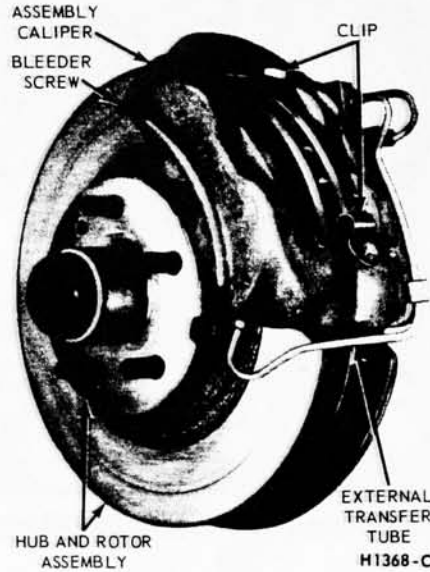


FIG. 3—Disc Brake Assembly

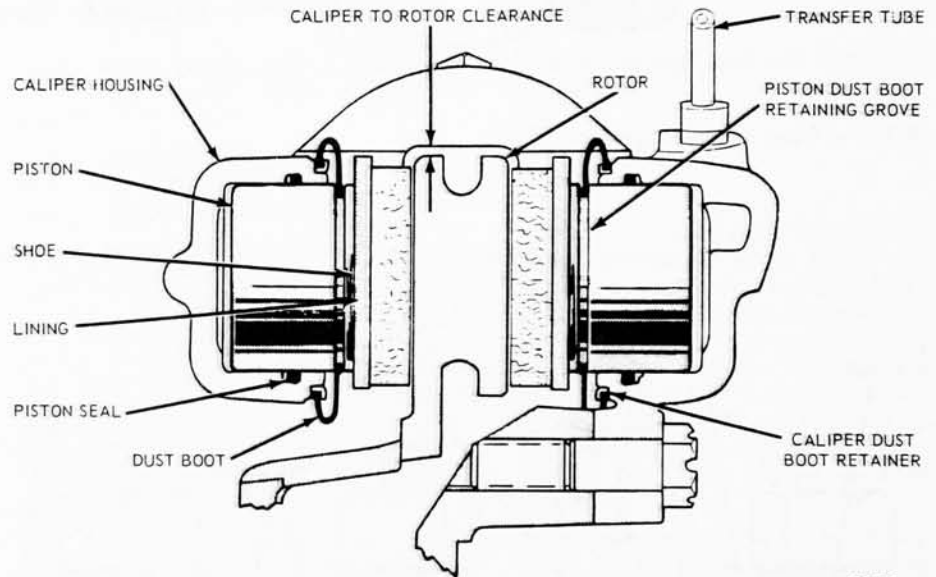
rubber dust boot to seal the cylinder bore from contamination (Fig. 4). Square-section rubber piston seals are positioned in grooves in the cylinder bores.

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



H1369-A

FIG. 4—Caliper Assembly-Sectional View

**DISC BRAKE ASSEMBLIES — FRONT WHEELS**

**RELATION AND FUNCTION OF COMPONENT PARTS**

...brake is a fixed caliper

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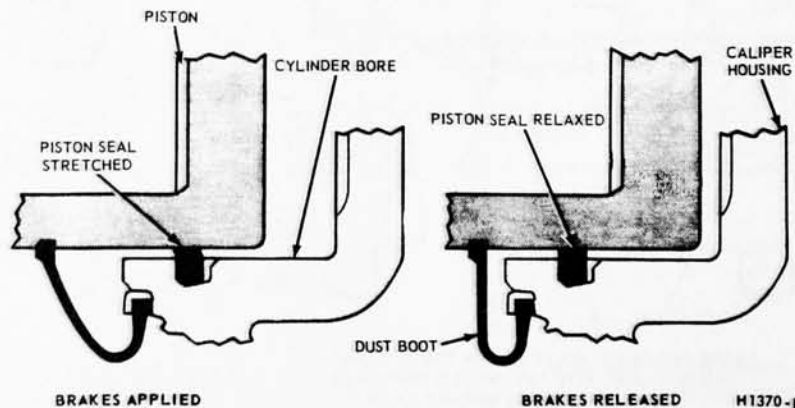


FIG. 5—Function of Piston Seal

H1370-B

outer ends of the shoe assemblies (Figs. 9 and 22). 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. 9). 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. 22). Two spring clips are attached to the top of the caliper to retain the shoe and lining assemblies. 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 fins and is attached to, and rotates with, the wheel hub. The outside diameter of the rotor is 11.960 inches and the inside diameter is 7.785 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. 10). The wheel provides protection for the outboard surface of the rotor.

### 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. 5). 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, provides 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 condition, there is no hydraulic pressure

(primary) and rear (secondary) brake systems under the full range of braking conditions. 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. 6). 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.

### OPERATION

With the vehicle moving rearward and 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 vehicle moving forward and the brakes applied, the secondary shoe

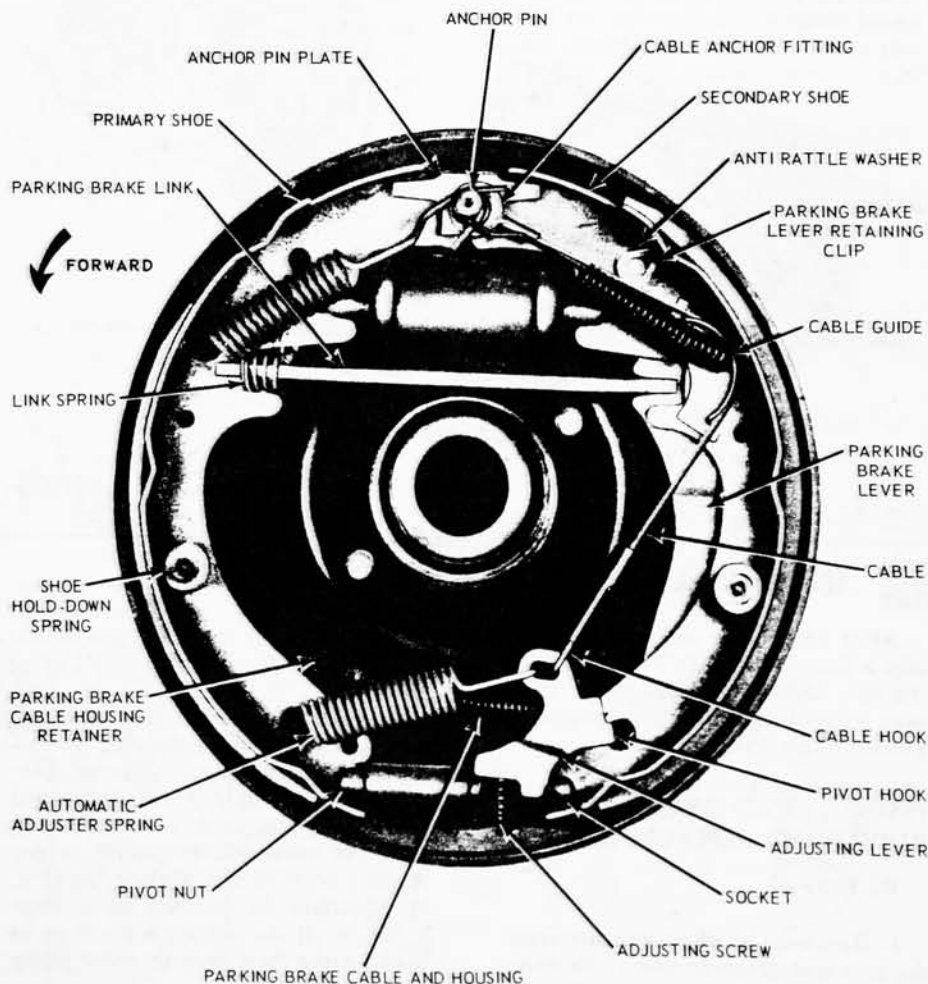


FIG. 6—Thunderbird Self Adjusting Brake Assembly-Rear Wheel

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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

The tandem diaphragm type booster 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. **Adjustment of the push rod is the only service permitted on this booster. The booster unit is to be exchanged when it is determined to be defective.**

### PARKING BRAKES

An independent foot-operated parking brake control (Fig. 7) 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 (Fig. 5, Part 2-1). The rear brake cables connect the equalizer assembly to the parking brake lever at each rear secondary shoe (Figs. 7 and 19).

### OPERATION

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 spring action on a pinion (Fig. 7).

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.

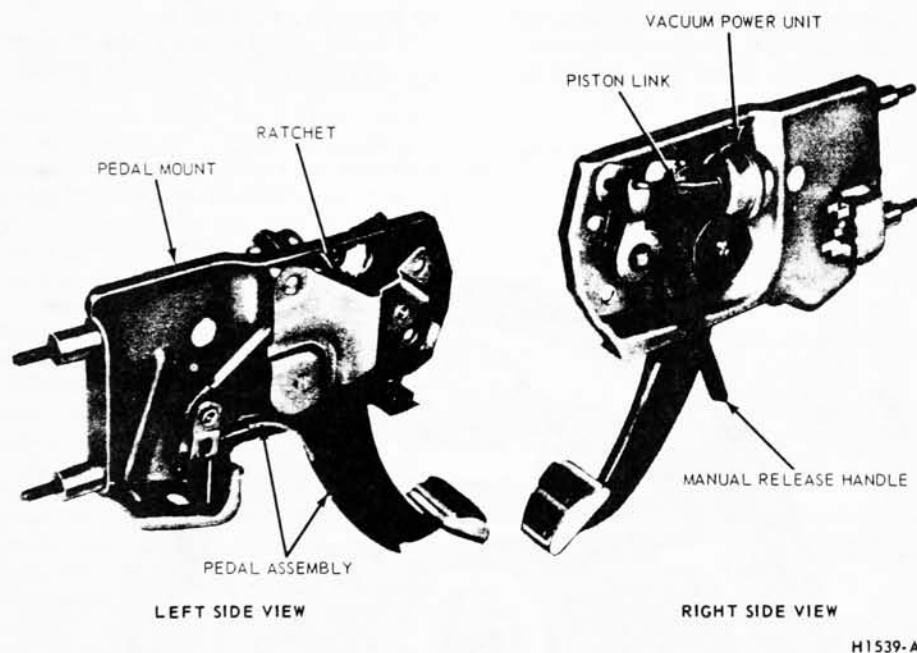


FIG. 7—Parking Brake Control Assembly

## 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 ADJUSTING REPLACEMENT

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2. Remove the two bolts that attach brake shoe retaining clips shield (Fig. 3).

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. 4). 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

The parking brake control assembly is mounted to the left cowl side panel (Fig. 19). The pedal assembly pivots on a stationary pedal mount (Fig. 7). The release lever is actuated automatically by the vacuum control or by a manual release handle which is connected to the lever through a slot and rivet pin (Fig. 7).

The vacuum release 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 spring out of the locked position (Fig. 7). The lower end of the release handle extends out for alternate manual release in the event of vacuum release failure or for optional manual release at any time.

Hoses connect the release unit and the engine manifold to a vacuum release valve in the transmission neutral safety switch (Figs. 7 and 8). 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.

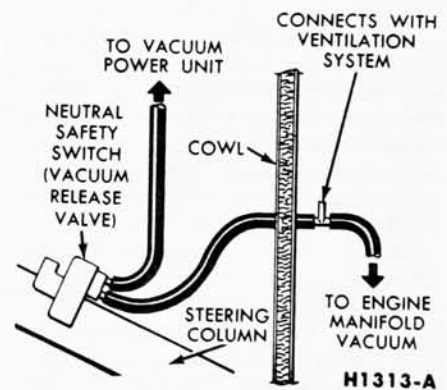


FIG. 8—Connections for Automatic Parking Brake Release

pliers and pull the shoe out of the caliper (Fig. 9).

### CLEANING AND INSPECTION

### INSTALLATION

When new shoe and lining assemblies are being installed to replace worn linings it will be necessary to push the pistons all the way into the caliper bores. This will displace fluid from the caliper into the master cylinder reservoir. Check primary (front) brake system reservoir level and remove



## FRONT WHEEL HUB AND ROTOR ASSEMBLY

### REMOVAL

1. Remove the wheel and tire from the hub and rotor assembly (Fig. 10). **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, scratching or contamination 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. 10).

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. Refer to the manual for specific instructions on**

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. 10).

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. 10).

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

## PROPORTIONING VALVE

### REMOVAL

1. Disconnect and remove the differential pressure valve - to proportioning valve brake tube (Fig. 18).

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

3. Remove the bolt that attaches the proportioning valve to the frame and remove the valve (Fig. 17).

### INSTALLATION

1. Install the proportioning valve on the frame. Position the valve to the apron so that the differential valve to proportioning valve brake tube is connected to the valve inlet stamped M and the front-to-rear brake tube is connected to the outlet stamped R. Fig. 17. Install the retaining bolt and bracket.

2. Connect the front-to-rear brake tube to the valve (Fig. 18).

3. Position and connect the differential pressure valve - to - proportioning valve brake tube.

4. Bleed the brake system and centralize the differential valve. (Refer to Part 2-1, Section 2 for the correct procedure.)

## BRAKE SHOE ADJUSTMENTS—REAR WHEELS

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

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 manual adjustment is performed with the drums removed, using the tool and the procedure detailed below.**

To adjust the brake shoes:

1. Using Rotunda Tool HRE 8650, (Fig. 11) determine the inside diameter of the drum braking surface.

2. Reverse the tool as shown in Fig. 11 and adjust the brake shoe diameter to fit the gauge. Hold the automatic adjusting lever out of engagement while rotating the adjustment screw, to prevent burring the screw slots. Make sure the adjusting screw rotates freely. If necessary, lubricate the adjusting screw threads with a thin, uniform coating of CIAZ-19590-B Grease.

3. Rotate Tool HRE 8650 around the brake shoes to be sure of the setting.

4. Apply a small quantity of high temperature grease to the points where the brake shoes contact the carrier plate, being careful not to get the lubricant on the linings.

5. Install the brake drum.

6. Install the three Tinnerman nuts and tighten securely.

7. Install the wheel on the drum and tighten the mounting nuts to specification.

8. Complete the adjustment by making several sharp reverse stops with a forward stop before each.

9. Check the adjustment by making several stops while operating in a forward direction.

## REAR BRAKE DRUM

### REMOVAL

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

2. Remove the wheel cover 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. 12). **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-adjust-**



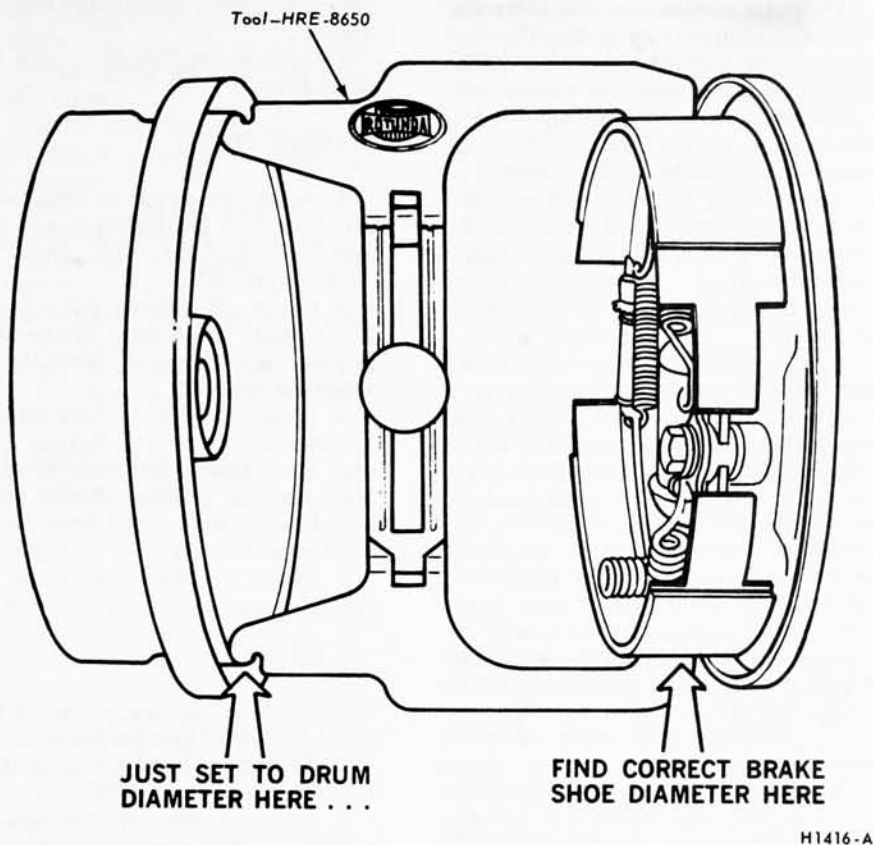


FIG. 11—Adjusting Brake Shoes, Using Tool HRE—8650

ing mechanism will not function properly. If the adjustment was changed, make certain that the adjuster lever is properly seated in the shoe web.

#### INSTALLATION

1. Remove the protective coating from a new drum with carburetor degreaser. Then sand lightly and wipe with a cloth soaked with denatured alcohol.

2. Adjust the brakes as outlined under Brake Shoe Adjustments in this section and install the brake drum.

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 wheel cover

4. Complete the brake adjustment by making several sharp reverse stops with a forward stop before each. Check the adjustment by making several stops while operating the vehicle in a forward direction.

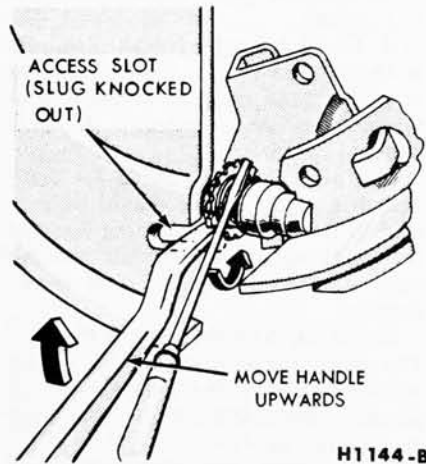


FIG. 12—Backing off Brake Adjustment

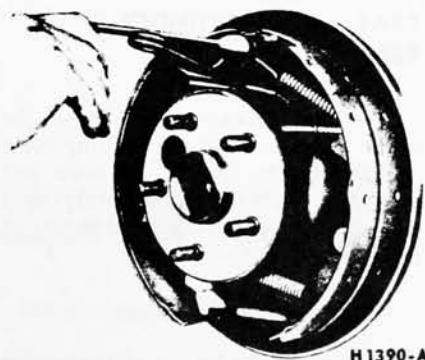


FIG. 13—Removing Retracting Spring

2. Remove the adjusting spring and adjusting lever. Remove the primary shoe-to-anchor spring with the tool shown in Fig. 14. With the same tool, remove the secondary shoe-to-anchor spring and unhook the cable eye from the anchor pin.

3. Remove the anchor pin plate.

4. Remove the cable guide from the secondary shoe (Fig. 6).

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

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

7. After removing the secondary shoe, disassemble the parking brake lever from the shoe by removing the retaining clip and spring washer (Fig. 6).

#### 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. 6).

4. Install 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. 6). **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. 14).

8. Install the primary shoe to anchor spring with the tool shown in Fig. 14.

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

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 1/2 turn.

REAR BRAKE SHOE  
REPLACEMENT

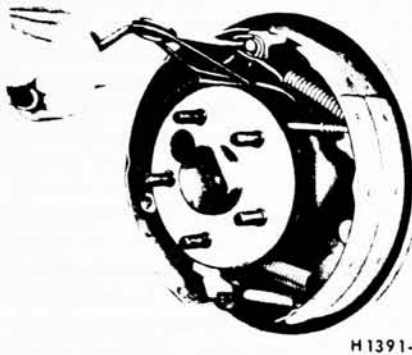


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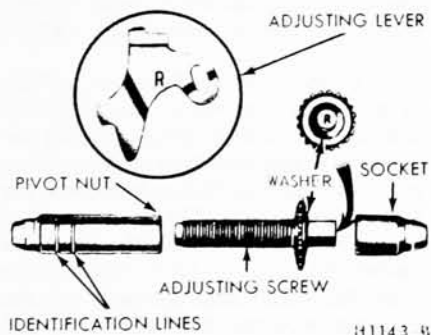


Interchanging the brake shoe adjusting screw assemblies from one side of the car to the other would cause the brake shoes to retract rather than expand each time the automatic adjusting mechanism operated. To prevent installation on the wrong side of the car, the socket end of the adjusting screw is stamped with an R or L (Fig. 15). The adjusting pivot nuts can be distinguished by the number of grooves machined around the body of the nut. Two grooves on the nut indicate a right thread, one groove indicates a left thread.



H1391-A

FIG. 14—Installing Retracting Spring



H1143 B

FIG. 15—Adjusting Screw and Lever Identification

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 brake assembly (Fig. 15).

12. Position the hooked end of the adjuster spring completely into the hole in the primary shoe web. The other end of the spring should be at the

14. After installation, check the action of the adjuster by pulling the section of the cable between the cable guide and the anchor pin 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  $11 \frac{1}{8}$  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.

### REAR WHEEL CYLINDER REPAIR

It is not necessary to remove the brake cylinder from the backing 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 re-

turn spring from the cylinder bore (Fig. 16).

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. 16). 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 cover, wheel and 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 attaching 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 cy-

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linder, and start the tube fitting nut into the threads of the cylinder.

2. Secure the cylinder to the carrier plate by installing the attaching bolts and lock washers.

3. Tighten the tube fitting nut to specification with Milbar tool 1112-144 or its equivalent.

4. Install the links in the ends of the brake cylinder, install the shoe and adjuster assemblies, and adjust the shoes as outlined in this section.

5. Install the brake drum, wheel and cover. Bleed the brakes and centralize the differential valve as outlined in Part 2-1, Section 2.

## REAR BRAKE BACKING PLATE REPLACEMENT

### REMOVAL

1. Remove the wheel cover, 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 lines up with the backing plate attaching nuts and remove the nuts. Pull the axle shaft assembly out of the housing with tool 4235C and a slide hammer (Part 4-2). **Be careful not to damage the axle seal by allowing the shaft to slide across it.** Then remove the backing plate.

### INSTALLATION

1. Position a new rear backing plate on the attaching 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 attaching bolts and against the backing plate. Install the attaching 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). Bleed the brake system and centralize the differential valve 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. 17).

Always bleed the entire system and centralize the differential valve 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 must 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 double flared properly to provide good leak-proof connections. Clean the brake tubing by flushing with clean brake fluid 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 112-144 or equivalent.

## BRAKE HOSE REPLACEMENT

Refer to Fig. 17 for an illustration of the brake system.

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

A properly installed brake hose should have clearance to all components during front and rear suspension bounce, rebound and full inside and outside turns.

## FRONT BRAKE HOSE — DISC BRAKES

### Removal

1. Open the hood. Raise the vehicle on a hoist.

2. Remove the front wheel cover. Remove the front wheel and tire as an assembly.

3. Disconnect the front brake hose at the brake line and remove the clip retaining the brake hose to the bracket. Remove the brake hose from the bracket.

4. Remove the bolt retaining the brake hose bracket and caliper assembly to the spindle, and remove the brake hose bracket.

5. Disconnect the steel tube from the caliper and brake hose connector. Remove the brake hose and bracket assembly.

### Installation

1. Position the brake hose bracket to the spindle, and install and torque the bracket and caliper retaining bolts to specification.

2. Connect the caliper steel line to the hose connector, and caliper. Torque to specification.

3. Position the brake hose to the bracket on the frame side rail; making sure the stripe on the hose is straight to prevent twisted hose. Install the clip, and connect the brake line to the hose and torque it to specification.

4. Bleed the front brake system and centralize the differential valve (Part 2-1, Section 2).

5. Install the wheel and tire assembly. Install the front wheel cover.

6. Lower the vehicle and close the hood.

## REAR BRAKE HOSE

### Removal

1. Raise the vehicle.

2. Disconnect the rear brake hose at the steel tubing.

3. Remove the clip retaining the brake hose to the bracket.

4. Disconnect the two steel tubes at the rear brake hose connector.

5. Remove the connector bracket to rear axle housing retaining bolt.

### Installation

1. Position the hose, connector and bracket assembly at the axle and install the connector bracket retaining bolt. Tighten the retaining bolt.

2. Connect the two steel tubes to the brake connector and tighten the retaining nuts to specifications.

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3. Position the rear brake hose in the bracket and install the retaining-clip. The hose should be installed so that it does not touch the muffler outlet pipe or shock absorber.

4. Connect the steel tube to the hose and tighten the nut to specification.

5. Bleed the rear brake hydraulic system and centralize the differential valve (Part 2-1, Section 2).

6. Lower the vehicle and close the hood.

### 3 REMOVAL AND INSTALLATION

#### DUAL-MASTER CYLINDER POWER BRAKES

##### REMOVAL

1. Remove the brake tubes from the primary and secondary outlet ports of the master cylinder.

2. Remove the two nuts and two lock washers attaching the master cylinder to the brake booster assembly.

3. Slide the master cylinder forward and upward from the vehicle.

##### INSTALLATION

1. Before installing the master cylinder, check the distance from the outer end of the booster assembly push rod to the master cylinder mounting surface. Turn the push rod adjusting screw in or out as required to obtain the specified length (Refer to Figs. 6 and 7, Part 2-1, Section 2).

2. Position the master cylinder assembly over the booster push rod and onto the two studs on the booster assembly.

3. Install the attaching nuts and lockwashers and torque them to specifications.

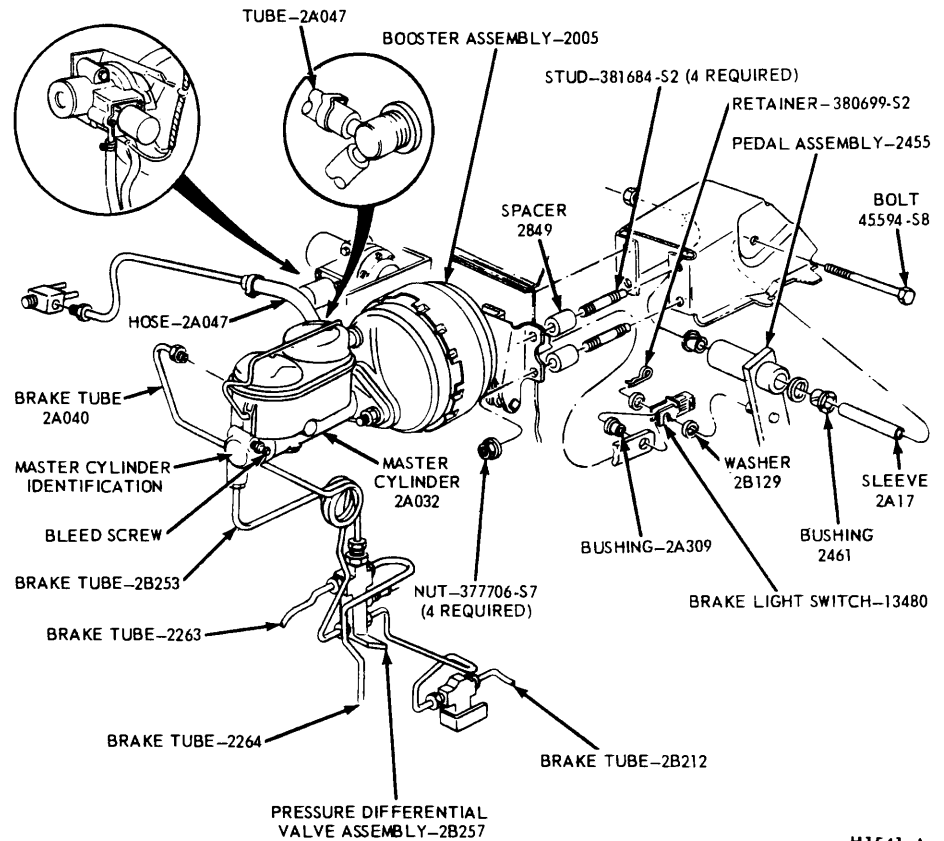
4. Install the front and rear brake tubes to the master cylinder outlet fittings. Torque the nuts to specification.

5. Fill the master cylinder with the specified brake fluid to within 1/4 to 1/2 inch of the top of the dual reservoirs. Use Rotunda Brake Fluid — Extra Heavy Duty — Part Number C6AZ-19542-A (ESA-M6C25-A) for disc brake applications. **The disc brake system fluid is colored blue for identification. Do not mix low temperature brake fluids with the specified fluid for the disc brake system.**

6. Properly seat the cover gasket and install the filler cap.

7. Loosen the bleed screw on the side of the master cylinder, bleed the dual-master cylinder, allowing the air to escape at the master cylinder bleed-screw; then, tighten the bleedscrew.

8. Refill the master cylinder and bleed the front wheel brake cylinders first, then bleed the rear wheel brake cylinders. Centralize the differential



H1541-A

FIG. 18—Brake Booster and Pedal Installation

#### PRESSURE DIFFERENTIAL VALVE ASSEMBLY

Refer to Figs. 17 and 18.

##### REMOVAL

1. Disconnect the brake warning light wire from the pressure differential valve assembly switch. **To prevent damage to the brake warning switch wire connector, expand the plastic lugs to allow removal of the shell-wire connector from the switch body.**

2. Loosen the tube nut connecting the primary (front brake) system inlet tube at the top of the pressure differential valve assembly and disconnect the tube.

3. Disconnect the primary system left front brake outlet tube from the top side of the pressure differential valve assembly.

4. Disconnect the primary system right front brake outlet tube from the

top side of the differential valve assembly.

5. Disconnect the secondary (rear brake) system inlet tube at the lower side of the pressure differential valve assembly.

6. Disconnect the secondary system rear brake outlet tube from the lower side pressure differential valve assembly.

7. Remove the screw retaining the pressure differential valve assembly to the frame side rail and remove the valve assembly.

8. If the differential valve is to be replaced, remove the brake warning lamp switch and install the switch in the new differential valve. **The pressure differential valve assembly and the brake warning lamp switch are separate units and each is serviced as a separate assembly only.**

9. Remove front wheel covers. Remove front wheel and tire assemblies.

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## INSTALLATION

1. Mount the pressure differential valve assembly on the frame side rail and tighten the attaching screw.

2. Connect the rear brake system inlet tube to the pressure differential valve assembly and tighten the tube nut to the specified torque (Refer to Part 2-3).

3. Connect the rear brake system outlet tube to the pressure differential valve assembly. Tighten the tube nut to the specified torque.

4. Connect the front brake system inlet tube to the pressure differential valve assembly and tighten the tube nut to the specified torque.

5. Connect the right front brake outlet tube to the pressure differential valve assembly. Tighten the tube nut to the specified torque.

6. Connect the left front brake outlet tube to the pressure differential valve assembly. Tighten the tube nut to the specified torque.

7. Connect the shell-wire connector to the brake warning lamp switch. **Make sure the plastic lugs on the connector hold the connector securely to the switch.**

8. Bleed the brakes and centralize the pressure differential valve.

9. Install front wheel and tire assemblies, and torque the retaining nuts to specification. Install wheel covers.

## BRAKE BOOSTER

### REMOVAL

Refer to Fig. 18.

1. Disconnect the vacuum hose from the booster.

2. Remove the attaching nuts, and remove the master cylinder from the booster. **It is not necessary to disconnect the brake lines**, but care should be taken that the brake lines are not deformed. Permanent deformation of brake lines can lead to tube failure.

3. Working inside the vehicle below the instrument panel, disconnect the booster push rod link from the brake pedal assembly. To do this, proceed as follows:

4. 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 for the pin**, and then lift switch

et assembly from the dash panel, sliding the push rod link out from the engine side of the dash panel (Fig. 18).

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

### INSTALLATION

1. Position the new booster (if required) with the four mounting studs entering the holes in the dash panel. If a binding condition occurs when a new booster is installed, it may be necessary to file the holes in the dash panel slightly to align with the studs. Do not file more than necessary.

2. Working from the passenger compartment, install four booster attaching nuts on the studs protruding through the dash panel. Do not tighten the nuts. Install the dust seal.

3. Working inside the vehicle 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. 18. 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 attaching nuts to specification. Before installing the master cylinder, check the distance from the outer end of the booster assembly push rod to the master cylinder surface. Turn the push rod adjusting screw in or out as required to obtain the specified length. (Refer to Part 2-1, Section 2, (Figs. 6 and 7).

5. Position the master cylinder to the booster, install the attaching nuts, and torque them to specification.

6. Connect the vacuum hoses to the booster.

7. Start the engine and check the booster master cylinder, brakes and stop lights for proper operation.

## 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. 18).

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.

### INSTALLATIONS

1. Apply a coating of SAE 10 engine oil to the bushings and locate all the bushings in their proper places on the pedal assembly (Fig. 18).

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 specifications.

3. 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. 18. 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 specifications.

## PARKING BRAKE CONTROL ASSEMBLY

### REMOVAL

Refer to Figure 19.

1. Remove the two nuts attaching the control assembly to the dash panel.

2. Remove the bolt attaching the control assembly to the side cowl bracket.

3. Disconnect the hose to the parking brake vacuum power unit.

4. Remove the cable retainer clip from the cable end and disconnect the cable from the control.

5. Remove the control assembly from the vehicle.

### INSTALLATION

1. Position the control in the approximate final position.

2. Fit the cable through its mounting hole and install the retaining clip.

3. Connect the vacuum hose to the parking brake power unit.

4. Install the attaching bolt to the side cowl bracket. Do not tighten.

5. Install the two attaching nuts on the control assembly bracket on the engine side of the dash panel.

6. Torque all nuts and bolts to specifications.

7. Adjust parking brake cable tension, and check operation, as outlined in Part 2-1, Section 2.

### PARKING BRAKE VACUUM POWER UNIT

#### REMOVAL

1. Remove the parking brake control assembly from the vehicle as described under removal in the foregoing procedures.

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 vehicle 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 ACTUATOR-TO-CONTROL ASSEMBLY CABLE

#### REMOVAL

Refer to Figure 19.

1. Remove the cable from the passenger compartment.

move the shield aside to gain access to the cable.

4. Remove the return spring from the actuator assembly.

5. Disconnect the control cable from the actuator.

6. Remove the retaining clip from the cable housing at the frame.

7. Work the cable free and remove it from the vehicle.

#### INSTALLATION

1. Work the new cable through the frame and body openings and position it in the approximate final position.

2. Position the cable housing at the frame opening and install the retaining clip.

3. Lower the vehicle to a convenient level to work in the passenger compartment.

4. Insert the cable in the control assembly and install the retaining clip.

5. Raise the vehicle fully.

6. Connect the cable end to the actuator.

7. Install the return spring to the actuator.

8. Position the splash shield and install the six attaching bolts. Torque to specifications.

9. Adjust parking brake cable tension and check operation as outlined in Part 2-1, Section 2.

10. Lower the vehicle and replace any floor mat, kick pads or ductwork that might have been displaced.

### PARKING BRAKE EQUALIZER-TO-REAR WHEEL CABLE

#### REMOVAL

1. Raise the vehicle. Remove the rear wheel cover. Remove the wheel and tire as an assembly.

2. Remove the three Tinnerman nuts that hold the brake drum in place, and remove the drum.

3. Remove the brake shoe retracting springs.

4. Loosen the equalizer rod adjusting nut and disconnect the cable from the equalizer (Fig. 19).

5. Remove the retainer clip that secures the cable housing to the frame bracket, and pull the cable and housing out of the bracket.

6. Remove the cable to frame clamp attaching nuts and the clamp.

7. Working on the wheel side of the backing plate (Fig. 19), compress the prongs on the cable retainer so that it can pass through the hole in the backing plate. Draw the cable retainer out of the hole.

8. With the spring tension off the parking brake lever, lift the cable

out of the slot in the lever and remove it through the backing plate hole.

#### INSTALLATION

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

2. Pull the excess slack from the cable and insert the cable housing into the backing plate access hole so that the retainer prongs expand (Fig. 19). **The prongs must be securely locked in place.**

3. Install the brake shoe retracting springs.

4. Position the cable to the frame and install the retaining clamp so that the cable conduit armor extends forward of the clamp. Install the clamp attaching screws.

5. Engage the forward end of the cable housing with the frame bracket and secure it with the clip.

6. Insert the ball end of the cable into the equalizer.

7. Make a preliminary brake adjustment with the use of Tool HRA-8650 (Fig. 11).

8. Install the rear drum. Tighten the three Tinnerman nuts that secure the drum. Install the wheel and wheel cover.

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

10. Lower the vehicle.

11. Adjust the rear brakes (Part 2-2, Section 2).

### PARKING BRAKE ACTUATOR-TO-EQUALIZER CABLE

Refer to Part 2-1, Section 2, Figure 5 and this Part, Figure 19.

#### REMOVAL

1. Raise the vehicle on a hoist.

2. Remove the adjusting nut which retains the cable to the equalizer.

3. Remove the cable end from the equalizer.

4. Unhook the cable from the actuator, and remove from the vehicle.

#### INSTALLATION

1. Insert new cable end into actuator.

2. Insert cable end into equalizer and tighten the adjusting nut snug.

3. Adjust the parking brake cable tension and check operation as outlined in Part 2-1, Section 2.

4. Lower the vehicle.





## 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 run-out of 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 (11.090 inches).

If the drum diameter is less than 0.030 inch oversize (11.060 inches) after refinishing, standard lining may be installed. If the drum diameter is 11.060 - 11.090 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.

### ROTOR REFINISHING

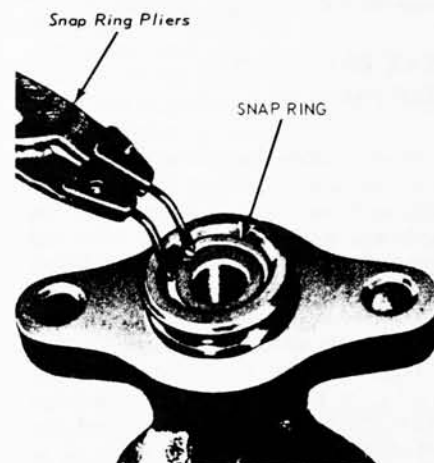
Rotunda Disc Brake Attachment, FRE-2249-2, is the **only approved tool** to be used to refinish the disc brake rotors. The step-by-step resurfacing procedure provided with the tool must be adhered to.

2. Check the inside diameter of the brake drum with a brake drum micrometer (Tool FRE-1431). If the diameter is less than 11.060 inches, standard linings may be installed. If the diameter is 11.060 - 11.090 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 0.008 inch clearance between any two rivets.

4. Remove the snap ring (Fig. 21) from the retaining groove at the rear of the master cylinder bore and remove the primary piston assembly from the master cylinder bore. **Do not remove the screw that retains the primary return spring retainer, return spring, pumping cup retainer, primary cup and protector on the primary piston. This assembly is factory pre-adjusted and should not be disassembled.**



H1477-B

FIG. 21—Removing Snap Ring—Typical

### DUAL MASTER CYLINDER

#### DISASSEMBLY

1. Clean the outside of the master cylinder and remove the filler cap and gasket. Pour out any brake fluid that remains in the cylinder.

2. Remove the secondary piston stop bolt from the bottom of the cylinder (Fig. 20).

3. Remove the bleed screw, if required.

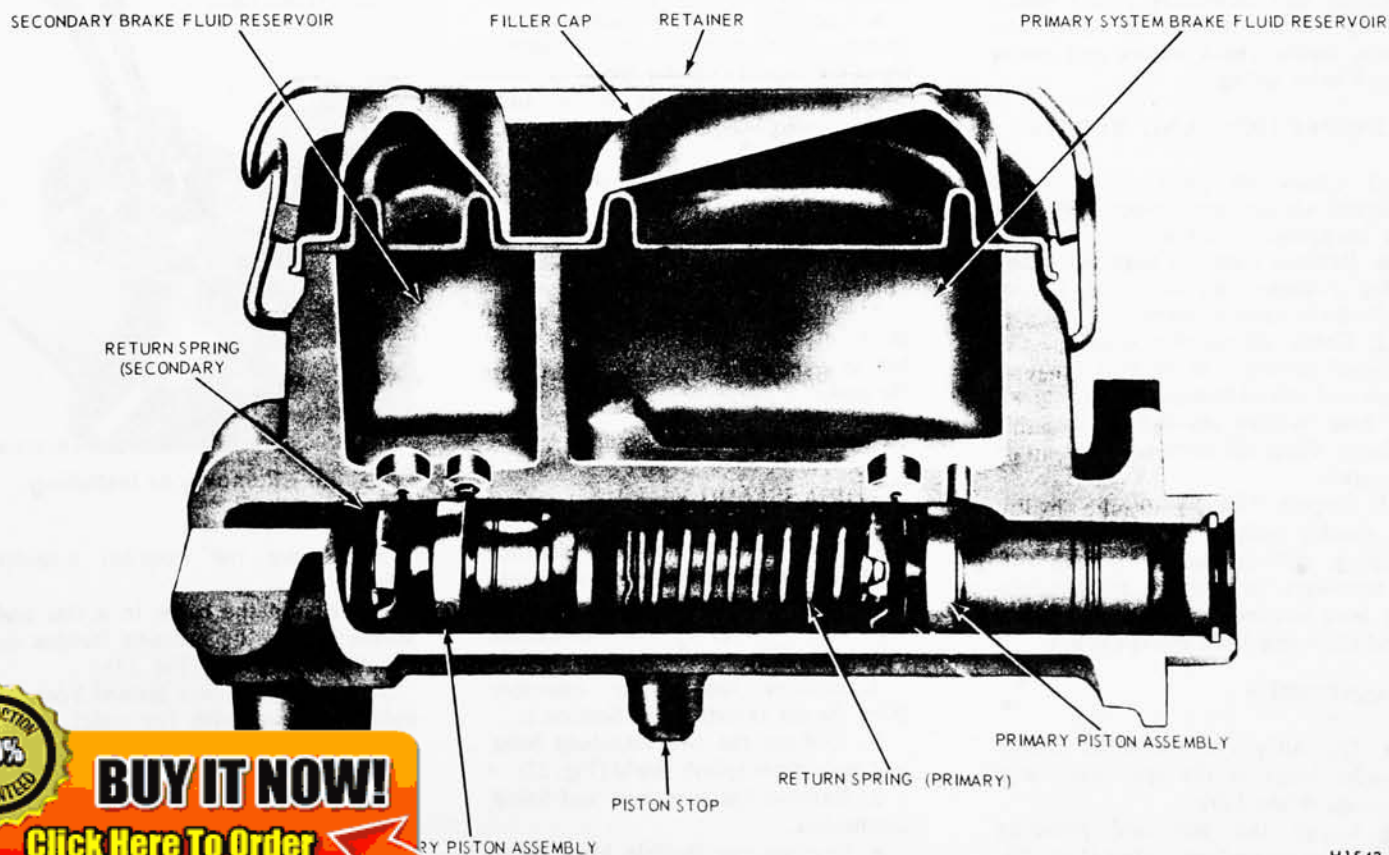


FIG. 20—Dual Master Cylinder—Disassembled

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The finished braking surfaces of the rotor must be flat and parallel within 0.0007 inch; lateral runout must not exceed 0.002 inch total indicator reading, and the surface finish of the braking surfaces are to be 85/15 micro inches. The minimum limiting dimensions (Fig. 9, Part 2-1) from the inboard bearing cup to the outboard rotor face (dimension A) and from the inboard bearing cup to the inboard rotor face (dimension B) must be observed when removing material from the rotor braking surfaces.

### 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 must 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 vehicle.**

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.

4. Remove the secondary piston, pumping cups protector, brake master cylinder primary cup, pumping cup retainer and secondary piston return spring. **Do not remove the outlet tube seats, outlet check valves and outlet check valve springs.**

### INSPECTION AND REPAIR

1. Clean all parts in clean denatured alcohol and inspect the parts for chipping, excessive wear or damage. Replace them, as required. When using a master cylinder repair kit, install all the parts supplied.

2. Check all recesses openings and internal passages to be sure they are open and free of foreign matter. Use the air hose to blow out dirt and cleaning solvent. Place all parts on a clean pan or paper.

3. Inspect the hydraulic hydraulic master cylinder bore for signs of etching, pitting, scoring or rust. If it is necessary to hone the master cylinder bore to repair damage, do not exceed allowable hone specifications.

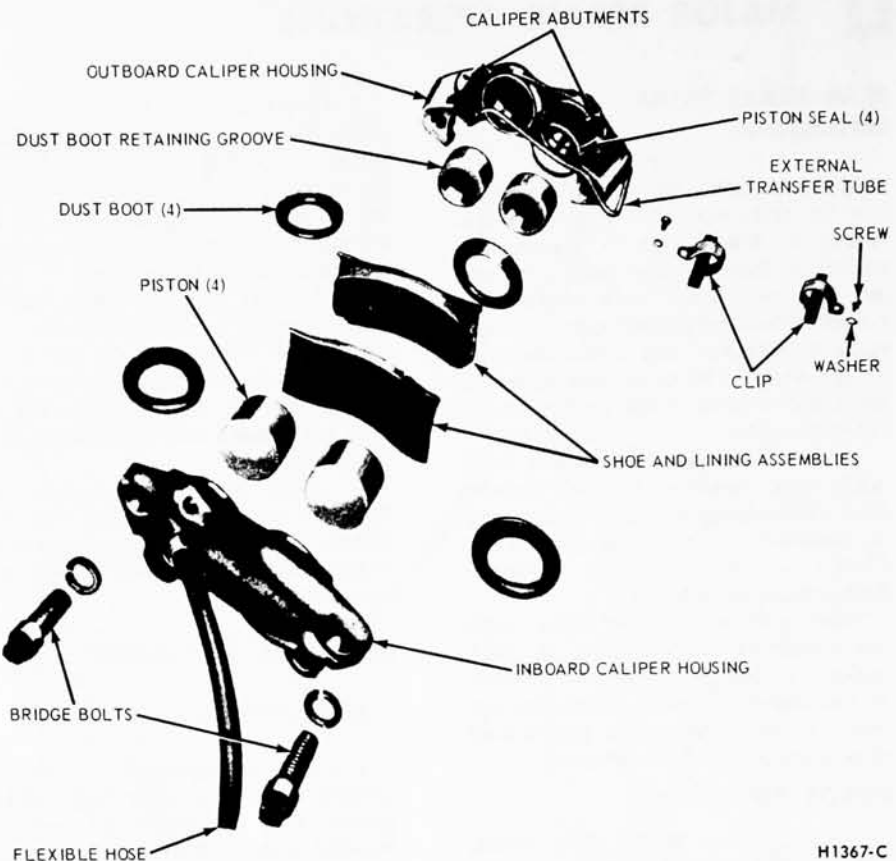


FIG. 22—Caliper Assembly—Disassembled

H1367-C

cylinder primary cup on the secondary piston; then, install the pumping cup retainer and secondary piston return spring on the secondary piston.

3. Carefully insert the complete secondary piston and return spring assembly in the master cylinder bore.

4. Install the primary piston and return spring assembly in the master cylinder bore.

5. Install the snap ring in the cylinder bore groove (Fig. 21).

6. Install the secondary piston stop bolt in the bottom of the master cylinder.

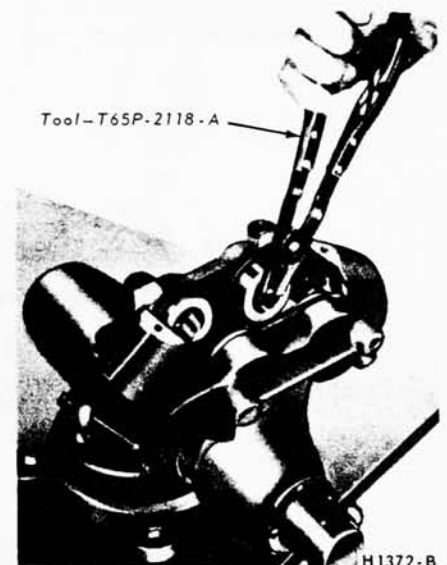
7. Install the bleed screw. Install the filler cap gasket. Position the gasket as shown in Fig. 20. **Make sure the gasket is properly seated.**

### 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. 22 for illustration purposes only.**

1. Remove the caliper assembly from the car as outlined in Section 2.
2. Remove the two attaching bolts and the caliper splash shield (Fig. 22).
3. Remove the two shoe and lining assemblies.
4. Remove the flexible brake hose from the caliper.



H1372-B

FIG. 23—Removing or Installing Pistons

5. Remove the external transfer tube.

6. Clamp the caliper in a vise and secure it by the mounting flanges on the inboard housing (Fig. 23).

7. Remove the four pistons from the cylinder bores with the special tool shown in Fig. 23. The caliper pistons must be removed prior to removal of the dust boot. As the piston is withdrawn from the caliper, spread the dust boot back over the piston. To prevent cocking with consequent damage

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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. Such damage causes poor sealing.**

If a piston is so completely 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. 22). If this method of removal is used, the pistons must be replaced.

Remove the dust boots from the caliper assembly.

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. 22). 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 worn off.

#### ASSEMBLY

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

2. The new caliper seals must be flat round and not twisted when setting freely on a clean surface. Discard any new seals that have been deformed in shipping or storage. Installation of deformed seals may result in seal leakage.

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 re-use the original seals.**

4. Install the new dust boots by seating the boot flange in the outer caliper bore groove. Position in one area and gently work around until

fully seated. **Do not reuse the old dust boots.**

5. 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. Spread the dust boot over the piston as the piston is being installed. 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. 23. Rotate the piston with the tool while pushing it inward at the same time. Seat the dust boots carefully in the piston groove, be sure that each boot is fully seated in their groove.

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



## PART 2-3— Specifications

### DRUM BRAKE DIMENSIONS—INCHES

Drum Inside Diameter	Drum Maximum Boring Limit	LINING LENGTH		LINING WIDTH		Wheel Cylinder Bore Diameter	Master Cylinder Bore Diameter
		Primary	Secondary	Primary	Secondary		
		Color Coded Yellow-Black	Color Coded Blue-Black	Color Coded Green-Yellow	Color Coded Blue-Black		
11.030	11.090	9.30	11.92	2.250	2.250	0.938	1

### BRAKE CHECKS AND ADJUSTMENTS—INCHES

Type of Check or Adjustment	Specification
Brake Shoe Repair	Drum Diameter
	11.030–11.060
	11.060–11.090
	Brake Lining Required
	Standard
	Oversize
	Maximum Brake Lining Clearance (Midway between Rivets) – 0.008
	Maximum Lining Wear Limit (From Top of Rivets) – 1/32
Pedal Free Height – Min.	5 1/4 Max. to 4 11/32 from dash panel bare metal
Pedal Total Travel <sup>2)</sup>	2.340
Master Cylinder	Hydraulic Master Cylinder Bore Maximum Honed Diameter – 1.003
Power Unit	Push Rod Adjustment – 0.980–0.995
Drum Out-of-Round	Refinish if Total Indicator Runout Exceeds 0.007
Self-Adjustment Cable Length	End of Cable Anchor to End of Cable Hook – 11 1/8 ± 1/64
Rotor Runout <sup>1)</sup>	0.002 Total Lateral Runout
Rotor Thickness	1.250
Rotor Outside Dia.	11.960
Rotor Inside Dia.	7.785
Caliper Cylinder Bore Dia.	1.938
<sup>1)</sup>	<p>The following requirements must be met when resurfacing disc brake rotors:            Rotunda Disc Brake Attachment FRE-2249-2 is the only approved tool to be used to refinish the disc brake rotors. The step-by-step resurfacing procedure provided with the tool must be adhered to.            The finished braking surfaces of the rotor must be flat and parallel within 0.0007 inch; lateral runout must not exceed 0.002 inch total indicator reading, and the surface finish of the braking surfaces are to be 85/15 micro inches. The minimum limiting dimensions of 0.395 inch from the inboard bearing cup to the outboard rotor face and 0.755 inch from the inboard bearing cup to the inboard rotor face must be observed when removing material from the rotor braking surfaces.</p>
<sup>2)</sup>	Dimension to be measured parallel to the vertical centerline of the steering column with a 50 pound load applied to the centerline of the brake pedal pad.

### DIMENSIONS (INCHES)

Conditioned FoMoCo	Shoe and Lining Maximum Wear Limit	0.231
36 x 1.90		
0.03 Sq. In./segment	Lining Maximum Wear Limit (from front surface of shoe)	0.066
0 nominal		
0.036 nominal		



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**TORQUE LIMITS (FT-LBS)**

Description	Ft-Lbs	Description	Ft-Lbs
Parking Brake Control Assembly Mounting Bolt	15–19	Hub and Rotor Assembly to Front Wheel Spindle Rotate rotor while torquing to 17–25 ft-lbs. Back off the adjusting nut 1/2 turn and retighten to 10–15 inch pounds while rotating wheel. Selectively position nut retainer on adjusting nut so that a set of slots are in line with cotter pin hole. Adjusting nut should not be rotated in this operation. Lock adjusting nut and nut retainer with cotter pin so that the cotter pin end does not interfere with seating of wheel static collector in spindle hole.	
Wheel Cylinder Bleeder Screw	50 ①		
Brake Pedal Support Bracket to Instrument Panel	9–13		
Wheel to Hub and Drum Nuts – 5 Lug	70–115		
Master Cylinder to Booster Body	18–25		
Brake Booster to Dash	18–25		
Drum to Axle Shaft Speed Nut	Hand Push Fit		
Brake Cylinder to Brake Backing Plate Bolt	15–20 ①		
Brake Backing Plate to Axle Housing	30–40		
Brake Line Connection to Axle Housing Bolt	12–18		
Line Connection—Nut Sizes (2)			
3/8–24	8–15		
7/16–24	10–18		
1/2–20	12–20		
9/16–18	15–25		
Caliper Assembly to Spindle	120–130		
Caliper Bleeder Screw (Must be Leakproof)	10 Max.		
Caliper Brake Shoe Clips	7–9		
Caliper Bridge Bolts	75–105		
Rotor Splash Shield to Spindle	9–14		
Wheel Assembly to Front Wheel Hub and Rotor Assembly	75–115		

① In-Lbs. Max.  
② All hydraulic line connections (nuts) must be torqued the specified value and free of fluid leakage.

**SERVICE TOOLS**

Ford Tool No.	Former No.	Description	Ford Tool No.	Former No.	Description
Rotunda HRE-8650		Brake Adjusting Gauge	TOOL-33621	33621	Internal Snap Ring Pliers
–	LM-119	Brake Cylinder Retaining Clamp	–	Milbar	
–	2018-A	Brake Adjusting Tool	–	1112–144	Inch-lb torque wrench
–	2162	Adapter Cap	TOOL-4235-C	4235-C	Axle Shaft Remover
–	2035-N	Brake Shoe R & R Spring	Rotunda FRE-1431	–	Brake Drum Micrometer



# Suspension, Steering, Wheels & Tires

GROUP  
**3**

<b>PART 3-1</b>	<b>PAGE</b>	<b>PART 3-4</b>	<b>PAGE</b>
Suspension, Steering, Wheels And Tires General Service .....	3-1	Wheels And Tires .....	3-29
<b>PART 3-2</b>		<b>PART 3-5</b>	
Suspension .....	3-9	Tilt-Away Type Steering Column.....	3-34
<b>PART 3-3</b>		<b>PART 3-6</b>	
Steering .....	3-18	Specifications .....	3-47

## PART 3-1— Suspension, Steering, Wheels and Tires—General Service

<b>Section</b>	<b>Page</b>	<b>Section</b>	<b>Page</b>
1 Diagnosis and Testing .....	3-1	Wheel Balancing .....	3-4
Steering Preliminary Checks.....	3-1	3 Cleaning and Inspection.....	3-6
Shock Absorber Checks .....	3-4	Front End General Inspection .....	3-6
Front Wheel Alignment Checks .....	3-2	Steering Gear.....	3-6
2 Common Adjustments and Repairs .....	3-4	Flushing the Power Steering System .....	3-7
Camber and Caster Adjustments.....	3-4		

### 1 DIAGNOSIS AND TESTING

#### STEERING

Figures 12 and 13 lists various steering trouble symptoms and possible causes. Several of these symptoms are also common to suspension, frame, and wheel and tire troubles. For this reason, be sure that the cause of the trouble is in the steering gear or linkage before adjusting, repairing, or replacing any of the steering parts.

#### STEERING PRELIMINARY CHECKS

The following preliminary checks should always be made before performing any trouble-diagnosis

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. **Do not hold the wheels against their stops for more than 5 seconds.** Recheck the fluid level.

#### Check Fluid Level

Run the engine until the fluid is at normal operating temperature (160°-180°F). 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 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 vehicle 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 5.0 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 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 pry bar should be placed between a half-inch cast boss on the front face of the pump cover plate and cast boss on the pump mounting bracket to 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 the shut off valve between the end of the hose and the pump outlet (Fig. 1).

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 to 160°-180°F.

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 hydraulic fluid (CIAZ-19582-A) to the proper level.

6. With the engine running at approximately 500 rpm and no steering wheel load, and the lubricant at

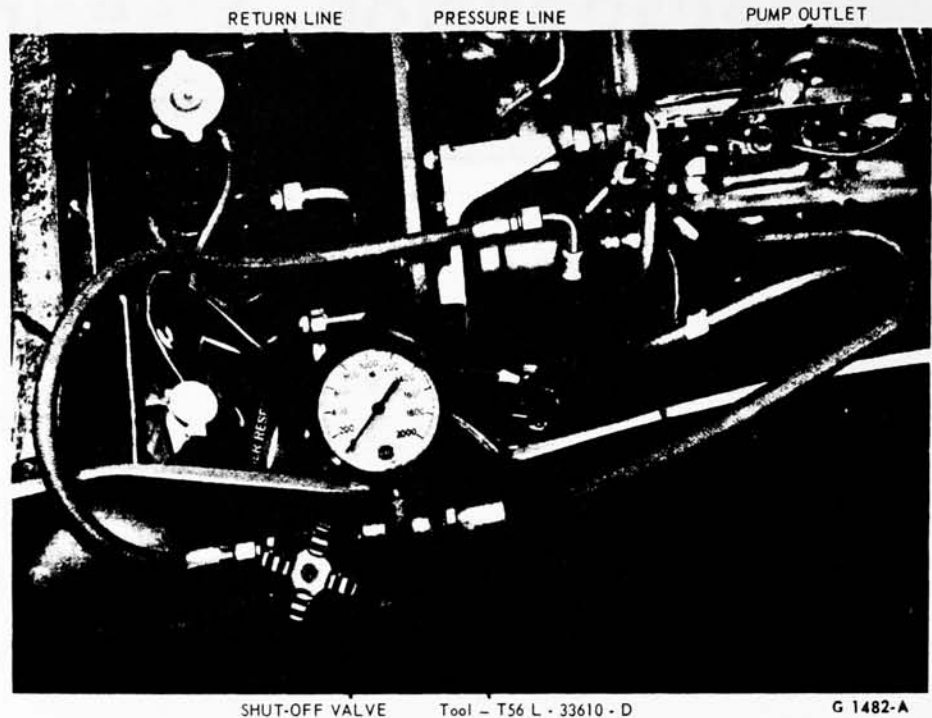


FIG. 1—Pressure Testing Tool—Typical

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 (maximum 5 seconds), as this would abnormally increase the lubricant temperature and cause undue pump and/or steering gear wear. Engine rpm should not exceed fast idle during this test.

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

8. Remove the pressure testing gauge set and 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 vehicle is at curb height. Before checking or ad-

justing 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. Whenever possible, front wheel alignment checks should be performed on stationary wheel aligning equipment. In the absence of such equipment, portable equipment may be used and the work may be performed on a level floor. The floor area should be level within 1/4 inch from front to rear of the vehicle and within 1/8 inch from side to side. Alignment height spacers (Figs. 2 and 3) are used to check caster and camber. The spacers should be omitted when checking toe-in.

1. Check the runout of each front wheel and tire using a dial indicator against the rim outer band. If the runout exceeds 1/8 inch, correction may be made by rotating the wheel on the drum. When the minimum runout has been obtained, mark the point of greatest runout so the wheels can be positioned as shown in Fig. 4 when checking the front end alignment. Hold a piece of chalk against the wheel rim or the tire sidewall while spinning the wheels. The chalk will mark the rim or tire at the point of greatest runout.

2. Drive the vehicle 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. 5). 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.

3. With the vehicle 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 vehicle and position the alignment spacers between the suspension lower arm and the frame spring pocket as shown in Fig. 2. Be sure the spacer pin is placed in the correct hole for the vehicle being checked. The lower end of the alignment spacers should be placed over the head of the strut front attaching bolt. Remove the bumpers from the right and left rear side rails. Position the rear alignment spacers between the rear axle and the rear side rails as shown in Fig. 3.

4. Install the wheel alignment equipment on the vehicle. Which ever 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.

The caster is the forward or rearward tilt of the top of the wheel spindle (Fig. 6). If the spindle tilts 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 1/2°. However, a difference of not more than 1/4° is preferred.

**CAMBER**

Check the camber angle at each front wheel.

Camber is the amount the front wheels are tilted at the top (Fig. 6). If a wheel tilts outward, camber is positive. If a wheel tilts inward, camber is negative. The correct camber angle, or outward (positive) tilt, is specified in Part 3-5. The maximum difference between both front wheel camber angles should not exceed 1/2°. However, a difference of not

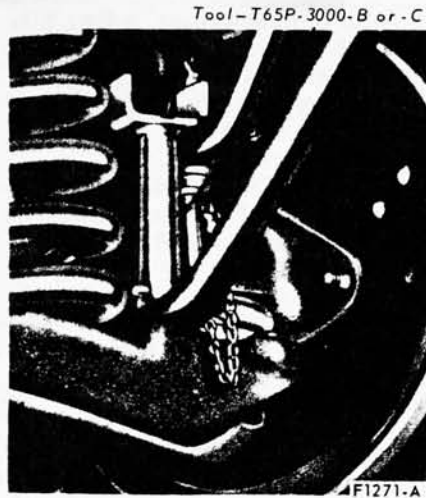


FIG. 2—Alignment Spacer Installation— Front

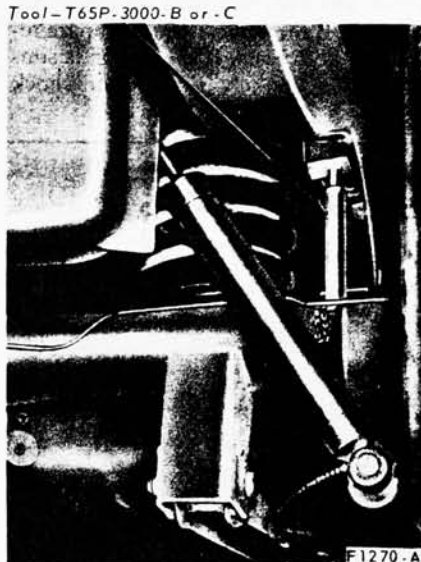


FIG. 3—Alignment Spacer Installation —Rear

in. 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 3-6. The turning angle cannot be adjusted directly, because it is a result

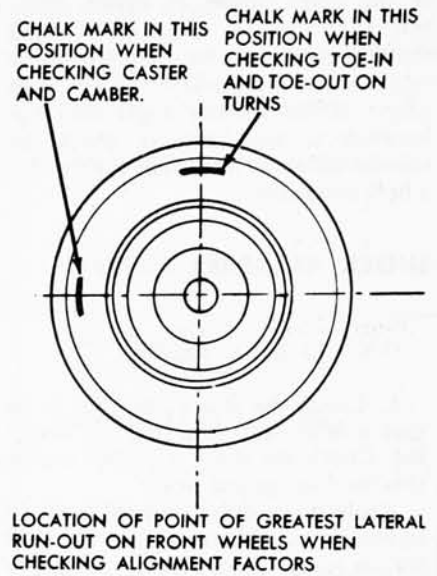


FIG. 4—Front Wheel Position For Checking Alignment

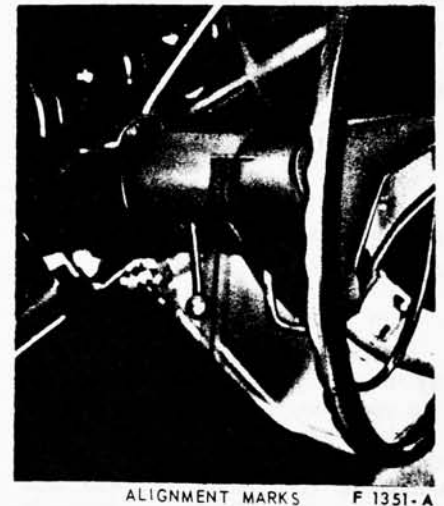


FIG. 5—Straight Ahead Position Marks—Typical

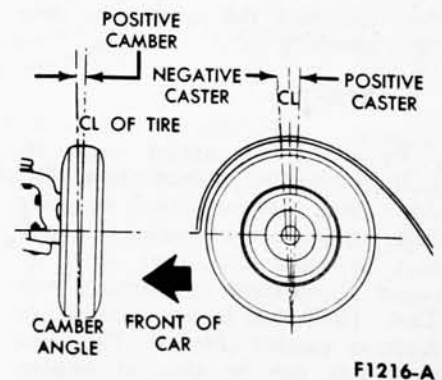


FIG. 6—Caster and Camber Angles

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not be used to check and adjust toe-

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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.

## SHOCK ABSORBER CHECKS

### ON VEHICLE TESTS

1. Check the shock absorber to be sure it is securely and properly installed. Check the shock absorber insulators for damage and wear.

Replace any defective insulators and tighten attachments to the specified torque (on a shock absorber which incorporates integral insulators, replace the shock absorber).

2. Inspect the shock absorber for

evidence of fluid leakage. A light film of fluid is permissible. Be sure any fluid observed is not from sources other than the shock absorber.

Replace the shock absorber if leakage is severe.

3. Disconnect one end of the shock absorber. Extend and compress the shock absorber as fast as possible, using as much travel as possible. Action should become smooth and uniform throughout each stroke. Higher resistance on extension than on compression is a normal condition. Faint swish noises are also normal.

Remove the shock absorber for a bench test if action is erratic. If the action is smooth, but the shock absorbers are suspected of being weak follow step 4:

4. Repeat step 3 on the mating shock absorber installed on the opposite side of the vehicle, and compare results of both tests. If the action is similar, it is unlikely that either shock

absorber is defective. Reconnect both shock absorbers.

Replace the shock absorber having the lower resistance. Ensure that the part number of the replacement is the same as that of the original shock absorber. The replacement shock absorber resistance will appear to be higher than either original due to initial friction of the rod seal.

### BENCH TEST

With the shock absorber right side up (as installed in vehicle), extend it fully. Then turn the shock absorber up side down and fully compress it. Repeat this procedure at least three times to ensure that any entrapped air has been expelled. Now place the shock absorber right side up in a vise, and hand stroke the shock absorber as described in On Vehicle Tests, step 3. If action is not now smooth and uniform, install a new shock absorber.

## 2 COMMON ADJUSTMENTS AND REPAIRS

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 AND CASTER ADJUSTMENTS

Camber and caster is adjusted by loosening the bolts that attach the upper suspension arm inner shaft to the frame side rail, and moving the inner shaft in or out in the elongated bolt holes with the tool shown in Fig. 7. The tool should be installed with the tool pins in the frame holes and the hooks over the upper arm inner shaft. Then, tighten the tool hook nuts snug before loosening the upper arm inner shaft attaching bolts.

#### CAMBER

To adjust the camber angle, install the tool as outlined above (Fig. 7.) Loosen both inner shaft attaching bolts. Tighten or loosen the hook



FIG. 7—Camber and Caster Adjusting Tool

#### CASTER

To adjust the caster angle, tighten the tool front hook nut or loosen the rear hook nut (Fig. 8) as required to increase caster to the desired angle. To decrease caster, tighten the tool rear hook nut or loosen the front hook nut as required (Fig. 8). The caster angle can be checked without tightening the inner shaft attaching bolts. Check the camber adjustment to be sure it did not change during the caster adjustment and adjust if necessary. Then, tighten the upper arm inner shaft

attaching bolts to specification. Remove the adjusting bar (Tool T65P-3000-D) and the alignment spacers (Tool T65P-3000-B or C).

### TOE-IN AND STEERING WHEEL SPOKE POSITION ADJUSTMENTS

Check the steering wheel spoke position when the front wheels are in the straight-ahead position. If the spokes are not in their normal position, they can be properly adjusted while toe-in is being adjusted.

1. Loosen the two clamp bolts on each spindle connecting rod sleeve (Fig. 9).

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. 9). 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. 10).

3. Recheck toe-in and the steering wheel spoke position. 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. 9).

4. When toe-in and the steering wheel spoke position are both correct, torque the clamp bolts on both connecting rod sleeves to specification (Part 3-5). Lubricate clamp, bolt and nut with light oil prior to

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SUSPENSION UPPER ARM MOVEMENT	CASTER CHANGE	CAMBER CHANGE
Front Bolt Outboard	Tilt Backward Increase Positive Caster or Decrease Negative Caster	Tilt Outward Increase Positive Camber or Decrease Negative Camber
Rear Bolt Outboard	Tilt Forward Decrease Positive Caster or Increase Negative Caster	
Front Bolt Inboard	Tilt Forward Decrease Positive Caster or Increase Negative Caster	Tilt Inward Decrease Positive Camber or Increase Negative Camber
Rear Bolt Inboard	Tilt Backward Increase Positive Caster or Decrease Negative Caster	

FIG. 8—Caster and Camber Adjustments

torquing to specification. The sleeve position should not be changed when the clamp bolts are tightened.

**WHEEL BALANCING**

See the instructions provided with the Rotunda Wheel Balancer.

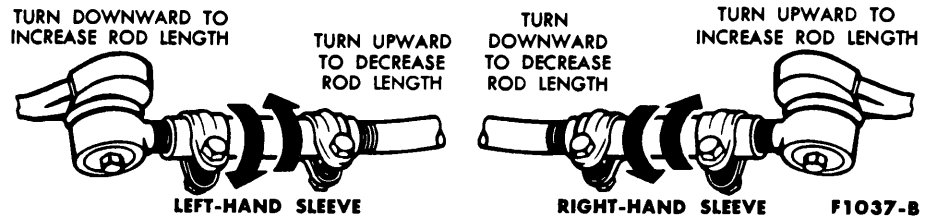


FIG. 9—Spindle Connecting Rod Adjustments

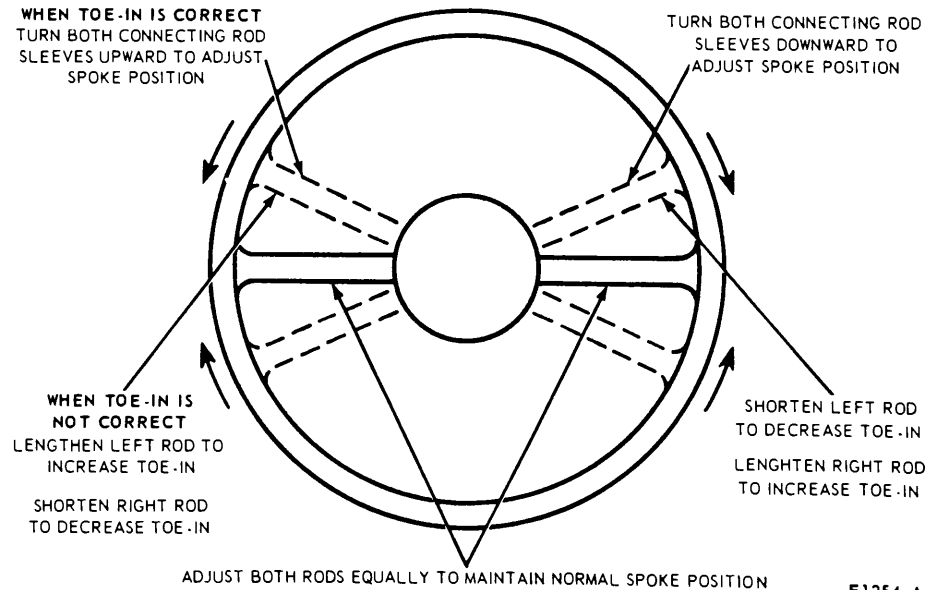


FIG. 10—Toe-In and Steering Wheel Spoke Alignment Adjustment

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### 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 vehicle 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 backing plate mountings. Torque all loose nuts and bolts to specification. 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 specifications. 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 vehicle 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 pre-delivery. 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 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 tire will eventually damage the

placed beneath the lower arms.

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 upper end of the spindle and the upper arm.

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

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

#### LOWER BALL JOINT INSPECTION

1. Raise the vehicle on jacks placed under the lower arms as shown in Fig. 11. This will unload the lower ball joints.

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

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

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

5. Grasp the tire at the top and bottom and slowly move the tire in and out (Fig. 11). Note the reading (radial play) on the dial indicator. If the reading exceeds specifications (Part 3-5), replace the lower ball joint.

#### STEERING GEAR

##### CLEANING

Disassembly and assembly of the steering gear and the sub-assemblies must be made on a clean workbench. As in repairing any hydraulically operated unit, cleanliness is of utmost importance. 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 fluid as possible. Handle all parts very carefully to avoid nicks, burrs, scratches and dirt, which could make the parts unfit for use.

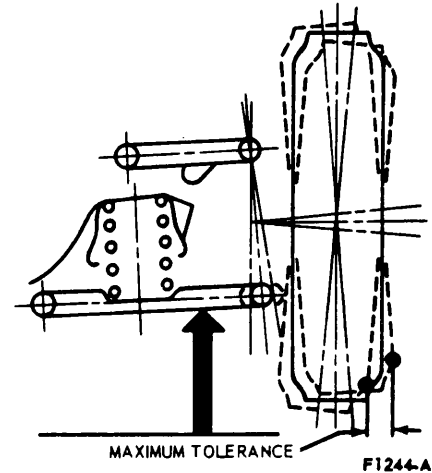


FIG. 11—Measuring Upper Ball Joint Radial Play

#### INSPECTION

1. Check the sector shaft bushing if so equipped, or journal in the cover for wear. If worn, replace the cover.

2. Inspect the input shaft bearing for cracked races and the balls for looseness, wear, pitting, end play or other damage. Check the fit of the bearing on the input shaft. Replace the bearing, if required.

3. Inspect the valve housing for wear, scoring or burrs.

4. Inspect the tube seats in the pressure and return ports in the valve body for nicks, etc. If necessary, remove and replace.

5. Check the sector shaft bushings if so equipped, or journal in the housing for wear. If worn, replace the bushings or housing.

6. Check all fluid passages for obstruction or leakage.

7. Inspect the steering gear housing for cracks, stripped threads, and mating surfaces for burrs. Inspect the piston bore of the housing for scoring or wear. If necessary, replace the housing.

8. Check the input shaft bearing after installation to be sure that it rotates freely.

9. If the valve spool is not free in the valve housing, check for burrs at the outward edges of the working lands in the housing and remove with a hard stone. Check the valve spool for burrs and, if burrs are found, stone the valve in a **radial direction only**. Check for freedom of the valve again.

10. Check the piston rack teeth and sector shaft teeth for nicks and burrs.

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### 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 is required when installing a new pump.

1. Remove the power steering pump and remove the pulley as out-

lined in Part 3-3.

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

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

4. Fill the reservoir with hydraulic fluid (CIAZ-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 to the proper level. **Do not overfill.**

10. Lower the vehicle.

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

<b>JERKY STEERING</b>	Low fluid level or fluid leakage. Obstruction in power steering lines or within the steering gear.	Loose steering gear mountings. Incorrect steering gear adjustment. Loose or worn drive belt.
<b>HARD STEERING AND/OR LOSS OF POWER ASSIST</b>	Low fluid level or fluid leakage. Air in power steering system. Obstruction in power steering lines or within the steering gear. Insufficient power steering pump pressure.	Incorrect steering gear adjustment. Steering gear valve spool binding or out of adjustment. Loose or worn drive belt.
<b>HARD TURNING WHEN STATIONARY</b>	Low fluid level or fluid leakage. Obstruction in power steering lines or within the steering gear.	Insufficient power steering pump pressure. Loose or worn drive belt.
<b>STEERING AND SUSPENSION NOISES</b>	Low fluid level or fluid leakage. Air in power steering system. Obstruction in power steering lines or within the steering gear.	Loose steering gear mountings. Insufficient power steering pump pressure. Incorrect steering gear adjustment.
<b>LOOSE STEERING SHIMMY SIDE-TO-SIDE WANDER OR WHEEL TRAMP OR</b>	Loose steering gear mountings.	Incorrect steering gear adjustment.
<b>BINDING OR POOR RECOVERY</b>	Insufficient power steering pump pressure. Incorrect steering gear adjustment. Steering gear valve spool binding	or out of adjustment. Obstruction within the steering gear. Loose or worn drive belt.
<b>BODY SWAY OR ROLL HARDER STEERING IN ONE DIRECTION</b>	Incorrect steering gear adjustment. Steering gear valve spool binding or out of adjustment.	
<b>ABNORMAL OR IRREGULAR TIRE WEAR</b>	Incorrect steering gear adjustment.	

FIG. 12—Diagnosis Guide



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)
	POSSIBLE CAUSES OF TROUBLE														
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 Spring					X	X	X	X	X			X	X	X	
6. Glazed, Loose or Broken Power Steering Pump Belt	X		X	X	X		X					X			X
7. Bent Spindle Arm							X	X		X		X			
8. Bent Spindle							X	X		X		X			
9. Lack of Lubrication			X	X	X						X				X
10. Air in Power Steering System	X		X		X	X									
11. Obstruction in Power Steering Lines			X	X	X										
12. Loose or Weak Shock Absorber					X	X			X			X			X
13. Loose or Worn Suspension Arm Bushings					X	X						X			X
14. Binding Front Suspension Ball Joints or Steering Linkage	X		X	X	X						X				X
15. Loose, Worn, or Damaged Steering Linkage or Connections	X	X			X	X		X		X		X			
16. Loose Steering Gear Mountings	X	X			X	X		X	X						
17. Insufficient Steering Pump Pressure			X	X							X				
18. Incorrect Steering Gear Adjustment	X	X	X	X	X	X		X	X		X	X			
19. Incorrect Brake Adjustment	X				X		X					X			
20. Incorrect Front Wheel Bearing Adjustment	X	X			X	X	X	X				X			
21. Wheel Out of Balance	X				X	X						X			X
22. Incorrect Front Wheel Alignment			X		X	X	X	X		X	X	X			
23. Out-of-Round Wheel or Brake Drum						X						X			X
24. Frame or Underbody Out of Alignment							X					X			X
25. Bent Rear Axle Housing					X		X					X			X
26. Excessive Wear of Power Steering Pump Internal Parts					X										
27. Steering Gear Valve Spool Binding or Out of Adjustment					X	X						X			
					X	X						X			
	X		X	X							X				



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# PART 3-2— Suspension

Section	Page	Section	Page
1 Description and Operation .....	3-9	Front Suspension Lower Arm .....	3-13
Front Suspension.....	3-9	Front Spring.....	3-14
Rear Suspension.....	3-9	Front Suspension Upper Arm .....	3-14
2 In-Vehicle Adjustments and Repairs.....	3-12	Front Wheel Spindle .....	3-14
Upper Ball Joint Replacement—Arm		Rear Spring.....	3-15
in Vehicle.....	3-12	Rear Suspension Lower Arm .....	3-15
Lower Ball Joint Replacement—Arm		Rear Suspension Upper Arm .....	3-16
in Vehicle .....	3-12	Track Bar .....	3-16
Stabilizer Repair.....	3-12	Shock Absorbers .....	3-16
Front Suspension Lower Arm Strut		4 Major Repair Operations .....	3-17
and/or Bushing.....	3-13	Front Suspension Upper Arm Bushings	
3 Removal and Installation .....	3-13	—Arm Removed.....	3-17
Hoisting Instructions .....	3-13		

## 1 DESCRIPTION AND OPERATION

### 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 frame. The lower arm pivots on a bolt in the front crossmember (Fig. 1). A coil spring seats between the lower arm and the top of the spring housing. A double action shock absorber is bolted to the 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 surfaces. The swiveling ball joints also permit the spindles and wheels to be turned to the left or right by the steering gear and linkage.

The pivoting action of the suspension arms provides an **up-and-down** movement for the spindles and wheels as required by bumps or depressions in the road surface. The coil springs and shock absorbers control this up-and-down movement. The stabilizer bar (Fig. 1) is at-

tached to each lower arm to dampen road shocks and minimize road sway. The struts, which are connected between the suspension lower arms and the frame crossmember 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.

The rear axle housing and wheel assembly is suspended from the frame by a coil spring and shock absorber at each side of the vehicle and by three arms (one upper and two lower) which pivot in the frame members (Fig. 2).

Each coil spring is mounted between a lower seat, which is welded to the axle housing, and an upper seat which is integral with the frame.

The upper end of the rear shock absorber is attached to the spring upper seat; the lower end is bolted to a bracket on the axle housing.

The upper suspension arm attaches to the right side of the axle housing

through an eccentric pivot bolt and a bracket which is welded to the top of the housing. The forward end of the arm is connected by a pivot bolt to the frame crossmember.

Each lower suspension arm attaches to one end of the axle housing through a pivot bolt and a bracket which is welded to the underside of the housing. The forward end of the arm is connected by a pivot bolt to the frame side member.

A track bar is connected between the upper arm bracket on the axle housing and a mounting bracket on the left frame side rail.

All of the above mentioned components work together to control the position and the movement of the rear axle housing and wheel assembly. The coil springs and shock absorbers cushion road shocks and bumps. The suspension arms prevent forward or rearward movement of the axle housing and wheel assembly with respect to the frame. The pivoting action of the suspension arms provides an **up-and-down** movement for the axle and wheel assembly as required by changes in the road surface. The track bar holds the assembly in proper alignment with the frame to prevent lateral swaying action.



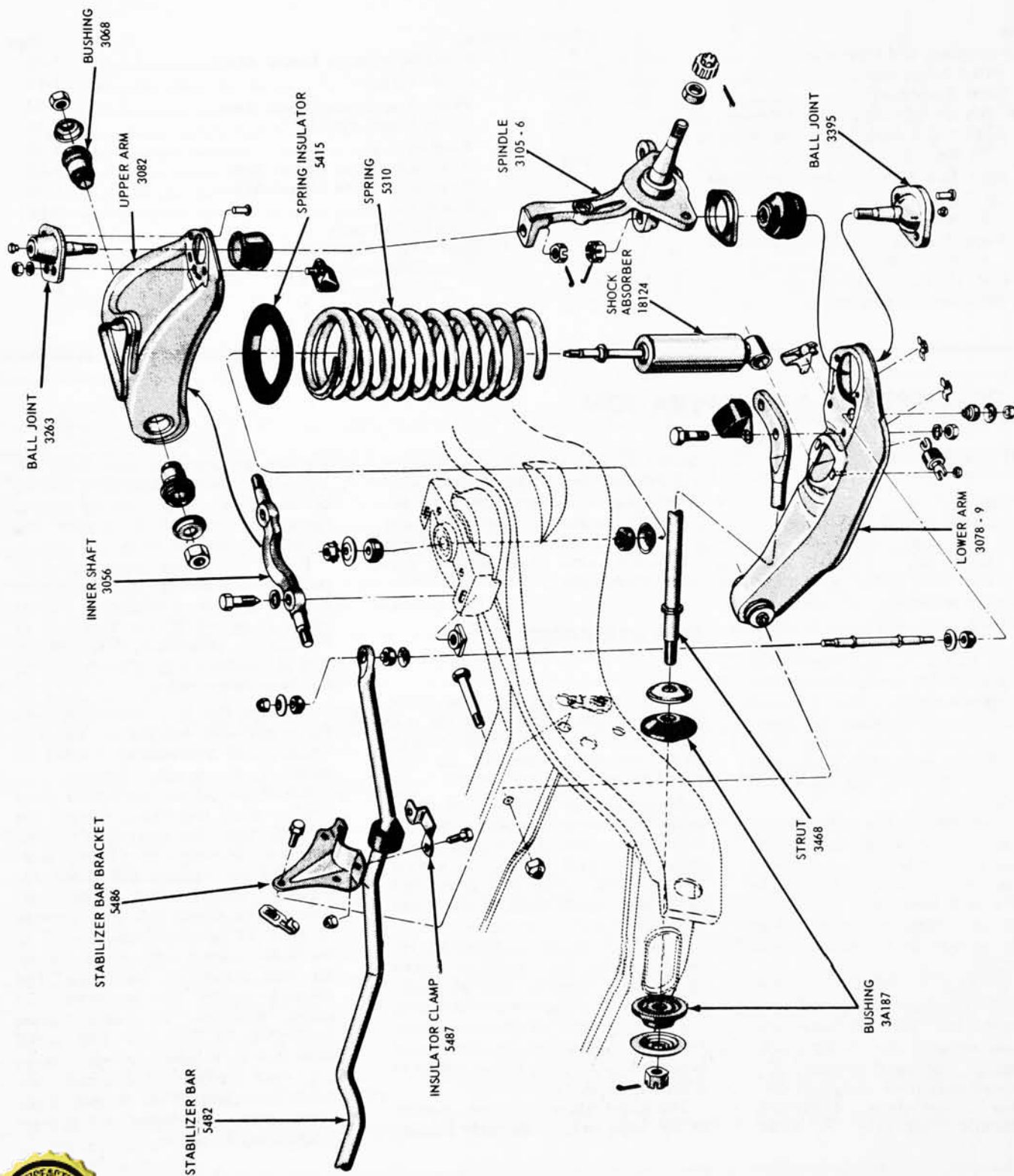


FIG. 1—Front Suspension Disassembled



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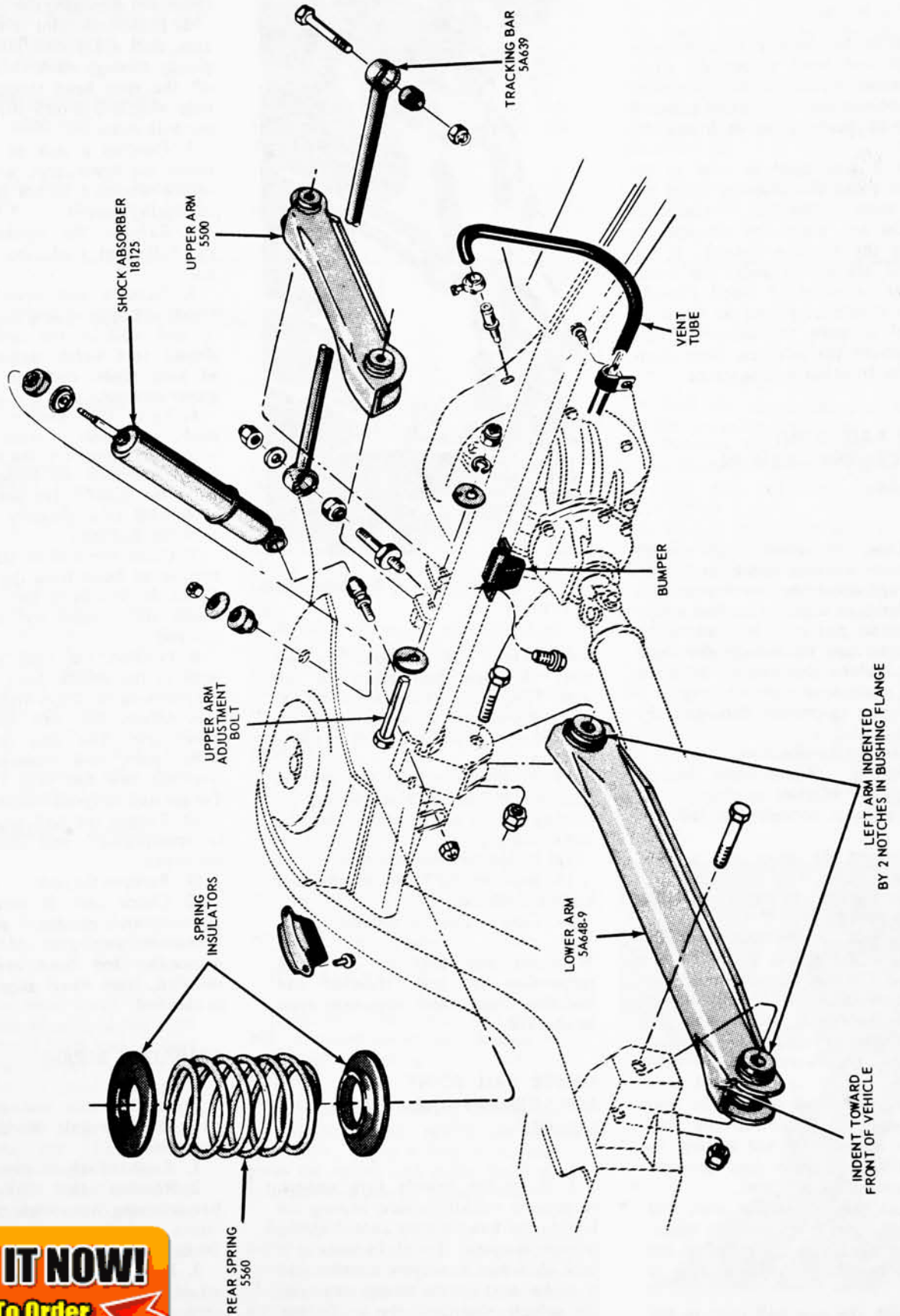


FIG. 2—Rear Suspension Disassembled



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## 2 IN-VEHICLE ADJUSTMENTS AND REPAIRS

### HOISTING INSTRUCTIONS

Damage to steering linkage components and front suspension struts may occur if care is not exercised when positioning the hoist adapters of 2 post hoists prior to lifting the vehicle.

If a 2 post hoist is used to lift the car, place the adapters under the lower arms or the No. 1 crossmember. Do not allow the adapters to contact the steering linkage. If the adapters are placed under the crossmember, a piece of wood (2x4x16 inches) should be placed on the hoist channel between the adapters. This will prevent the adapters from damaging the front suspension struts.

### UPPER BALL JOINT REPLACEMENT—ARM IN VEHICLE

1. Raise the vehicle high enough to provide working space, and place a support under the lower arm. If a chain hoist or a jack that has a narrow contact pad is to be used on the bumper to raise the vehicle, distribute the load along the bumper by using a steel plate 3 or 4 inches long as a contact pad to prevent damaging the bumper.

2. Remove the wheel and tire.

3. Drill a 1/8-inch hole through each upper ball joint retaining rivet. Using a large chisel, cut off the rivets.

4. Remove the upper arm suspension bumper.

5. Remove the cotter pin and nut from the upper ball joint stud.

6. Place a box wrench over the lower end of the ball joint remover tool, and position the tool as in Fig. 3. The tool should seat firmly against the ends of both studs, and not against the lower stud nut.

7. Turn the wrench until both studs are under tension, and then, with a hammer, tap the spindle near the upper stud to loosen the stud from the spindle. **Do not attempt to loosen the stud with tool pressure alone.** Remove the ball joint.

8. Clean the end of the arm, and

Tool—T57P-3006-A



FIG. 3—Disconnecting the Ball Joints—Typical

bolts, nuts, and washers. Do not rivet the new ball joints to the arm. Torque the nuts to specification.

10. Install the upper arm suspension bumper. Torque the nut to specification.

11. Position the ball joint stud in the spindle bore, and torque the attaching nut to specification. Install a new cotter pin.

12. Install the wheel and tire.

13. Remove the safety stands, and lower the vehicle.

14. Check and, if necessary, adjust caster, camber, and toe-in. **Whenever any part of the front suspension has been removed and installed, front wheel alignment must be checked.**

### LOWER BALL JOINT REPLACEMENT—ARM IN VEHICLE

1. Raise the vehicle high enough to provide working space, leaving the lower arm free to drop as coil spring tension is eased. If a chain hoist or a jack that has a narrow contact pad is to be used on the bumper to raise the vehicle, distribute the load along the bumper by using a steel plate

3 or 4 inches long as a contact pad to prevent damaging the bumper.

2. If the ball joint is riveted to the arm, drill a 1/8-inch pilot hole completely through each rivet. Then drill off the rivet head through the pilot hole with a 3/8-inch drill, and drive out both rivets.

3. Position a jack or safety stand under the lower arm, and lower the vehicle about 6 inches to offset the coil spring tension.

4. Remove the cotter pin from the ball joint stud, and remove the nut.

5. Place a box wrench over the lower end of the tool shown in Fig. 3, and position the tool. **The tool should seat firmly against the end of both studs, and not against the upper stud nut.**

6. Turn the wrench until both studs are under tension, and then, with a hammer, tap the spindle near the lower stud to loosen the stud from the spindle. **Do not loosen the stud with tool pressure alone.** Remove the ball joint.

7. Clean the end of the arm, and remove all burrs from the hole edges. Check for cracks in the metal at the holes, and replace the arm if it is cracked.

8. Position the stud of the ball joint to the spindle bore, and install the retaining nut finger-tight.

9. Attach the ball joint to the lower arm. **Use only the specified bolts, nuts, and washers. Do not rivet the new ball joint to the arm. Torque nuts to specifications.**

10. Torque the ball joint stud nut to specification, and install a new cotter pin.

11. Remove the jack.

12. Check and, if necessary, adjust caster, camber, and toe-in. **Whenever any part of the front suspension has been removed and installed, front wheel alignment must be checked.**

### STABILIZER REPAIR

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

1. Raise the vehicle 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.

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

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

6. Lower the vehicle.

### FRONT SUSPENSION LOWER ARM STRUT AND/OR BUSHING

1. Remove the cotter pin from the lower arm strut at the frame front

crossmember and remove the nut, washer, and bushing from the strut.

2. Remove nuts, washers, and bolts attaching the strut and rubber bumper to the lower arm (Fig. 1).

3. Pull the strut from the frame crossmember.

4. Remove the crossmember rear side bushing and washer from the strut.

5. Place the crossmember rear side washer and bushing on the strut and

position the strut to the frame and lower arm.

6. Position the rubber bumper on the strut and install the bolts, washers, and nuts attaching the strut to the lower arm. Torque the nuts and bolts to specification.

7. Install the bushing, washer, and nut on the strut at the front crossmember. Tighten the nut and install the cotter pin.

8. Check caster, camber, and toe-in and adjust if necessary.

## 3 REMOVAL AND INSTALLATION

### HOISTING INSTRUCTIONS

Damage to steering linkage components and front suspension struts may occur if care is not exercised when positioning the hoist adapters of 2 post hoists prior to lifting the vehicle.

If a 2 post hoist is used to lift the vehicle, place the adapters under the lower arms or the No. 1 crossmember. Do not allow the adapters to contact the steering linkage. If the adapters are placed under the crossmember, a piece of wood (2x4x16 inches) should be placed on the hoist channel between the adapters. This will prevent the adapters from damaging the front suspension struts.

### FRONT SUSPENSION LOWER ARM REMOVAL

1. Raise the front of the vehicle and position safety stands under both sides of the frame just back of the lower arms.

2. Remove the wheel cover.

3. Remove the wheel and tire from the hub. Remove 2 bolts and washers that attach the caliper and brake hose bracket to the spindle. Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose. Then, remove the hub and rotor from the spindle.

4. Disconnect the lower end of the shock absorber, and push it up to the

7. Remove 2 bolts and nuts attaching the strut to the lower arm.

8. Loosen the lower ball joint stud nut one or two turns. **Do not remove the nut from the stud at this time.**

9. Install Tool T57P-3006-A between the upper and lower ball joint studs (Fig. 3). **The tool should be seated firmly against the ends of both studs and not against the stud nuts.**

10. With a wrench, turn the adapter screw until the tool places the stud under tension. Tap the spindle near the lower stud with a hammer to loosen the stud in the spindle. **Do not loosen the stud from the spindle with tool pressure only.**

11. Position a floor jack under the lower arm and remove the lower ball joint stud nut.

12. Lower the floor jack and remove the spring and insulator (Fig. 4).

13. Remove one nut and bolt attaching the lower control arm to the No. 2 crossmember and remove the lower arm.

### INSTALLATION

1. Position the lower arm to the No. 2 crossmember and loosely install the attaching bolt and nut (Fig. 4).

2. Position the spring and insulator to the upper spring pad and lower arm. Using a floor jack, compress the spring and guide the lower ball joint stud into the spindle hole.

3. Install the ball joint stud attaching nut and torque to specification. Continue to tighten the nut until the cotter pin hole is in line with the nut slots. Install a cotter pin in the upper and lower ball joint studs.

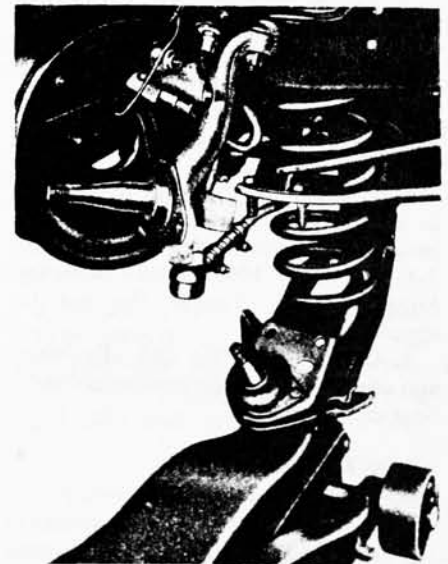
4. Pull the shock absorber down and connect to the lower arm.

5. Position the strut and bumper to the lower arm. Install the attaching bolts and nuts and torque to specification.

6. Torque the lower arm to No. 2 crossmember attaching bolt and nut to specifications.

7. Position the stabilizer bar link to the lower arm and install the attaching nuts.

8. If equipped with disc brakes—Install the hub and rotor on the spindle. Position the caliper over the rotor and install the attaching bolts. Be sure to insert the upper bolt through the brake hose bracket. Torque the bolts to specification. Install the wheel and tire on the hub and adjust the wheel bearings as outlined in Part 3-4.



F1275-A

FIG. 4—Removing Lower Arm—Typical

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9. Install the hub cap or wheel cover.

10. Remove the safety stands and lower the vehicle.

11. Check the caster, camber, and toe-in and adjust as required (Section 2, Part 3-1).

### FRONT SPRING

1. Raise the vehicle and support the front end of the frame with jack stands.

2. Place a jack under the lower arm to support it.

3. Disconnect the lower end of the shock absorber from the lower arm.

4. Remove the bolts that attach the strut and the rebound bumper to the lower arm.

5. Disconnect the lower end of sway bar stud from the lower arm.

6. Remove the nut and bolt that secures the inner end of the lower arm to the crossmember.

7. Carefully lower the jack slowly to relieve the spring pressure on the lower arm, then remove the spring.

### INSTALLATION

1. Position the spring on the lower arm so that the lower end properly engages the seat.

2. Raise the lower arm carefully with a jack while guiding the inner end to align with the bolt hole in the crossmember. Insert the attaching bolt in the rear of the crossmember and through the lower arm. Install and torque the nut to specification.

3. Secure the lower end of the shock absorber to the lower arm with the two attaching bolts.

4. Secure the strut and the rebound bumper to the lower arm with the two attaching bolts. Torque the bolts to specification.

5. Connect the sway bar to the lower arm with the attaching washers and insulators as shown in Fig. 1 on page 3-11 of the 1966 Ford—Mercury Shop Manual. Torque the nut to specification.

6. Check the front end alignment and adjust it to the recommended specifications if required.

sides of the frame just back of the lower arm.

2. Remove the hub cap or wheel cover.

3. Remove the wheel and tire from the hub.

4. Remove the cotter pin from the upper ball joint stud nut.

5. Loosen the upper ball joint stud nut one or two turns. **Do not remove the nut from the stud at this time.**

6. Install tool T57P-3006-A between the upper and lower ball joint studs with the adapter screw on top (Fig. 3). **The tool should be seated firmly against the ends of both studs and not against the nuts or lower stud cotter pin.**

7. With a wrench, turn the adapter screw until the tool places the stud under tension. Tap the spindle near the upper stud with a hammer to loosen the stud in the spindle. **Do not attempt to loosen the stud from the spindle with tool pressure only.**

8. Remove the tool from between the ball joint studs and place a floor jack under the lower arm.

9. Raise the floor jack to relieve the pressure from the upper ball joint stud nut and remove the nut.

10. Remove the upper arm inner shaft attaching bolts. Remove the upper arm and inner shaft as an assembly (Fig. 4).

11. Remove the bumper from the upper arm.

### INSTALLATION

1. Position the bumper to the upper arm and install the nut and washer. Torque the nut to specifications.

2. Position the upper arm inner shaft to the frame side rail and install the 2 attaching bolts and washers snug.

3. Connect the upper ball joint stud to the spindle and install the retaining nut. Torque the nut to specification and continue to tighten the nut until the cotter pin hole in the stud is in line with the nut slots. Then, install the cotter pin.

4. Install the wheel and tire on the hub and adjust the wheel bearings as outlined in Part 3-4.

5. Install the hub cap or wheel cover.

6. Remove the safety stands and lower the front of the vehicle.

7. Check caster, camber, and toe-in and adjust as required (Section 2, Part 3-1).

### FRONT WHEEL SPINDLE

#### REMOVAL

1. Raise the vehicle until the front wheel clears the floor, and place a support under the frame.

2. Remove the hub cap or wheel cover.

3. Remove the wheel and tire from the hub. Remove 2 bolts and washers retaining the caliper and brake hose bracket to the spindle. Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose. Then, remove the hub and rotor from the spindle (Part 3-4). Remove 3 bolts attaching the splash shield to the spindle and remove the splash shield.

4. Remove the steering connecting rod from the spindle arm with Tool OTC 462.

5. Remove the cotter pins from both ball joint stud nuts, and loosen the nuts one or two turns. **Do not remove the nuts from the studs at this time.**

6. Install the ball joint remover tool between the upper and lower ball joint studs (Fig. 3). **The tool should seat firmly against the ends of both studs and not against the stud nuts.**

7. Turn the tool nut with a wrench until the tool places the studs under tension, and, with a hammer, tap the spindle near the studs to loosen them in the spindle. **Do not attempt to loosen the studs in the spindle with tool pressure only.**

8. Position a floor jack under the lower control arm.

9. Remove the ball joint stud nuts and lower the lower arm enough to remove the spindle.

#### INSTALLATION

1. Position the spindle to the lower ball joint stud and install the attaching nut. Torque the nut to specification. Continue to tighten the nut until the cotter pin hole is in line with the slots in the nut. Then, install the cotter pin.

2. Raise the lower arm and guide the upper ball joint stud into the spindle hole and install the attaching nut. Torque the nut to specification and install the cotter pin as outlined in the preceding step.

3. Remove the floor jack from under the lower arm.

4. Attach the steering connecting rod to the spindle and install the nut. Torque the nut to specification. Continue to tighten the nut until the cotter pin hole is in line with the

**SUSPENSION**

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at     

slots in the nut. Then, install the cotter pin.

5. Install the splash shield on the spindle and torque the attaching bolts to specification (Part 3-5). Install the hub and rotor on the spindle. Position the caliper over the rotor and install the attaching bolts. Be sure to insert the upper bolt through the brake hose bracket. Torque the bolts to specification (Part 3-5). Install the wheel and tire on the hub and adjust the wheel bearings as outlined in Part 3-4).

6. Install the hub cap or wheel cover. Then, remove the support stand and lower the vehicle.

7. Check caster, camber, and toe-in (Part 3-1) and adjust as necessary.

## REAR SPRING

### REMOVAL

1. Raise the vehicle on a hoist with the hoist under the rear axle housing. Place jack stands under the frame side rails.

2. Disconnect the lower studs of the two rear shock absorbers from the mounting brackets on axle housing.

3. Lower the hoist and axle housing until the coil springs are released (Fig. 5).

4. Remove the springs and the insulators from the vehicle.

### INSTALLATION

1. Position the spring in the upper and lower seats with an insulator between each seat and the spring. Position lower end of spring pig tail outboard, pointing rearward on the right hand spring; frontward on the left spring.

2. Raise the hoist and axle housing with the spring in position and connect the lower studs of the rear shock absorbers to the mounting brackets on the axle housing. Install the mounting nuts, and torque to specifications.

3. Remove the jack stands and lower the vehicle.

## REAR SUSPENSION LOWER ARM

### REMOVAL

Raise the vehicle on a hoist and

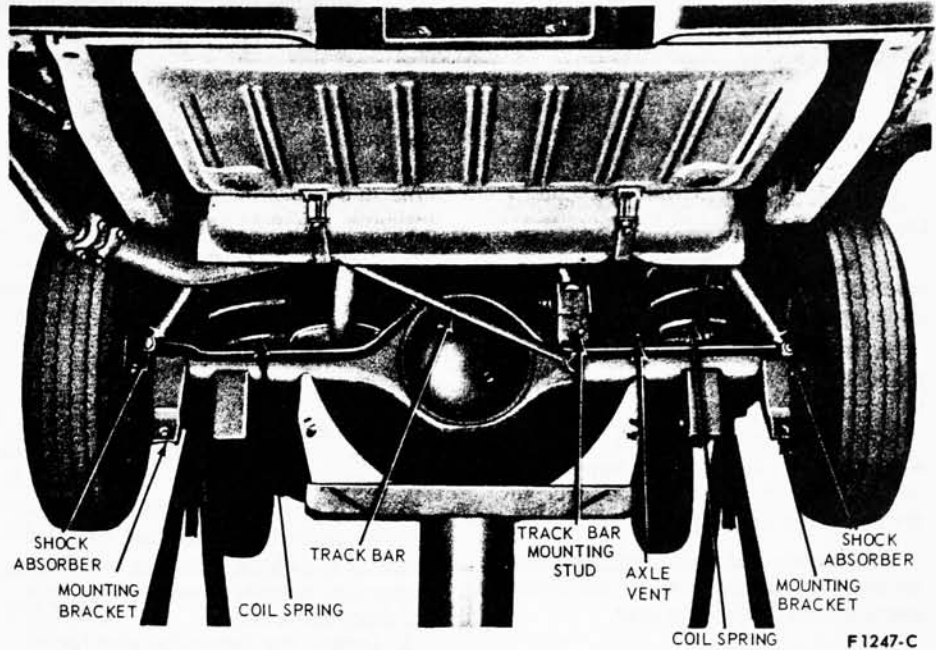


FIG. 5—Removing or Installing Rear Spring

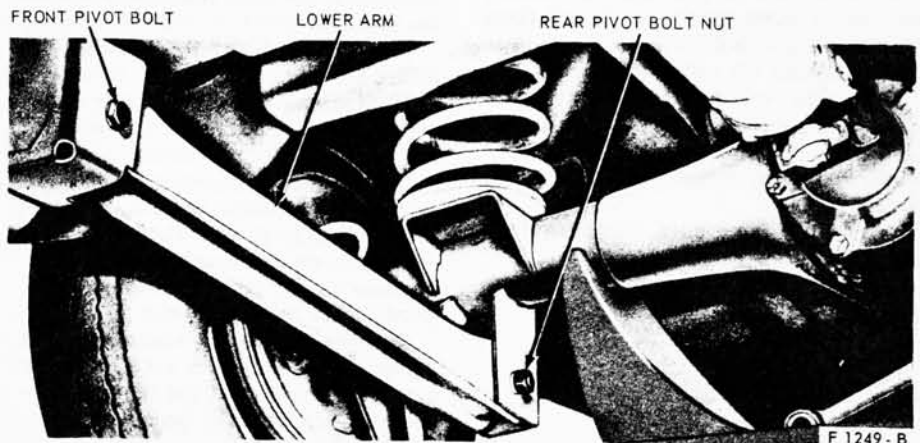


FIG. 6—Rear Suspension Lower Arm Installed

3. Disconnect the right and left shock absorbers from the axle.

4. Lower the axle enough to relieve spring pressure.

5. Remove the lower arm pivot bolt and nut from the axle bracket. Then, disengage the lower arm from the bracket.

6. Remove the pivot bolt and nut from the frame bracket and remove the lower arm from the vehicle.

### INSTALLATION

The rear suspension lower arms are not interchangeable. The lower arm for the left side can be identified by notches in the bushing flange (Fig. 2). The right arm does not have the notches.

1. Position the lower arm in the bracket on the frame side rail. Install

a new pivot bolt and nut (Fig. 6). Do not tighten the nut at this time.

2. Position the lower arm to the axle bracket and install a new bolt and nut (Fig. 6). Do not tighten the nut at this time.

3. Raise the axle and connect the rear shock absorbers to the axle.

4. Install alignment spacers (Tool—T65P-3000-B- or C) between the rear axle and frame (Fig. 3, Part 3-1). Then, torque the lower arm pivot bolts and nuts to specification (Part 3-5).

5. Connect the track bar to the mounting stud, install the washer and attaching nut, and torque to specification (Part 3-5).

6. Remove the alignment spacers and jack stands and lower the vehicle.


 Raise the vehicle on a hoist and  
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## REAR SUSPENSION UPPER ARM

### REMOVAL

1. Raise the vehicle and support the frame side rails with jack stands.
2. Support the rear axle, then disconnect the track bar from the axle housing.
3. Lower the axle far enough to allow the shock absorbers to support it.
4. Remove the nut, bolt and two washers that attach the upper arm to the axle housing. Disconnect the arm from the housing.
5. Remove the nut and bolt that secures the upper arm to the cross-member and remove the arm.

### INSTALLATION

1. Hold the upper arm in place on the crossmember and install the attaching new bolt and a new nut. Do not tighten the nut at this time.
2. Secure the upper arm to the axle housing with the flat washers and new attaching bolt, nut and lock-washer. Do not tighten the nut at this time.
3. Adjust the pinion angle as detailed in Part 3-1.
4. Remove jack stands and lower the vehicle.

### TRACK BAR

1. Raise the vehicle on an axle contact hoist.
2. Remove rubber cover at axle attachment of track bar.
3. Remove the nut and washer retaining the track bar to the upper arm bracket and disengage the track bar from the mounting stud (Fig. 5).
4. Remove the nut and bolt attaching the track bar to the frame side rail and remove the track bar.
5. Position the track bar to the frame side rail and install a new attaching bolt and nut.
6. Position the track bar on the upper arm bracket mounting stud and install the washer and a new attaching nut. Torque the track bar attaching nut and nuts to specification.

## SHOCK ABSORBERS

Passenger vehicles and station wagons are equipped with hydraulic shock absorbers of the direct-acting type and are nonadjustable and non-refillable, and cannot be repaired.

### SHOCK ABSORBER TESTS

#### On Vehicle Tests

1. Check the shock absorber to be sure it is securely and properly installed. Check the shock absorber insulators for damage and wear.

Replace any defective insulators and tighten attachments to the specified torque (on a shock absorber which incorporates integral insulators, replace the shock absorber).

2. Inspect the shock absorber for evidence of fluid leakage. A light film of fluid is permissible. Be sure any fluid observed is not from sources other than the shock absorber.

Replace the shock absorber if leakage is severe.

3. Disconnect one end of the shock absorber. Extend and compress the shock absorber as fast as possible, using as much travel as possible. Action should become smooth and uniform throughout each stroke. Higher resistance on extension than on compression is a normal condition. Faint swish noises are also normal.

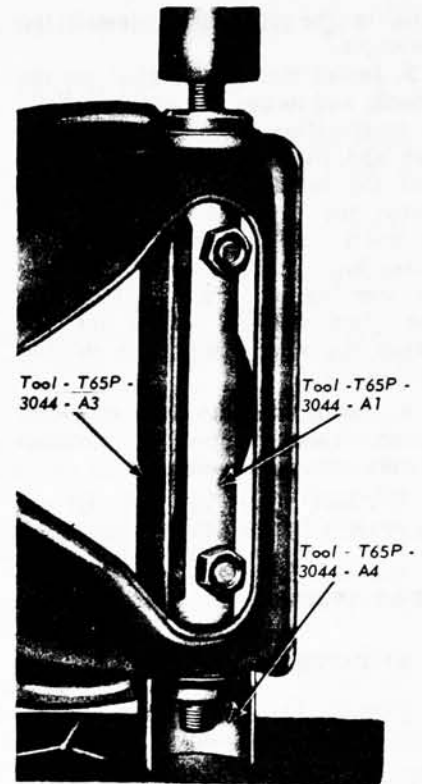
Remove the shock absorber for a bench test if action is erratic. If the action is smooth, but the shock absorbers are suspected of being weak follow step 4.

4. Repeat step 3 on the mating shock absorber installed on the opposite side of the vehicle, and compare results of both tests. If the action is similar, it is unlikely that either shock absorber is defective. Reconnect both shock absorbers.

Replace the shock absorber having the lower resistance. Ensure that the part number of the replacement is the same as that of the original shock absorber. The replacement shock absorber resistance will appear to be higher than either original due to initial friction of the rod seal.

#### Bench Test

With the shock absorber right side up (as installed in vehicle), extend it fully. Then turn the shock absorber up side down and fully compress it. Repeat this procedure at least three times to ensure that any entrapped air has been expelled. Now place the



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FIG. 7—Removing Upper Arm Bushings



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FIG. 8—Installing Upper Arm Shaft and Bushings

shock absorber right side up in a vise, and hand stroke the shock absorber as described on On Vehicle Tests, step 3. If action is not now smooth and uniform, install a new shock absorber.

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### FRONT SHOCK ABSORBER REPLACEMENT

1. Remove the nut, washer, and bushing from the shock absorber upper end.
2. Raise the vehicle on a hoist and install safety stands.
3. Remove 2 bolts attaching the shock absorber to the lower arm and remove the shock absorber.
4. Place a washer and bushing on the shock absorber top stud and position the shock absorber inside the front spring. Install the 2 lower attaching bolts and torque them to specifications.
5. Remove the safety stands and lower the vehicle.
6. Place a bushing and washer on

the shock absorber top stud and install the attaching nut. Torque to specifications.

### REAR SHOCK ABSORBER REPLACEMENT

1. Raise the vehicle on a hoist.
2. Remove the shock absorber mounting nut, washer and insulator from the upper stud at the upper side of the spring upper seat. Compress the shock absorber to clear the hole in the spring seat, and remove the inner insulator and washer from the upper mounting stud.
3. Remove the self-locking retaining nut, and disconnect the shock absorber lower stud from the mounting bracket on the rear axle housing (Fig. 2).

4. Expel all air by performing step 3 under On Vehicle Tests.

5. Place the inner washer and insulator on the upper mounting stud, and position the shock absorber so that the upper mounting stud enters the hole in the spring upper seat. While holding the shock absorber in this position, install the outer insulator and washer and the nut on the upper stud from the upper side of the spring upper seat. Torque the nut to specifications.

6. Extend the shock absorber and locate the lower stud in the hole in mounting bracket on the rear axle housing. Install a new self-locking attaching nut and torque to specifications.

## 4 MAJOR REPAIR OPERATIONS

### FRONT SUSPENSION UPPER ARM BUSHINGS—ARM REMOVED

1. Remove the nuts and washers from both ends of the upper arm inner shaft.
2. Install Tool T65P-3044-A1 on the inner shaft and place Tool T65P-3044-A3 inside the upper arm around the inner shaft (Fig. 7).

3. Position the upper arm in an arbor press on Tool T65P-3044-A4 (Fig. 7), and press the lower bushing out of the upper arm.

4. Remove the bushing from the inner shaft; turn the assembly over and remove the bushing from the other side of the arm. **It may be necessary to remove Tool T65P-3044-A1 from the inner shaft and remove**

**the shaft from the arm to remove the bushing from the shaft. Then, install the tool on the shaft and remove the other bushing.**

5. Position the shaft and bushings to the upper arm and install the bushings and inner shaft in the upper arm as shown in Fig. 8.

6. Install a washer and new nut on each end of the inner shaft.



# PART 3-3— Steering

Section	Page	Section	Page
1 Description and Operation .....	3-18	Power Steering Pump .....	3-22
Steering Gear.....	3-18	Vehicles Without Air Conditioner .....	3-22
Power Steering Pump .....	3-20	Vehicles With Air Conditioners .....	3-22
2 In-Vehicle Adjustments and Repairs.....	3-20	Power Steering Pump Pulley .....	3-22
Valve Spool Centering Check.....	3-20	Power Steering Pump Reservoir.....	3-23
Steering Gear Adjustments.....	3-21	4 Major Repair Operations .....	3-23
Pump Belt Tension Adjustment .....	3-21	Steering Gear .....	3-23
Power Steering Pump Drive		Valve Centering Shim Replacement .....	3-23
Belt Replacement.....	3-21	Steering Gear Disassembly .....	3-25
3 Removal and Installation.....	3-21	Parts Repair or Replacement .....	3-26
Steering Gear .....	3-21	Steering Gear Assembly .....	3-27

## 1 DESCRIPTION AND OPERATION

### STEERING GEAR

#### DESCRIPTION

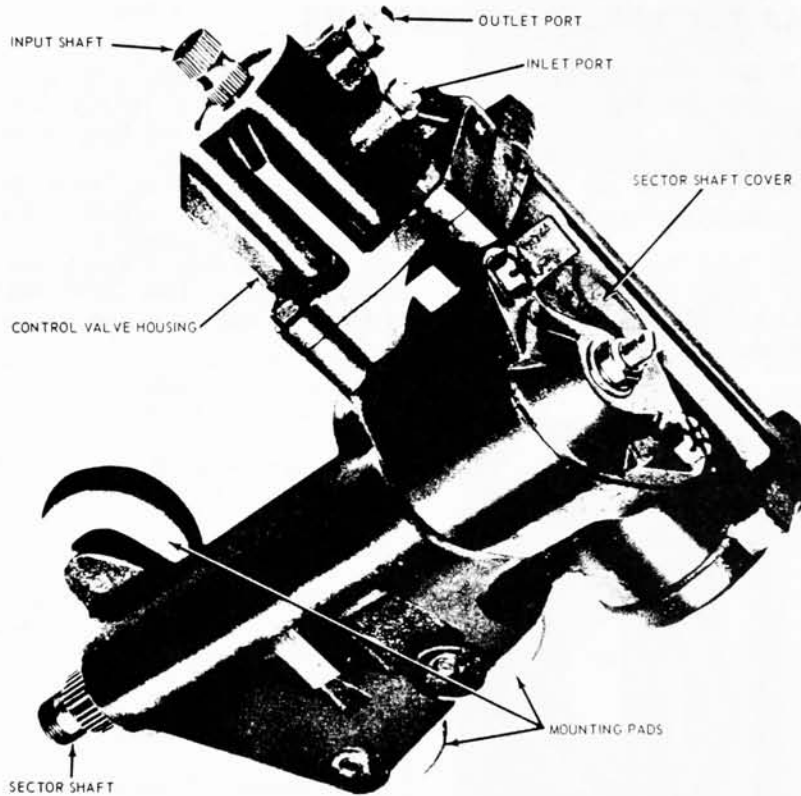
The power steering unit (Fig. 1) is a torsion-bar type of hydraulic assisted system. This system furnishes power to reduce the amount of turning effort required at the steering wheel. It also reduces road shock and vibrations.

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, input shaft 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 are not within speci-



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FIG. 1—Power Steering Gear

A change of one shim size will increase or decrease steering efforts approximately 1 1/2 in.-lbs.

Shims are available in the following thicknesses and are notched on the outside diameter for identification.

0.0057-0.0063	inch—0	notch
0.0077-0.0083	inch—1	notch
0.0097-0.0103	inch—2	notches
0.0117-0.0123	inch—3	notches
0.0137-0.0143	inch—4	notches

**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

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