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# Bronco

# Econoline

and

# Recreational

# Vehicle

# SHOP MANUAL

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## 1967 Ford Bronco Econoline and Recreational Vehicle Shop Manual

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3999 Peregrine Ridge Ct.

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

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# 1967 FORD BRONCO, ECONOLINE and RECREATIONAL VEHICLE

# SHOP MANUAL



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PUBLICATIONS

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## FOREWORD

*This shop manual provides the Service Technician with information for the proper servicing of the 1967 Bronco, Falcon Club Wagon, Econoline and Recreational vehicles.*

*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**

Official serial numbers are preceded and followed by asterisks to prevent unauthorized altering of numbers or symbols. Do not use the Vehicle Warranty Number which appears on the Warranty Plate for title or registration purposes.

### VEHICLE DATA

The Vehicle Data appears on the Rating Plate on the two lines following the Warranty Number. The first three digits under W.B. identify the wheel base in inches. The one or two letters under COLOR identify the exterior paint color (two letters designate a two-tone). The letter and three digits under MODEL designate the truck type within a series. The letter and numerals under BODY, designate the interior trim and body type. The letter identifies the interior trim scheme and the two numerals identify the body or cab type. The transmission installed in the vehicle is identified under TRANS by a letter code. The axle ratio is identified by either a letter and a number or two numbers under AXLE.

Falcon Station Buses and Club Wagons will not show the code information under W.B. (wheelbase), MAX. G.V.W. LBS. (maximum gross vehicle weight pounds), CERT. NET H.P. (certified net horsepower) or R.P.M. (at revolutions per minute). The District Code (two digit number), which appears between R.P.M. and D.S.O., identifies the district which ordered the vehicle. The numerals under D.S.O. reflect the Special Order Number (if the unit is other than standard production). The charts that follow list in detail the various vehicle data codes.

### VEHICLE WARRANTY NUMBER

The Warranty Number is the first line of numbers and letters appearing on the Rating Plate. (Fig. 1). The first letter and two numbers indicate the truck series. The letter following the truck series code designates the engine identification code. The letter following the engine identification code indicates the assembly plant at which the vehicle was built. The remaining numbers indicate the consecutive unit number. The charts that follow, list the various vehicle warranty number codes.

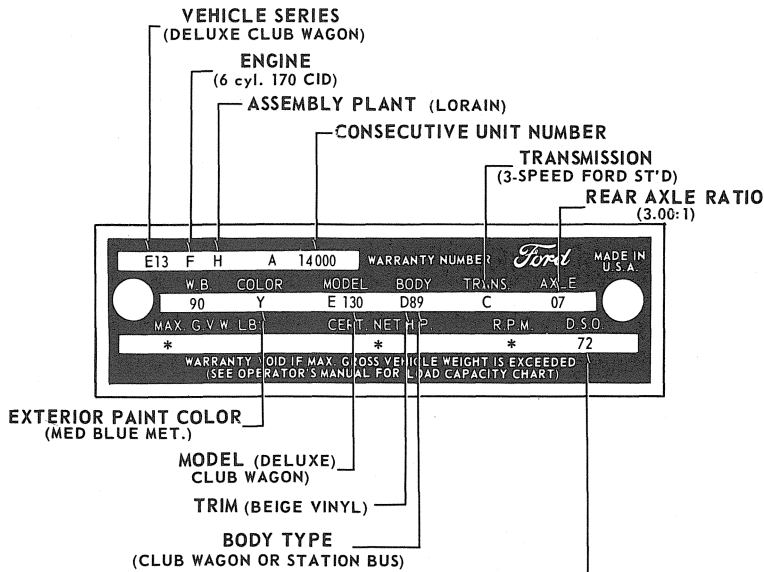
### REAR AXLE CODES — BRONCO

REGULAR	RATIO	RATING	LOCKING
03	4.11:1	2780 Lb.	A3
04	4.57:1	2780 Lb.	A4
05	4.11:1	3300 Lb.	A5
06	4.57:1	3300 Lb.	A6
18	3.50:1	2780 Lb.	B8
19	3.50:1	3300 Lb.	B9

Note: The number "2" immediately following a rear axle code on the rating plate indicates vehicle equipped with a locking front axle.

### ENGINE CODES

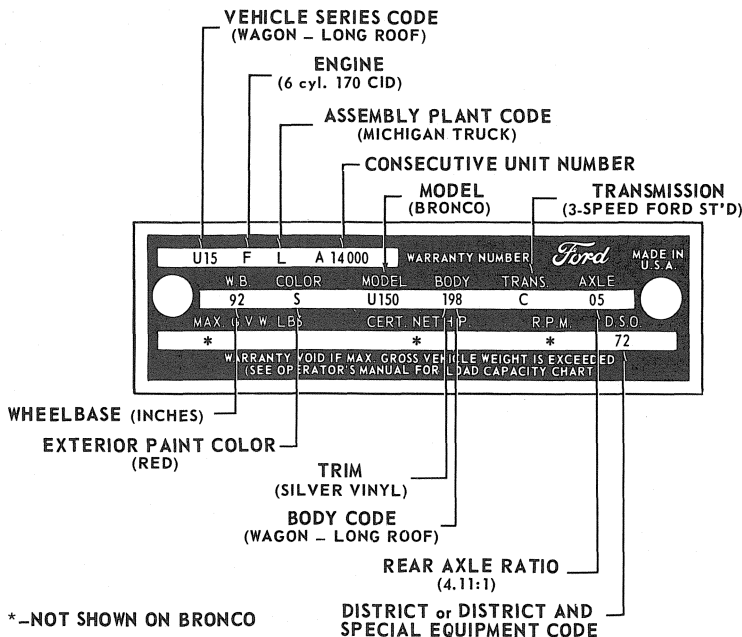
Code	Low Comp. Code	Engine
F	6	6 Cyl. 170 CID (1V)
A	1	6 Cyl. 240 CID (1V)
G	—	6 Cyl. 200 CID (1V)
N	—	8 Cyl. 289 CID (2V)



\*-NOT SHOWN ON FALCON CLUB WAGON AND ECONOLINE

FIG. 1—Typical Rating Plate — Econoline

P 1146-A



\*-NOT SHOWN ON BRONCO

FIG. 2—Typical Rating Plate-Bronco

P 1147-A

Figure 1 illustrates a typical Econoline Rating Plate. The rating plate is attached to the rear (lock) face of the left front door. On vans, buses and wagons, the official serial number is stamped in tunnel models, shield.

Figure 2 illustrates a typical Bronco Rating Plate which is located on the inner left side cowl panel (near the clutch pedal). The official title and registration number is stamped 12 inches to the rear of the right front shock absorber tower on the top surface of the right frame side rail.

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**ASSEMBLY PLANT CODES**

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

**CONSECUTIVE UNIT NUMBER**

Basically, the system assigns the monthly assignment of serial numbers into blocks as follows, beginning with August 1966.

August.....	A 00,000 - A 13,999
September.....	A 14,000 - A 27,999
October.....	A 28,000 - A 41,999
November.....	A 42,000 - A 55,999
December.....	A 56,000 - A 69,999
January.....	A 70,000 - A 83,999
February.....	A 84,000 - A 97,999
March.....	A 98,000 - A 111,999
April.....	A 12,000 - A 25,999
May.....	A 26,000 - A 39,999
June.....	A 40,000 - A 53,999
July.....	A 54,000 - A 67,999
August.....	A 68,000 - A 71,999

**TRANSMISSION CODES**

Code	Transmission
C .....	3-Spd Manual Shift
G .....	C-4 Automatic

**EXTERIOR PAINT COLOR CODES**

Code	M-30J/M-32J Spec. Number	Color
A.....	1724-A.....	Black
B.....	1734-A.....	Lt. Aqua
C.....	1525-A.....	White
D.①.....	1638-A.....	Peacock
E.....	2045-A.....	Med. Beige Met.
G.....	1526-A.....	Chrome Yellow
J.....	1515-A.....	Red
L.....	1237-A.....	Dk. Green
M.....	1619-A.....	White
Q.....	1624-A.....	Med. Blue Met.
S.②.....	1730-A.....	Vermilion
H.....	2097-A.....	Med. Green
.....	1631-A.....	Lt. Beige

**SERIES AND MODEL CODES**

Series	Model	Body
E10.....	E100.....	87A.....Std. Pick-Up
	E100.....	87B.....Dlx. Pick-up
E11.....	E110.....	89B.....Sta. Bus
	E114.....	89K.....Sta. Bus
E12.....	E120.....	89C.....Club Wagon
	E124.....	89T.....Club Wagon ①
E13.....	E130.....	89D.....Dlx. Club Wagon
	E125.....	89L.....Dlx. Club Wagon ①
E14.....	E140.....	89A.....Van, Regular R.H. Side Doors
E16.....	E140.....	89J.....Van, Regular R.H. ① Side Doors
E14.....	E140.....	89E.....Van, Display R.H. ① Fixed Windows
E16.....	E160.....	89M.....Van, Display R.H. ① Fixed Windows
E14.....	E140.....	89F.....Van, R & L Fixed Windows
E16.....	E160.....	89N.....Van, R & L Fixed ① Windows
E14.....	E140.....	89G.....Van, Cargo, R & L Side Doors
E16.....	E160.....	89R.....Van, Cargo, R & L Side Doors ①
E14.....	E140.....	89H.....Van, Panel
E16.....	E160.....	89S.....Van, Panel ①
U13.....	U100.....	96.....Open Body (Roadster) ②
U14.....	U100.....	97.....Pick-Up (Short Roof) ②
U15.....	U100.....	98.....Wagon (Long Roof) ②

① Extended Body  
② Bronco Only

**DISTRICT CODES**

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

**INTERIOR TRIM CODES**

Code	Trim Color
1.....	Parchment Vinyl (Bench Seat Bronco Only)
2.....	Blue Vinyl
3.....	Green Vinyl
4.....	Beige Vinyl
5.....	Red Vinyl
7.....	Parchment Vinyl (Bench Seat)
8.....	Parchment Vinyl (Driver Bucket Seat)
9.....	Parchment Vinyl (Driver & Passenger Bucket Seats)
B.....	Blue Woven Plastic and Blue Vinyl
C.....	Green Woven Plastic and Parchment Vinyl
D.....	Beige Woven Plastic and Parchment Vinyl
E.....	Red Woven Plastic and Red Vinyl

**W.B. (WHEELBASE)**

The wheelbase in inches is entered in this space. The Falcon bus and Club Wagon wheelbase will not be recorded.

The following information (except District Code) does not apply to the Falcon Club Wagons and Bronco warranty plates.

**MAX. G.V.W. LBS.**

The maximum gross vehicle weight in pounds is recorded in this space.

**CERT. NET H.P. R.P.M.**

The certified net horsepower at specified rpm is marked at this location.

**D.S.O.**

If the vehicle is built on a D.S.O., F.S.O., D.T.O., (special orders) the complete order number will be reflected under the DSO space after the District Code Number.

**REAR AXLE CODES — ECONO**

REGULAR	RATIO RATING	LOCKING
01	3.50:1 2300 Lb.	—
02	4.00:1 2300 Lb.	—
07	3.00:1 3050 Lb.	A7
11	3.50:1 3050 Lb.	B1
12	4.11:1 3050 Lb.	B2
13	4.57:1 3050 Lb.	B3



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# Brakes

GROUP

2

<b>PART 2-1</b>	<b>PAGE</b>	<b>PART 2-3</b>	<b>PAGE</b>
General Brake Service .....	2-1	Specifications .....	2-21
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## PART 2-1— General Brake Service

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Preliminary Tests .....	2-1	Pressure Bleeding .....	2-3
Road Test .....	2-2	Centralizing the Pressure	
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Causes .....	2-5	Parking Brake Linkage Adjustment .....	2-3
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Hydraulic System Bleeding and			
Centralizing of the Differential			
Valve .....	2-2		

### 1 DIAGNOSIS AND TESTING

#### PRELIMINARY TESTS

1. Check the fluid level in the master cylinder. 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, C6AZ-19542-A (ESA-M6C25-A) or equivalent to obtain the specified level. **This brake fluid is colored blue for identification purposes. Do not mix low temperature brake fluids with the specified fluid.**

2. If the brake pedal movement feels spongy, bleed the hydraulic brake system to remove air from the lines and cylinder. Refer to Hydraulic System Bleeding, Part 2-1, Section 2. Also, check for leaks or insufficient fluid.

3. Brake pedal lash (free play) is

than 1/4 inch for Econoline models. If the free play is excessive, make several reverse stops to insure uniform adjustment at all wheels.

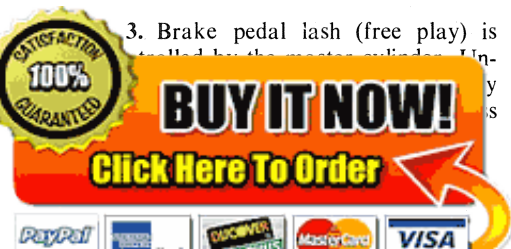
If the free play is still excessive, check the operation of the automatic adjusters. To check adjuster operation, inspect the brake shoes and the adjuster mechanisms for binding or improper installation. Follow the procedure described under Brake Shoe Adjustments in Part 2-2, Section 2.

4. **Turn the ignition switch on.** 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. Center the pressure valve as outlined under Bleeding the Brake System (Part 2-1, Section 2). If the warning light remains on, check the wire for a grounded condition and re-

pair or replace the wire. If the condition of the wire is good, replace the brake warning lamp switch.

5. If the brake warning lamp does not light when a pressure differential condition exists in the brake system, the warning lamp bulb 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.

6. Should one of the brakes be locked and the vehicle must be moved, open the brake cylinder bleeder screw long enough to let out a few drops of fluid. **This bleeding operation will release the brakes, but it will not correct the cause of the trouble.**



## ROAD TEST

The vehicle should be road tested only if the brakes will safely stop the vehicle. Apply the brakes at a speed of

25-30 mph to check for the existence of the trouble symptoms listed in Fig. 2, with the exception of those resolved in the preliminary tests and brake chatter. For each of the symptoms encountered,

check and eliminate the causes which are also listed in Fig. 2. To check for brake chatter or surge, apply the brakes lightly from approximately 50 mph.

## 2 COMMON ADJUSTMENTS AND REPAIRS

### BRAKE PEDAL ADJUSTMENT

The brake system of the Bronco and Econoline vehicles is designed to permit the full stroke of the master cylinder when the brake pedal is fully depressed. **If required, check for proper installation of the pedal mechanism and master cylinder when the master cylinder outlet lines are disconnected.** With the lines disconnected, place a sheet of paper on the floorboard under the pedal, and depress the pedal as far as possible with approximately 50 pounds force. If the paper can be removed without tearing, the master cylinder is properly installed.

#### BRONCO

The brake pedal adjustment or lash (free travel) of Bronco vehicles is controlled by the stroke of the master cylinder. No brake pedal adjustment is required.

#### ECONOLINE

The brake pedal lash (free travel) on Econoline models is controlled by the brake pedal bumper.

When the brake pedal free-travel (which is the movement of the brake pedal before the push rod touches the master cylinder piston) is less than 1/4 inch or more than 7/16 inch, the brake pedal should be adjusted.

1. Push the brake pedal down by hand, and check the free-travel. If the free-travel is not within specifications, raise the front end of the truck and position safety stands.

2. From underneath the truck, remove the retaining bolts and the forward splash shield.

Loosen the lock nut on the adjuster

4. Hold the bolt securely, and torque the lock nut to 12-24 ft-lbs.

5. Recheck the pedal free-travel to make sure that the adjustment did not change when the lock nut was tightened.

6. Install the forward splash shield and attaching bolts, remove the safety stands, and lower the vehicle.

### 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 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). **The differential valve will remain off center and the warning lamp will remain lit until the valve is centralized.** 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 required to centralize the valve will be created on the secondary system (rear brake) side of the differential valve.

#### MANUAL BLEEDING

The primary and secondary (front

and rear) hydraulic brake systems are individual systems and are bled separately. Bleed the longest line first on the individual system being serviced. **During the complete bleeding operation, DO NOT allow the reservoir to run dry.** Keep the master cylinder reservoir filled with Rotunda Brake Fluid—Extra Heavy Duty, C6AZ-19542-A (ESA-M6C25-A). **This brake fluid is colored blue for identification purposes. Do not mix low temperature brake fluids with the specified fluid during the bleeding operations. Never use brake fluid which has been drained from the hydraulic system.**

1. Bleed the master cylinder at the outlet port side of the system being serviced. To bleed the master cylinder, loosen the master cylinder to hydraulic line nut. Operate the brake pedal slowly until the brake fluid at the outlet connection is free of bubbles, and tighten the nut securely.

2. Position a suitable 3/8 inch box wrench (Fig. 1) on the bleeder fitting on the brake wheel cylinder. Attach a rubber drain tube to the bleeder fitting. **The end of the tube should fit snugly around the bleeder fitting.**

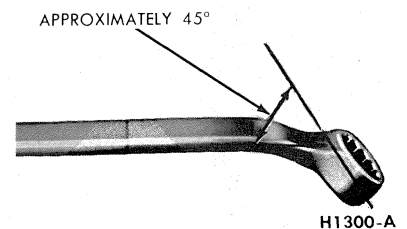






FIG. 1—Wrench for Bleeding Brake Hydraulic System

3. Submerge the free end of the tube in a container partially filled with clean


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brake fluid, and loosen the bleeder fitting approximately 3/4 turn.

4. Push the brake pedal down slowly thru its full travel. Close the bleeder fitting, then return the pedal to the fully-released position. Repeat this operation until air bubbles cease to appear at the submerged end of the bleeder tube.

5. When the fluid is completely free of air bubbles, close the bleeder fitting and remove the bleeder tube.

6. Repeat this procedure at brake wheel cylinder on the opposite side. Refill the master cylinder reservoir after each wheel cylinder is bled. When the bleeding operation is completed, the fluid level should be filled to within 1/4 to 1/2 inch from the top of the reservoirs.

7. Centralize the pressure differential valve. Refer to the Centralizing of the Pressure Differential Valve procedures which follow.

### PRESSURE BLEEDING

Bleed the longest lines first. The bleeder tank should contain enough new Rotunda Brake Fluid—Extra Heavy Duty, C6AZ-19542-A (ESAM6C25-A) to complete the bleeding operation. The tank should be charged with approximately 10 to 30 pounds of air pressure. Never exceed 50 pounds pressure. This brake fluid is colored blue for identification purposes. Do not mix low temperature brake fluids with the specified fluid during the bleeding operations. Never use brake fluid that has been drained from the hydraulic system.

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. Position a 3/8 inch box wrench

(Fig. 1) 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.

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

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

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

7. Repeat steps 3 through 6 at the opposite wheel cylinder of the system being bled.

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

9. Remove the 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.

10. Centralize the pressure differential valve, using the procedure which follows:

### CENTRALIZING THE PRESSURE DIFFERENTIAL VALVE

1. On an Econoline model, remove the front splash shield retaining bolts and remove the splash shield.

2. Turn the ignition switch to the ON position. Loosen the pressure differential valve inlet tube nut of the unfailed system, or the side opposite the system that was bled last. Operate the brake pedal carefully and gradually until the pressure differential valve is returned to a centralized position and the brake warning light goes out.

3. 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.

4. On an Econoline model, install the front lower splash shield and tighten the retaining bolts.

5. Turn the ignition switch off.

### PARKING BRAKE LINKAGE ADJUSTMENT

#### ECONOLINE

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 by turning the handle counterclockwise and pushing it down.

2. Pull the parking brake handle up one notch from its normal released position.

3. Raise the vehicle.

4. Turn the lock nut in front of the equalizer (Fig. 16, Part 2-2) several turns forward.

5. Turn the adjusting nut forward against the equalizer until a moderate drag is felt when turning the rear wheels in the direction of forward rotation.

6. When the cables are properly adjusted, tighten the lock nut.

7. Release the parking brake, and make sure that the brake shoes return to the fully released position and no drag is felt when turning the rear wheels.

#### BRONCO

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

1. Apply the parking brake control pedal until the first notch of the ratchet is engaged.

2. Raise the vehicle on a suitable hoist or jack.

3. Refer to Fig. 17, Part 2-2 and install a cable tension gauge to each cable in turn, in the area indicated in Fig. 17.

4. Loosen the locknut in front of the equalizer, and tighten the adjusting nut until a cable tension of 80-90 lbs. is registered on the gauge.

5. If a tension gauge is not available, tighten the adjusting nut until a medium drag is felt on each rear brake. Release the control pedal and make sure the brakes are free of the drum, so that the shoes are not pulled off their anchors.

6. Lock the adjustment with the locknut, and lower the vehicle.

## 3 CLEANING AND INSPECTION

Part 2-2, Section 2. Wash all the parts except the brake shoes in a cleaning fluid and dry them with compressed air.

2. Brush all dust from the backing

plates and the interior of the brake drums.

3. Inspect the brake shoes for excessive lining wear or shoe damage. If the

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lining is worn to within 1/32 inch of any rivet head or if the shoes are damaged, they must be replaced. Replace any lining that has been oil saturated. Replace lining in axle sets. Prior to replacement of 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 springs show

any loss of load or change in free length, indicating overheating, replacement of the retracting and hold down springs is necessary. **Overheated springs lose their pull and could cause the new lining to wear prematurely, if they are not replaced.**

5. If the vehicle has 24,000 or more miles of operation on the brake linings or signs of overheating are present when relining brakes, the wheel cylin-

ders should be disassembled and inspected for wear and entrance of dirt into the cylinder. The cylinder cups should be replaced at this time to avoid 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 them. Refer to Part 2-2, Section 4 for refinishing.



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FIG. 2 – BRAKE TROUBLE SYMPTOMS AND POSSIBLE CAUSES

Possible Causes of Trouble Symptoms	Trouble Symptoms														
	One Brake Drags	All Brakes Drag	Hard Pedal	Spongy Pedal	Vehicle 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	Warning Lamp Stays Lighted	Warning Lamp Does Not Light
Mechanical Resistance at Pedal or Shoes		X	X				X							X	
Brake Line Restricted	X	X	X		X									X	
Leaks or Insufficient Fluid				X			X	X					X	X	
Improper Tire Pressure					X				X						
Improperly Adjusted or Worn Wheel Bearings	X				X										
Distorted or Improperly Adjusted Brake Shoe	X	X	X		X	X	X				X	X		X	
Faulty Retracting Spring	X				X										
Drum Out of Round	X				X		X								
Linings Glazed or Worn			X		X	X	X			X	X	X			
Oil or Grease on Lining			X		X	X	X		X		X	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			X	
Dirty Brake Fluid	X	X							X				X		
Faulty Master Cylinder		X					X	X					X	X	
Air in Hydraulic System	X			X			X						X		
Self Adjusters Not Operating					X		X							X	
Insufficient Shoe-to-Carrier Plate Lubrication	X												X		
Tire Tread Worn						X					X				
Poor Lining to Drum Contact							X								
Loose Front Suspension							X								
Threads Left by Drum Turning Tool Pulls Shoes Sideways											X				
Cracked Drum							X								
One Section of Dual System is Inoperative								X		X			X	X	
Differential Pressure Valve is Not Centered														X	
Wiring to Warning Lamp or Switch is Grounded														X	
Warning Lamp Switch is Grounded														X	
Warning Lamp Bulb is Burned Out															X
Wiring to Lamp or Switch has an															X
ive															X



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# PART 2-2— Brake System

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## 1 DESCRIPTION AND OPERATION

### HYDRAULIC, SELF-ADJUSTING BRAKE SYSTEM

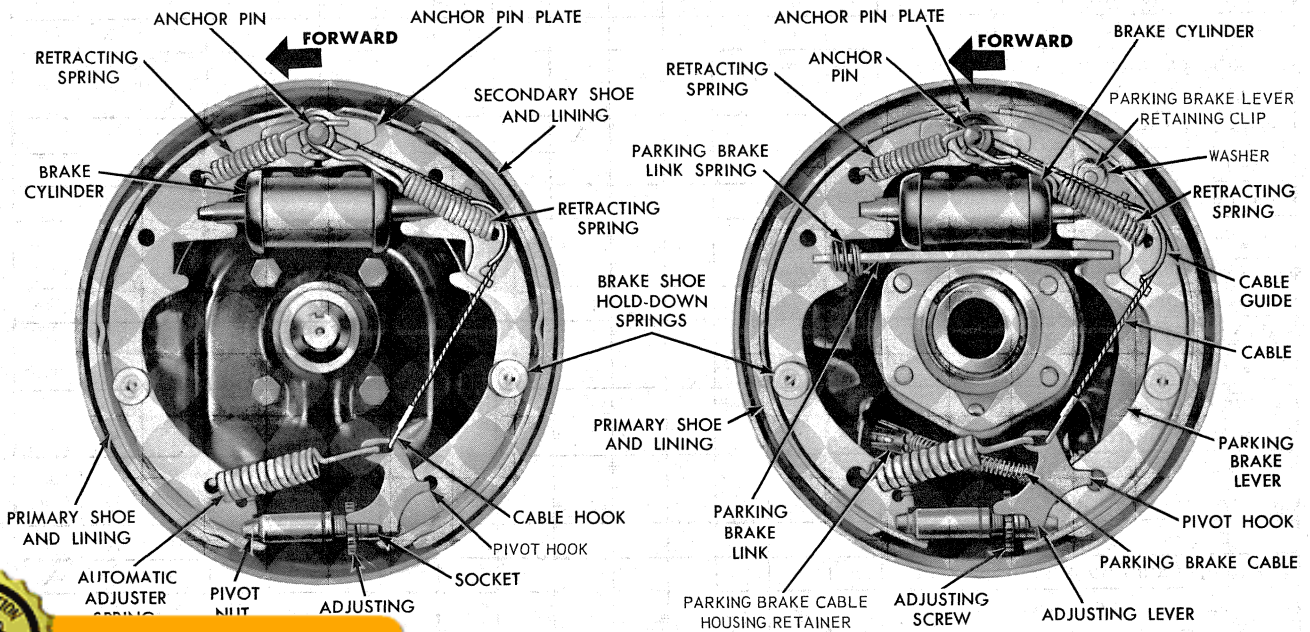
Single-anchor, internal-expanding duo-servo self-adjusting hydraulic brakes with a safety, dual master cylinder are used on Econoline (Figs. 1 and 2) and Bronco (Fig. 3) vehicles.

The master cylinder converts physical force from the brake pedal into hydraulic pressure against the pistons in the wheel cylinders. The wheel cylinders

convert hydraulic pressure back into physical force at the brake shoes. The dual, safety-type master cylinder contains a double hydraulic cylinder

der pistons, in turn, convert hydraulic pressure back into physical force at the brake shoes.

The dual, safety-type master cylinder contains a double hydraulic cylinder



REAR BRAKE

H1340-B



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Assemblies—Econoline



with two fluid reservoirs, two hydraulic pistons (a primary and secondary) and

two residual check valves, located in the outlet ports (Figs. 2 and 3). The master

cylinder secondary outlet port is connected to the rear brakes and the pri-

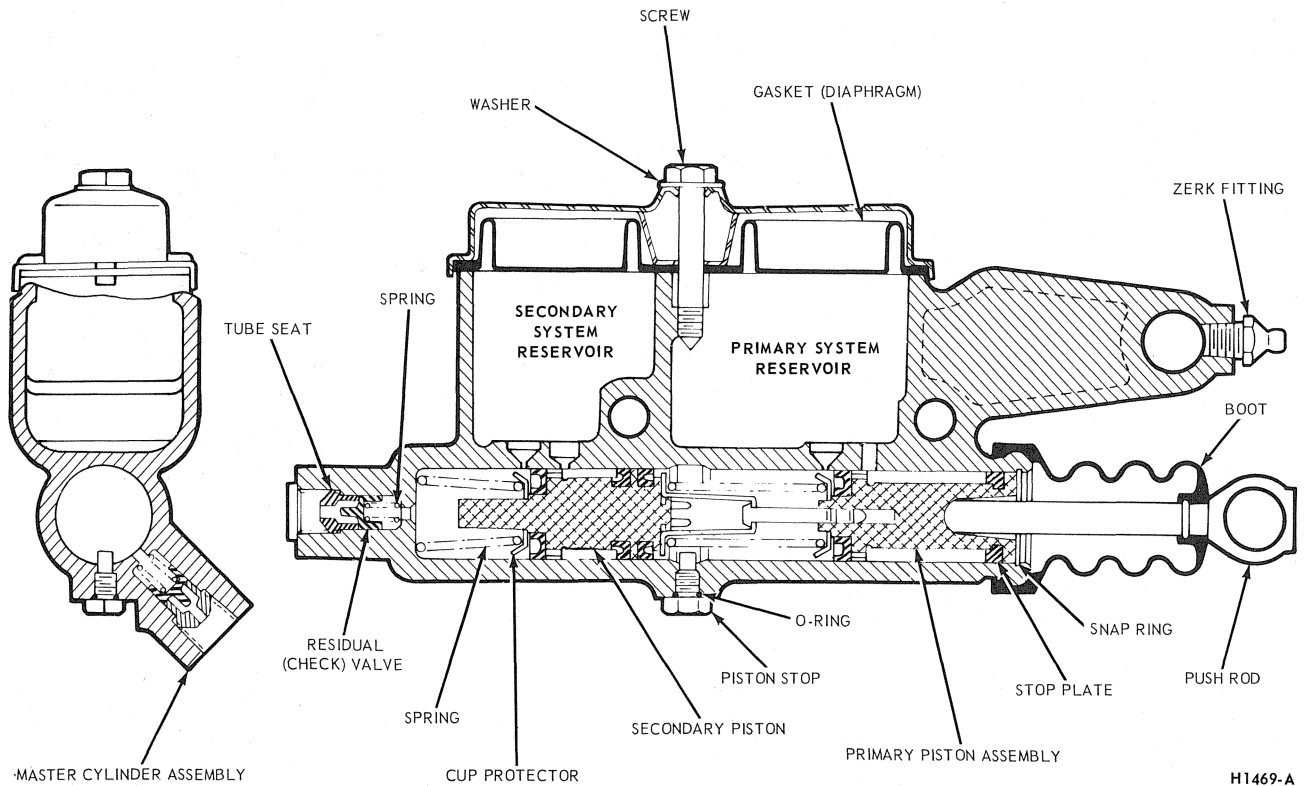
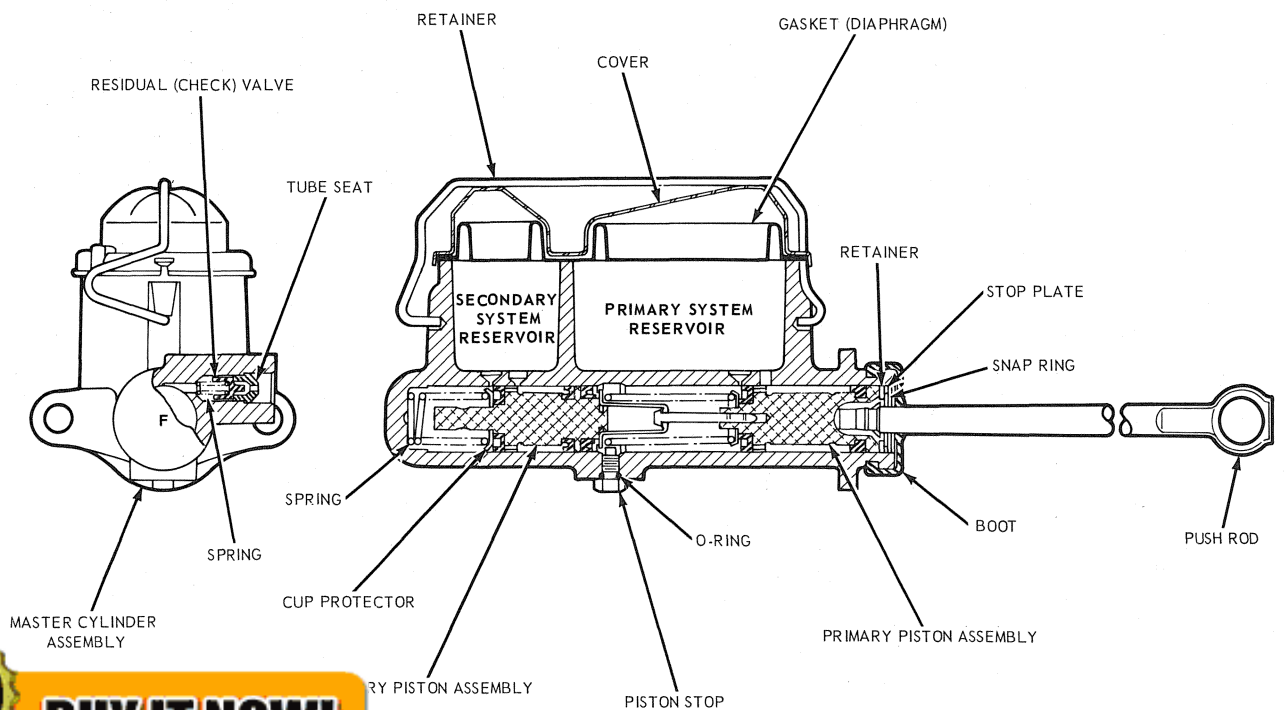


FIG. 2—Dual-Master Cylinder—Econoline

H1469-A



—Bronco

H1470-A

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mary brake outlet port is connected to the front brakes.

The master cylinder primary and secondary pistons function together when the primary and secondary systems are fully operative.

With the master cylinder and front and rear brake systems filled and bled, a solid column of fluid is located on both the primary (front brake) and secondary (rear brake) pistons. Upon application of the brakes at the brake pedal, fluid is displaced by the pistons, into the wheel cylinders to activate both the front and rear brakes. Upon release of brake application the brake fluid returns from the wheel cylinders through the front and rear brake lines and residual valves to the master cylinder bore.

Failure in either the front or rear brake system does not result in failure of the entire hydraulic brake system. Should hydraulic failure occur in the rear brake system, the hydraulic pressure from the primary piston (which actuates the front brakes) causes the unresisted secondary piston (which actuates the rear brakes) to bottom out in its bore. The primary piston then proceeds to actuate the front brakes with the continued stroke of the brake pedal. Fluid under pressure will continue to be displaced by the front brake (primary)

system allowing braking at the front wheels.

Should a failure occur in the primary (front brake) hydraulic system; the initial brake pedal stroke would cause the unresisted primary piston to bottom out on the secondary piston. Continued pedal stroke will move both pistons, and the fluid under pressure applied by secondary piston will apply the rear brakes.

Failure in one independent hydraulic system does not affect the hydraulic fluid displacement of the other independent system. In addition, hydraulic output pressure remains basically the same for the same pedal effort.

The increased pedal travel and pedal effort required to compensate for the loss of the failed portion of the brake system provides adequate warning that partial brake failure has occurred. **With the ignition switch turned on, a dual brake warning light on the instrument panel will also indicate a brake system failure.**

Brake lines (tubes) are connected from the brake master cylinder primary and secondary system outlet ports to the pressure differential valve assembly (Figs. 12 and 13). The electrical brake warning switch, and the brake lines (tubes) leading from the differential valve assembly to the front and rear

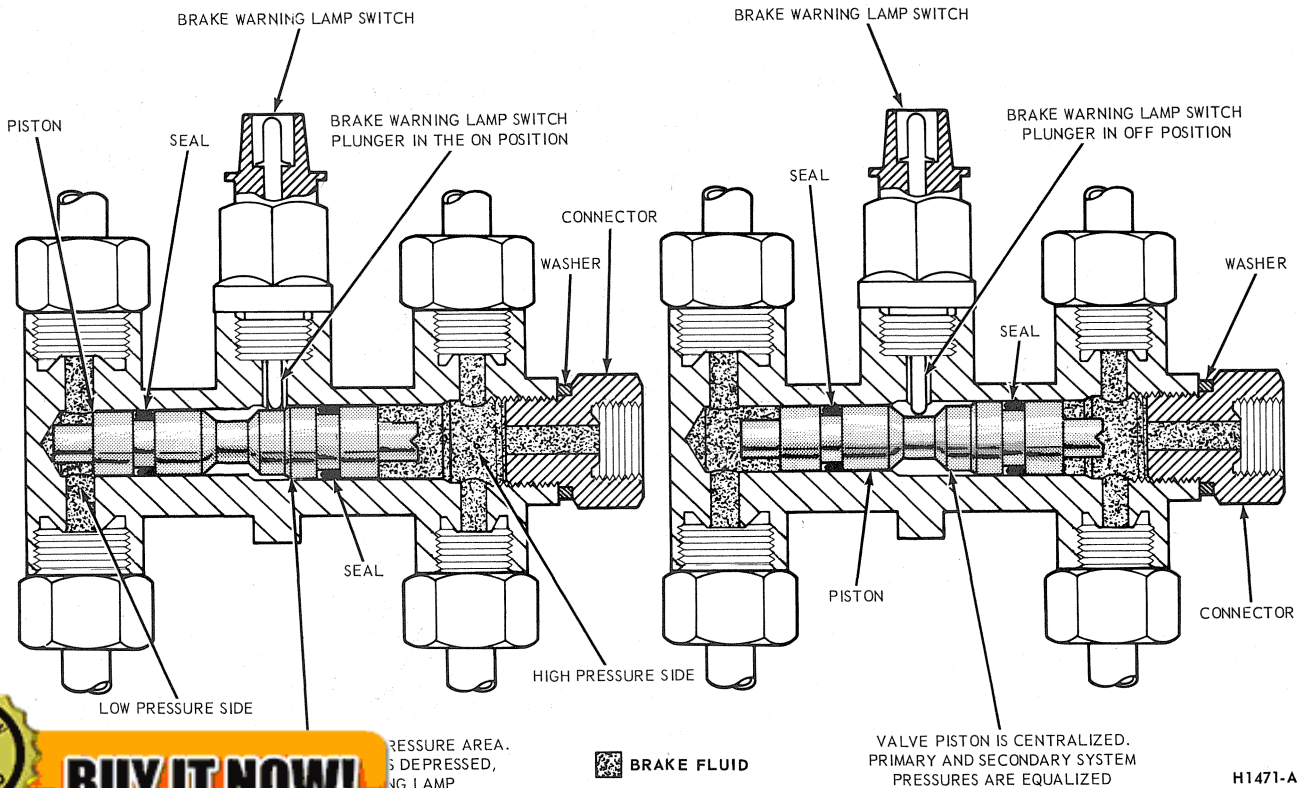
wheel brake cylinders are also shown in Figs. 12 and 13.

The brake system hydraulic pressure differential valve assembly and the mechanically operated electrical switch operates the dual brake system warning light.

The spring-loaded switch plunger contacts the bottom of a tapered shoulder groove in the center of the differential valve. O-ring seals are used in the seal ring lands near each end of the valve (Fig. 4).

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

Conversely, failure of the front brakes would force the differential valve toward the low pressure area (front brake system outlet port) and activate the brake warning switch mechanism in the same manner as described above.



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...RESSURE AREA...  
...S DEPRESSED...  
...NG LAMP

—Typical

H1471-A

The self-adjusting brake mechanism consists of a cable, cable guide, adjusting lever, and adjuster spring (Fig. 1). 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 while the vehicle is moving rearward and the brake pedal pressure is firmly applied.

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

is against the anchor pin and the primary shoe is moved toward the drum. Therefore, the adjuster does not operate.

The rear brake assembly is basically the same as the front brake. The conventional parking brake lever, link, and spring are used in the rear brake assemblies.

The anchor pins on all brakes are fixed and non-adjustable.

Installation of the brake pedals for the Bronco and Econoline vehicles are shown in Figs. 14 and 15.

## PARKING BRAKE CONTROLS

### ECONOLINE

An independent hand-operated parking brake control actuates the rear wheel brake shoes through a cable linkage. The operating cable is routed from the parking brake control assembly to the equalizer lever which is attached to the equalizer assembly. The rear brake cables connect the equalizer assembly to the parking brake lever at each rear secondary shoe as shown in Fig. 1.

When the handle is pulled the primary and secondary brake shoes are forced against the rear brake drums. The handle is held in the applied position by the engagement of a spring loaded pawl with a ratchet. Turning the handle counterclockwise disengages the pawl from the ratchet to release the brakes.

### BRONCO

An independent foot-operated parking brake control actuates the rear wheel brake shoes through a cable linkage. The operating cable is routed from the parking brake control assembly to the equalizer. The rear brake cables connect the equalizer assembly to the parking brake lever at each rear secondary shoe (Fig. 17).

When the pedal is depressed the secondary brake shoes are forced against the rear brake drums. The pedal is held in the applied position by the engagement of a spring-loaded pawl with a ratchet in the control assembly (Fig. 17).

The parking brake control assembly is mounted to the cowl inner side panel. The pedal pivots on a stationary pedal mount. A spring-loaded pawl and a release lever are assembled to the pedal. A ratchet is assembled to the upper end of the pedal. The pawl contacts the ratchet at such an angle that the ratchet teeth will slide over the pawl as the pedal is depressed; however, when the applying motion stops and the pedal starts to release, the pawl engages the ratchet and thus locks the brakes in the applied position.

When the manual release lever is pulled back, (Fig. 17), the cam action of the lever on the pawl cam pin will disengage the pawl from the ratchet to release the brakes.

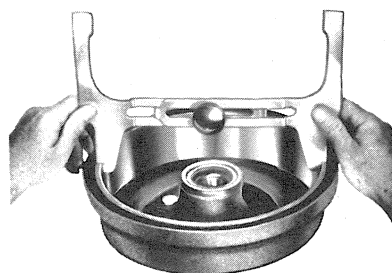
## 2 IN-VEHICLE ADJUSTMENTS AND REPAIRS

### BRAKE SHOE ADJUSTMENT

The 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.

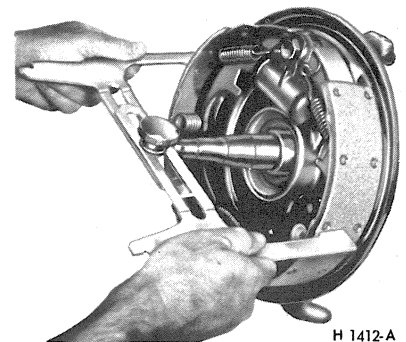
Considerable time savings can be made when performing one of these operations, by using Rotunda Tool HRE 8650 to adjust the brake shoes while the drum is removed. Use the following procedure:

1. Insert the tool into the brake drum as shown in Fig. 5. Adjust the spread of the tool and lock in place with the lock knob.



H 1411-A

FIG. 5—Measuring Drum



H 1412-A

FIG. 6—Measuring Shoes

2. Use the automatic adjusting lever out of engagement while rotating the adjusting screw, to prevent burring the screw slots. Make sure the adjusting screw rotates freely. If necessary, lubri-

cate 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.

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

On Bronco front wheels, install the outer wheel bearing cone and adjusting nut. Adjust the front wheel bearings as detailed in Part 3-6, Section 2. If the vehicle is equipped with free-running lock-out hubs, refer to Front Wheel Drive Lock-Out Hub Installation, Part 4-3, Section 2.

On Econoline front wheels, install the wheel outer bearing, washer, and adjusting nut, then adjust the wheel bearings as outlined in Part 3-6, Section 2.

On the rear wheels, install the three attaching nuts and tighten them securely.

On Econoline front wheels, install the wheel outer bearing, washer, and adjusting nut, then adjust the wheel bearings as outlined in Part 3-6, Section 2.

On the rear wheels, install the three attaching nuts and tighten them securely.

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

6. Complete the adjustment by applying the brakes several times while backing the vehicle.

### FRONT BRAKE DRUM —ECONOLINE

#### REMOVAL

1. Raise the vehicle so that the wheel is clear of the floor.

2. Remove the wheel cover or hub cap, wheel, and bearing dust cap. Remove the cotter pin, nut lock, nut, and washer.

3. Pull the brake drum approximately two inches forward and push back into position. Remove the wheel bearing and withdraw the brake drum.

If the brake drum will not come off, insert a narrow screwdriver through the brake adjusting hole in the backing plate, and disengage the adjusting lever from the adjusting screw. While thus holding the adjusting lever away from the adjusting screw, back off the adjusting screw with the brake adjusting tool (Fig. 7). **Back off the adjustment only if the drum cannot be removed. Be very careful not to burr, chip, or damage the**

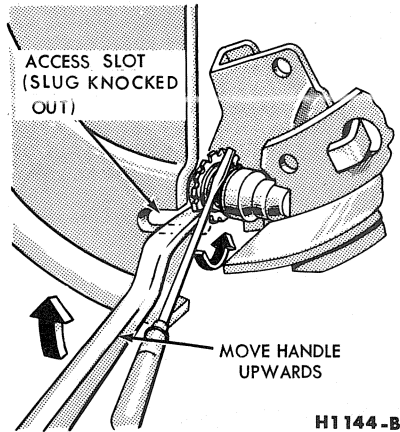


FIG. 7—Backing Off The Brake Adjustment—Typical

check to make sure that the adjusting lever is still properly seated in the shoe web.

#### INSTALLATION

1. If the drum is being replaced, remove the protective coating from the new drum with carburetor degreaser. Install new bearings and grease retainer. Pack the wheel bearings, install the inner bearing cone and roller assembly in the inner cup, and install the new grease retainer. See Part 3-6, Section 2.

If the original drum is being installed, make sure that the grease in the hub is clean and adequate.

2. Refer to Brake Shoe Adjustment in this section and adjust the brake shoes as outlined, using Rotunda Tool HRE 8650. Adjust the brake shoes as outlined using Rotunda Tool HRE 8650.

3. Install the drum assembly, outer wheel bearing, washer and adjusting nut.

4. Adjust the wheel bearing as outlined in Part 3-6, Section 2. Install the nut lock and cotter pin. Then install the grease cap.

5. Install the wheel and hub cap.

### FRONT BRAKE DRUM —BRONCO

#### REMOVAL

1. Raise the vehicle and install safety stands.

2. Back off the brake adjusting screw, if necessary. Remove the wheel cover, if installed.

3. Remove the front grease cap. Remove the driving hub retaining

snap ring and slide the splined driving hub from between the axle shaft and the wheel hub. Remove the driving hub spacer. (If equipped with free-running lock-out hubs, refer to Front Wheel Drive Lock-Out Hub Removal, Part 4-3, Section 2.)

4. With tool T59T-1197-B, remove the lock nut, washer, and wheel bearing adjusting nut from the spindle. Remove the wheel, hub and drum as an assembly. The wheel outer bearing will be forced off the spindle at the same time. Protect the spindle and inner bearing cone from dirt.

5. Remove the wheel and tire from the hub.

6. Press the hub bolts from the hub and drum and remove the drum.

#### INSTALLATION

1. If the drum is being replaced, remove the protective coating from the new drum with carburetor degreaser.

2. Inspect the hub grease seal and bearing cups. Replace as necessary.

3. Press new hub bolts into the hub and drum assembly.

4. Install the hub and drum assembly on the spindle.

5. Install the outer wheel bearing cone and adjusting nut. Adjust the front wheel bearings as detailed in Part 3-6, Section 2. (If equipped with free running lockout hubs, refer to Front Wheel Drive Lock-Out Hub Installation, Part 4-3, Section 2.)

### REAR BRAKE DRUM

#### REMOVAL

1. Raise the vehicle so that the wheel is clear of the floor.

2. Remove the hub cap and wheel and tire. Remove the three attaching nuts and remove the brake drum.

If the brake drum will not come off, insert a narrow screwdriver through the brake adjusting hole in the carrier plate, and disengage the adjusting lever from the adjusting screw. While thus holding the adjusting lever away from the adjusting screw, back off the adjusting screw with the brake adjusting tool (Fig. 7). **Back off the adjustment only if the drum cannot be removed. Be very careful not to burr, chip, or damage the notches in the adjusting screw; otherwise, the self adjusting mechanism will not function properly.**

If the adjusting screw was backed off, check to make sure that the adjusting lever is still properly seated in the shoe web.



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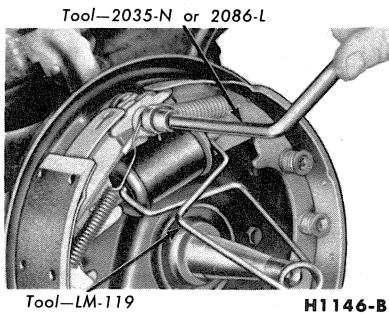
**INSTALLATION**

1. Remove the protective coating from a new drum with carburetor degreaser.
2. Adjust the brake shoes as outlined under Brake Shoe Adjustment in this section, using Rotunda Tool HRE 8650.
3. Place the drum over the brake assembly and into position.
4. Install the three attaching nuts and tighten securely. Install the wheel on the axle shaft flange studs against the drum, and tighten the nuts to specifications.

**BRAKE SHOE AND ADJUSTING SCREW**

**REMOVAL**

1. With the wheel and drum removed, install a clamp over the ends of the brake cylinder as shown in Fig. 8.



**FIG. 8—Typical Retracting Spring Removal**

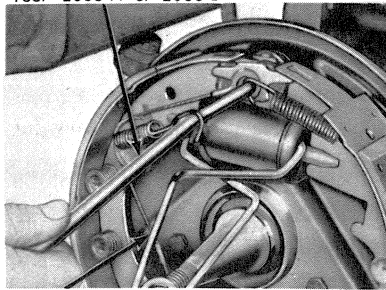
2. Remove the secondary shoe to anchor spring with the tool shown in Fig. 8. With the same tool, remove the primary shoe to anchor spring. Unhook the cable anchor.
3. Remove the cable guide from the secondary shoe (Fig. 1).
4. Remove the shoe hold-down springs, shoes, adjusting screw, pivot nut, socket and automatic brake adjusting parts.
5. On rear brakes, remove the parking brake link and spring. Disconnect the parking brake cable from the parking brake lever.
6. After removing the rear brake secondary shoe, disassemble the parking brake lever from the shoe by removing the retaining clip and spring washer (Fig. 1).

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 backing plate.
3. Position the brake shoes on the backing plate, and install the hold down spring pins, springs, and cups. Use aluminum colored springs for the primary shoe and purple springs for the secondary shoe. On the rear brake, install the parking brake link, spring, and washer. Connect the parking brake cable to the parking brake lever (Fig. 1).

4. Place the cable anchor over the anchor pin with the crimped side toward the backing plate.
5. Install the primary shoe to anchor (short) spring with the tool shown in Fig. 9.

Tool-2035-N or 2086-L



**FIG. 9—Typical Retracting Spring Installation**

6. Install the cable guide on the secondary shoe web with the flanged hole fitted into the hole in the secondary shoe web. Thread the cable around the cable guide groove (Fig. 1.)

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

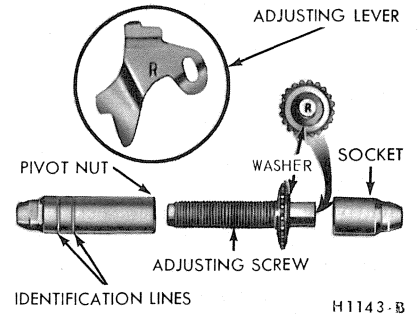
7. Install the secondary shoe to anchor (long) spring (Fig. 9).

**Be certain that the cable end 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.

On front brakes, install the shoe retracting assist spring.

8. Apply high-temperature (C4AZ-19590-A) grease to the threads of 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.

**Interchanging the brake shoe adjusting screw assemblies from one side of the vehicle to the other would cause the brake shoes to retract rather than expand each time the automatic adjusting**



**FIG. 10—Adjusting Screw and Lever Identification**

**mechanism operated.** To prevent installation on the wrong side of the truck, the socket end of the adjusting screw is stamped with an R or L (Fig. 10). The adjusting pivot nuts can be distinguished by the number of lines machined around the body of the nut. Two lines indicate a right nut; one line indicates a left nut.

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

10. Hook the cable hook into the hole in the adjusting lever from the backing plate side. The adjusting levers are stamped with an R or L to indicate their installation on a right or left brake assembly (Fig. 10).

11. Position the hooked end of the adjuster spring into the large hole in the primary shoe web, and connect the loop end of the spring to the adjuster lever hole.

12. Pull the adjuster lever, cable and automatic adjuster spring down and toward the rear to engage the pivot hook in the large hole in the secondary shoe web (Fig. 9).

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

If pulling the cable does not produce the action described, or if the lever action is sluggish instead of positive and sharp, check the position of the lever on the adjusting screw toothed wheel. With the brake in a vertical position (anchor at the top), the lever should contact the adjusting wheel one tooth above the center line of the adjusting screw. If the contact point is below this center line,

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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 the specified length (Part 2-3), plus or minus 1/64 inch, from the far edge of the cable anchor hole to the inside edge 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. Repair the hook or 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.

14. Remove the clamp from the brake cylinder. Perform a brake adjustment. Install the drum and wheel. Adjust the brakes as required.

## WHEEL CYLINDER REPAIR

The cylinder does not have to be removed from the backing plate for disassembly, inspection, or overhaul. However, if the inspection reveals sev-

ere scoring or damage, the cylinder must be removed for replacement.

### DISASSEMBLY

1. Remove the rubber boots (Fig. 11). Remove the pistons, cups, and return spring from the cylinder bore.

2. Remove the bleeder screw.

### INSPECTION

1. Wash all parts in clean denatured alcohol, and dry with compressed air.

2. Check all internal parts for excessive wear or damage. **If any internal part requires replacing, all should be replaced.**

3. Inspect the cylinder bore for score marks and rust. If either condition is present, the cylinder must be honed. **However, the cylinder should not be honed more than 0.003 inch beyond its original diameter.**

4. Check to be sure that the bleeder hole is open.

### ASSEMBLY

1. Apply a coating of heavy-duty brake fluid to all internal parts.

2. Thread the bleeder screw into the cylinder and tighten securely.

3. Insert the return spring, cups, and pistons (Fig. 11) in their respective positions in the cylinder bore. Place a boot over each end of the cylinder.

## WHEEL CYLINDER REPLACEMENT

### REMOVAL

1. With the wheel in a raised posit-

ion, remove the wheel and drum.

2. Place a clamp over the ends of the brake cylinder.

3. Remove the brake shoe assembly, following steps previously outlined in this section.

4. Disconnect the brake line from the brake cylinder. To disconnect the hose at a front cylinder, loosen the pipe fitting that connects the opposite end of the hose to the brake tube at a bracket on the frame. Remove the horseshoe-type retaining clip from the hose and bracket, disengage the hose from the bracket, then unscrew the entire hose assembly from the front brake cylinder.

At a rear cylinder, unscrew the pipe fitting that connects the tube to the cylinder.

5. Remove the two cylinder retaining screws at the back side of the backing plate, and remove the cylinder.

### INSTALLATION

1. Place the brake cylinder into position against the backing plate, and secure with two screws and lock washers. Torque to specification.

2. On a front cylinder, install a new copper gasket over the hose fitting. Screw the hose assembly into the cylinder. Engage the opposite end.

## BRAKE BACKING PLATE REPLACEMENT

### REMOVAL

1. Remove the wheel and brake drum. Disconnect the brake line from the brake cylinder.

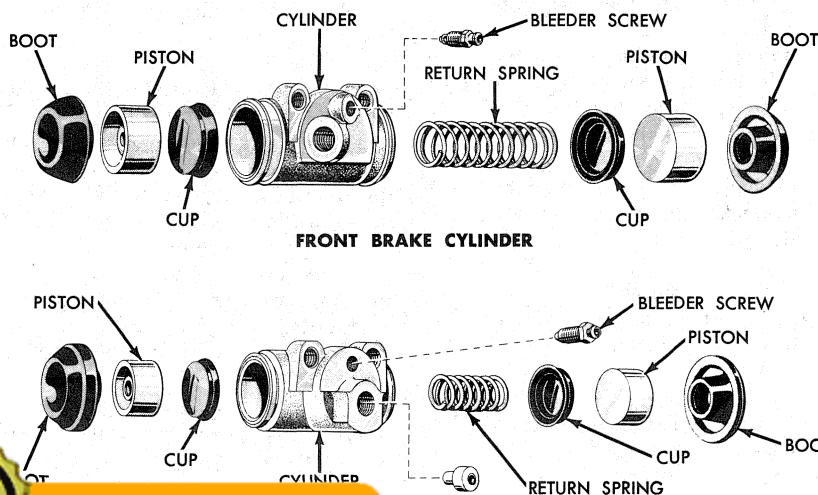
2. Remove the brake shoe assemblies and the brake cylinder as outlined in this section. On the rear wheels, disconnect the parking brake lever.

3. If the rear backing plate is being replaced, rotate the axle shaft so that the hole in the axle shaft flange lines up with the backing plate retaining nuts, and remove the nuts. Pull the axle shaft assembly out of the housing with Tool T60K-4234-A and T50T-100-A, then remove the backing plate.

If the front backing plate is being replaced, remove the four bolts and nuts that secure the plate to the front wheel spindle and remove the plate.

### INSTALLATION

1. Position a new rear backing plate on the retaining bolts in the axle housing flange. Insert the axle shaft into the housing so that the splines engage the differential side gear with the bearing retainer sliding onto the attaching bolts



FRONT BRAKE CYLINDER

REAR BRAKE CYLINDER

H1129-B

Typical Cylinders—Typical



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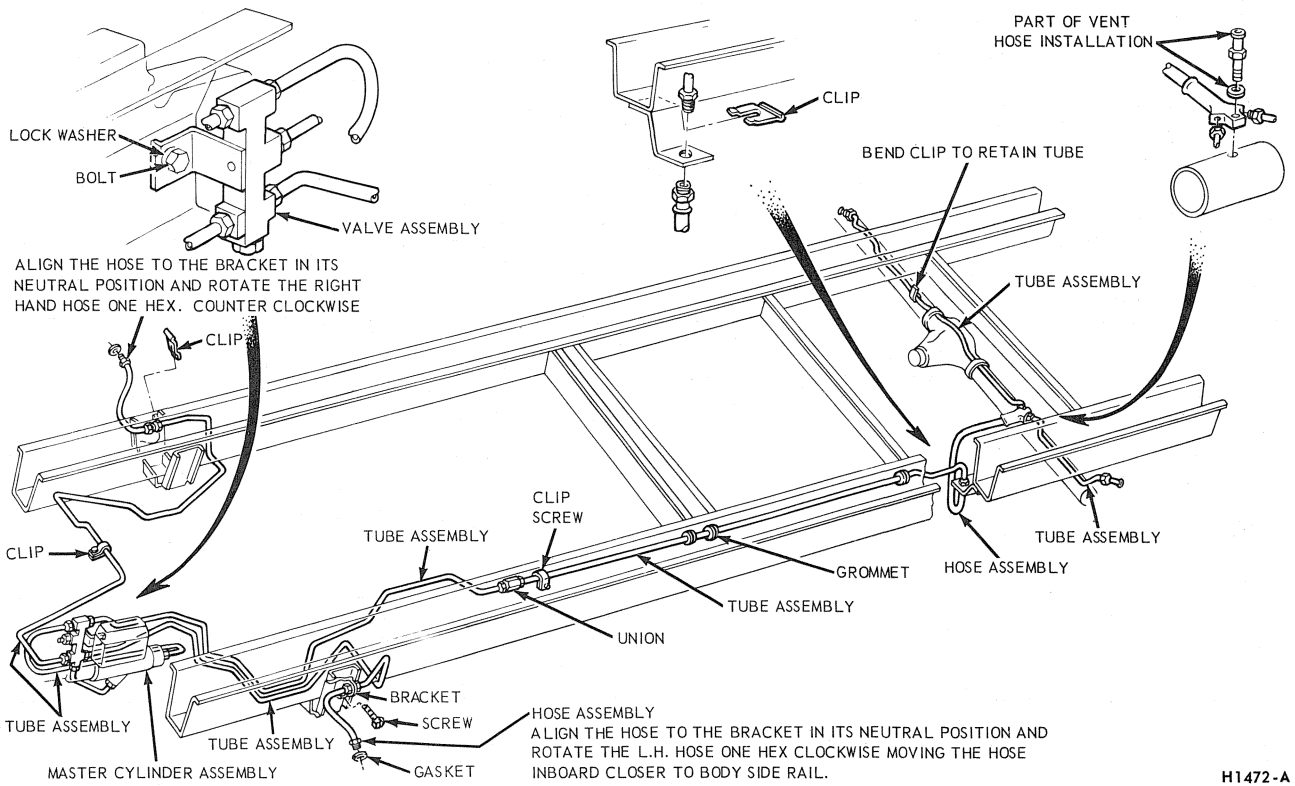
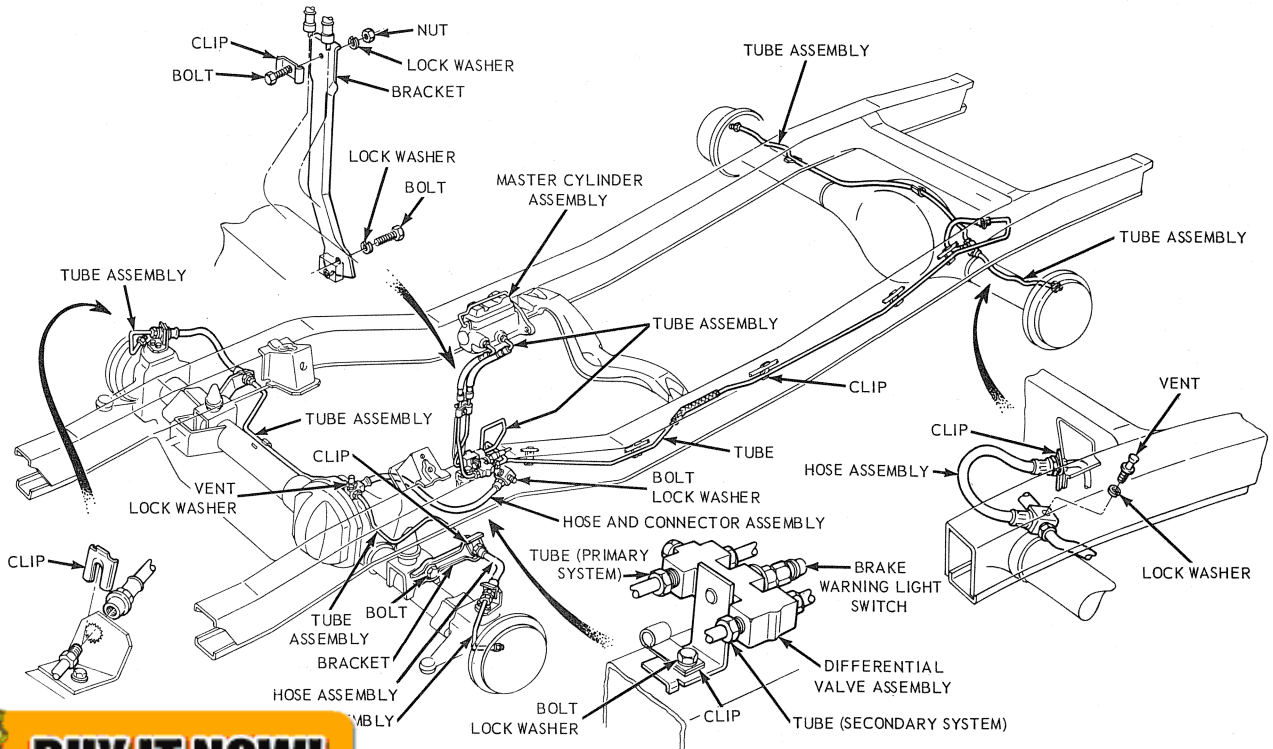


FIG. 12—Brake System—Econoline



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and against the backing plate. Install the attaching nuts through the access hole in the axle shaft flange, and torque to specification.

Position a new **front** backing plate to the wheel spindle, install the attaching bolts and nuts, and torque to specification.

2. Install the brake shoes and the brake cylinder as outlined in this section.

3. Connect the brake line to the brake wheel cylinder, then install the wheel and brake drum.

4. Adjust the brake shoes as outlined in this section.

### 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. The Bronco models also have primary and secondary system hoses that lead from the master cylinder to

the differential valve assembly (Figs. 12 and 13).

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

### BRAKE TUBE REPLACEMENT

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

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

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

### BRAKE HOSE REPLACEMENT

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

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

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

Place a new gasket over the rear hose fitting and screw the hose assembly into the rear brake tube connector. Engage the front end of the hose to the bracket on the frame. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut (Figs. 12 and 13).

## 3 REMOVAL AND INSTALLATION

### MASTER CYLINDER —ECONOLINE

#### REMOVAL

1. Raise the front end of the vehicle and position safety stands.
2. Remove the attaching bolts and the forward splash shield.
3. Disconnect the brake pedal return spring (Fig. 14).
4. Remove the lock nut and the eccentric bolt, which connect the return spring bracket and the master cylinder push rod to the brake panel bracket.
5. Remove the snap ring from the brake pedal pivot pin.
6. Disconnect the brake lines at the master cylinder.
7. Remove the two mounting bolts that secure the cylinder between the two mounting brackets. To prevent the brake pedal and master cylinder from swinging freely after the mounting bolts are removed, hold the master cylinder firmly when removing the mounting bolts.
8. Swing the cylinder down, and remove it from the brake pedal pivot pin. Remove the pivot pin bushings.

cylinder body. Mount the cylinder on the pivot pin.

2. Swing the cylinder up and into position between the mounting brackets. Install the mounting bolts and the pivot-pin snap ring (Fig. 14). Torque the mounting bolts to specification.

3. Connect the brake hydraulic lines to the master cylinder.

4. Connect the push rod and the return spring bracket to the brake pedal with the eccentric bolt and nut.

5. Connect the return spring to the bracket (Fig. 14).

6. Bleed the hydraulic brake system as outlined in Part 2-2.

7. Adjust the brake pedal free-travel at the eccentric bolt as outlined under Brake Pedal Adjustment in Part 2-1. Torque the eccentric bolt nut to specification.

8. Apply chassis lubricant to the grease fitting at the brake pedal pivot.

9. Install the splash shield and retaining bolts, remove the safety stands, and lower the truck.

### MASTER CYLINDER—BRONCO

#### REMOVAL

1. Disconnect the wires from the stoplight switch (Fig. 15).
2. Disconnect the brake hydraulic system lines at the master cylinder.

3. Disconnect the dust boot from the rear of the master cylinder at the dash panel.

4. Remove the hair pin retainer and slide the stop light switch off the brake pedal pin just far enough for the switch outer hole to clear the pin. Remove the stoplight switch from the pin.

5. Slide the master cylinder push rod off the brake pedal pin. Remove the bushing and washers.

6. Remove the master cylinder retaining bolts and remove the master cylinder.

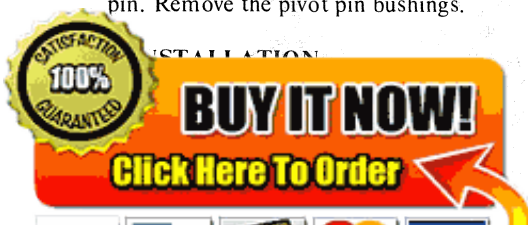
#### INSTALLATION

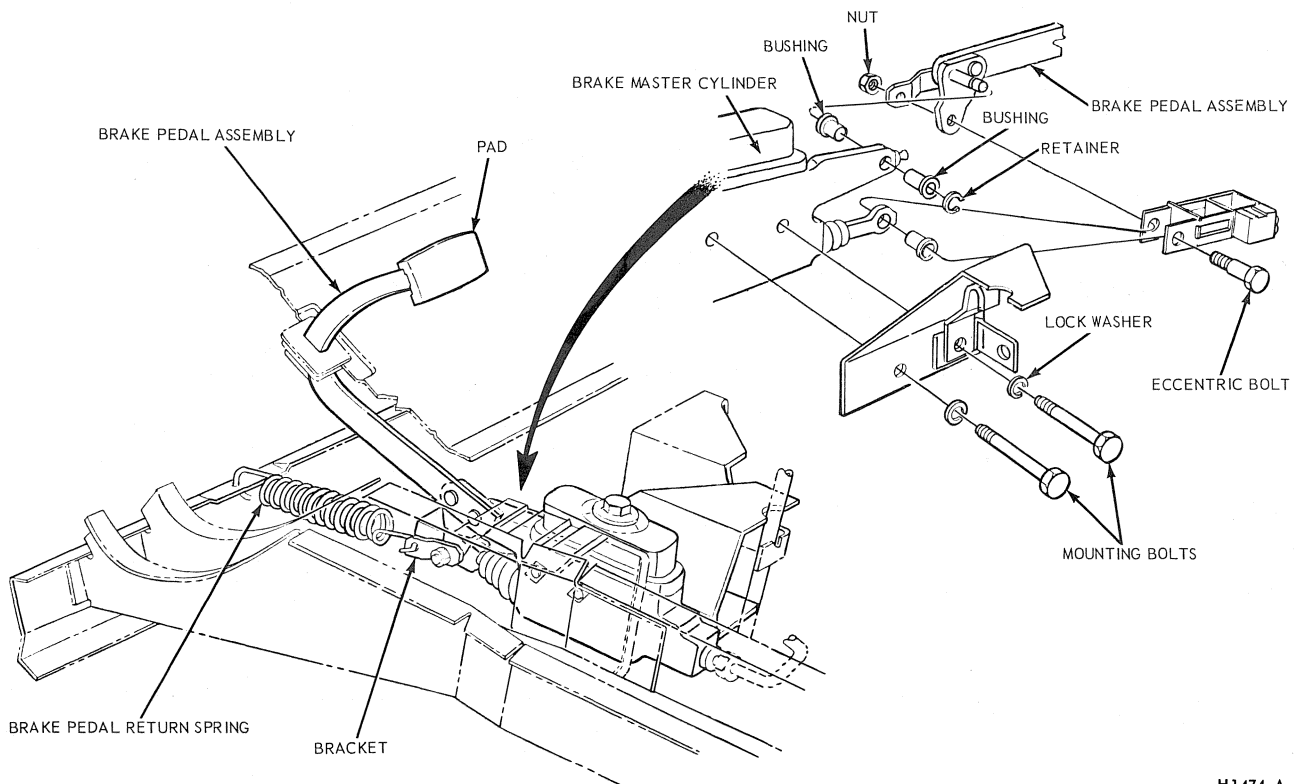
1. Position the master cylinder assembly on the dash panel and install the retaining bolts. Torque the bolts to specification.

2. Connect the hydraulic brake system lines to the master cylinder.

3. Position the boot over the push rod and secure the boot to the master cylinder.

4. Lubricate the push rod bushing with lubricant (Rotunda Engine Oil SAE 10W-20W-30). Insert the bushing in the push rod. Coat the washers with the lubricant, and position the push rod and bushing, washers and stoplight switch on the brake pedal pin. Install the hair pin type retainer.





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FIG. 14—Brake Master Cylinder and Brake Pedal Installed—Econoline

5. Connect the stop light switch wires to the switch.
6. Bleed the hydraulic brake system as outlined in Part 2-2.

### DIFFERENTIAL VALVE

#### REMOVAL

1. Raise the front end of the vehicle and position safety stands.
2. On an Econoline model, remove the retaining bolts and forward splash shield.
3. Disconnect the wires from the brake warning lamp 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.**
4. Disconnect the hydraulic brake system lines at the differential valve assembly.
5. Remove the bolt and lockwasher securing the differential valve assembly to the underbody or frame member.

### INSTALLATION

1. Install the retaining bolt, lockwasher and the differential valve on the underbody member, and tighten the retaining bolt.
2. Connect the brake hydraulic system lines to the differential valve.
3. Connect the shell-wire connector to the brake warning lamp switch. **Make sure the plastic lugs on the connector are holding the connector securely to the switch.**
4. Bleed the brakes. Refer to Part 2-1, Section 2 for the proper procedure.
5. On an Econoline model, position the forward splash shield and install the retaining bolts.
6. Remove the safety support stands and lower the vehicle.

### BRAKE PEDAL—ECONOLINE

#### REMOVAL

1. Working inside the cab, fold back the floor mat and remove the retaining screws and the steering column floor pan cover. Pull up the rubber seal.
2. Raise the front end of the vehicle and place safety stands into position.
3. From underneath the vehicle,

remove the attaching bolts and the forward splash shield.

4. Disconnect the brake pedal return spring, and remove the brake pedal eccentric bolt, return spring bracket, and nut (Fig. 14).

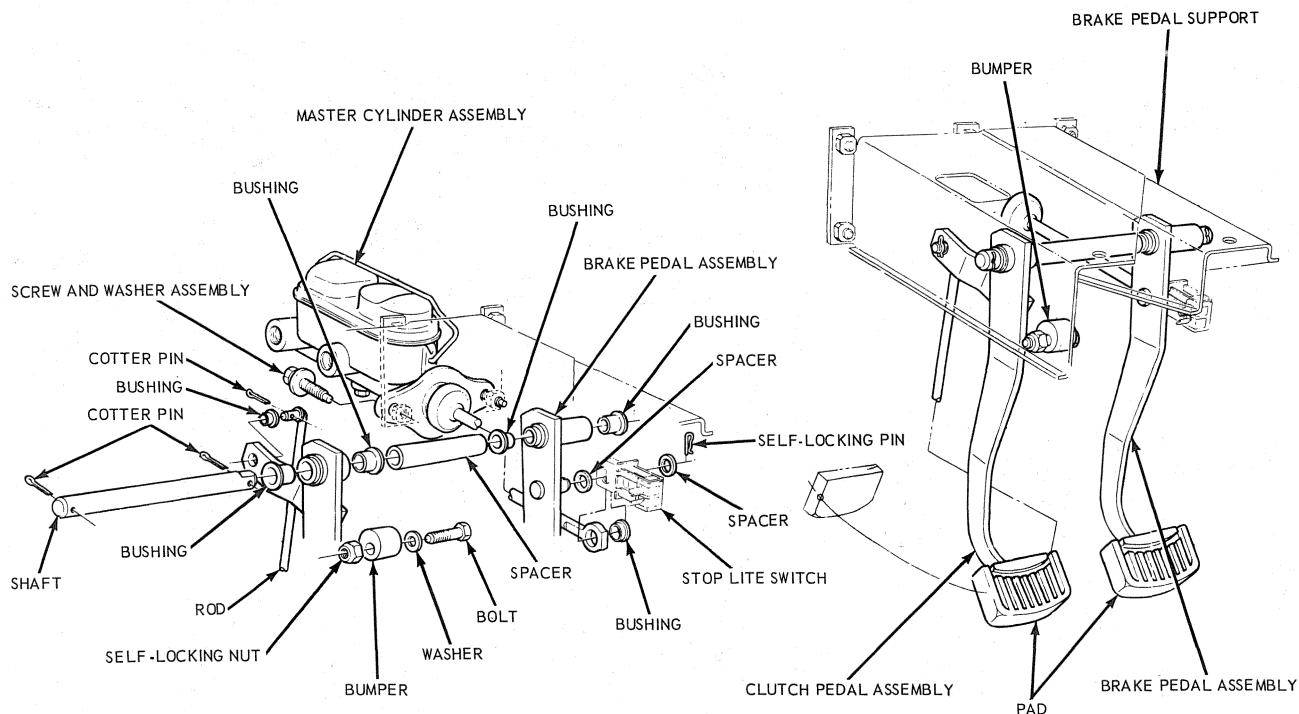
5. Remove the snap ring from the pivot pin, slide the brake pedal and pivot pin assembly out of the pivot pin bore in the master cylinder, and lower the assembly from the left side of the floor pan.

6. Remove the bushings from the pivot pin bore in the master cylinder.

#### INSTALLATION

1. Install the pivot pin bushings in the pivot pin bore in the master cylinder.
2. Insert the brake pedal pivot pin into the bore, then connect the master cylinder push rod and the return spring bracket with the eccentric bolt and nut. Do not tighten the nut at this time.
3. Connect the brake pedal return spring at the bracket, and install the snap ring on the pivot pin.
4. Adjust the brake pedal free-travel, and torque the eccentric nut to specification.





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FIG. 15—Brake Master Cylinder and Brake Pedal Installation—Bronco

5. Apply chassis lubricant to the grease fitting at the brake pedal pivot.

6. Replace the forward splash shield, and secure with attaching bolts. Remove the safety stands and lower the vehicle.

7. Position the rubber seal at the brake pedal in the cab, install the steering column floor pan and secure with attaching screws.

## BRAKE PEDAL—BRONCO

### REMOVAL

1. Disconnect the wires from the stoplight switch.

2. Remove the hair pin retainer (Fig. 15) and slide the stop light switch off the brake pedal pin just far enough for the pin. Remove the stoplight switch from the pin.

3. Slide the master cylinder push rod off the brake pedal pin. Remove the bushing and washers.

4. Remove the cotter pin from the right side of the brake and clutch pedal

### INSTALLATION

1. Coat the brake pedal bushings and the shaft with lubricant (Rotunda Engine Oil SAE 10W-20W-30).

2. Position the bushings, pedal and shaft on the brake pedal support and install the retaining cotter pin (Fig. 15). Spread the cotter pin ends.

3. Lubricate the master cylinder push rod bushing with the lubricant. Insert the bushing in the push rod. Coat the washers with the lubricant, and position the push rod and bushing, washers and stop light switch on the brake pedal pin. Install the hair pin type retainer.

4. Connect the wires to the stop light switch.

## PARKING BRAKE HANDLE—ECONOLINE

### REMOVAL

1. Push the equalizer lever slightly forward, and disconnect the ball end of the cable from the lever (Fig. 16).

2. Pull the brake handle up, and disconnect the cable end from the ratchet bar.

3. Remove the lock pin from the ratchet bar, and remove the brake handle assembly.

### INSTALLATION

1. Position the ratchet bar in the brake handle housing assembly.

2. Install the lock pin in the ratchet bar, and connect the cable end to the ratchet bar.

3. Push the equalizer lever slightly forward, and insert the ball end of the cable in the slot on the equalizer lever (Fig. 16).

4. Adjust the parking brakes as outlined in Part 2-1.

## PARKING BRAKE EQUALIZER TO HANDLE CABLE—ECONOLINE

### REMOVAL

1. Push the equalizer lever slightly forward, and disconnect the ball end of the cable from the lever (Fig. 16).

2. Remove the cotter pin, clevis, and pulley from the parking brake bracket.

3. Raise the ratchet bar retainer out of the last (full release stop) notch of the ratchet bar, and allow the ratchet bar to slide down the housing until it bottoms.

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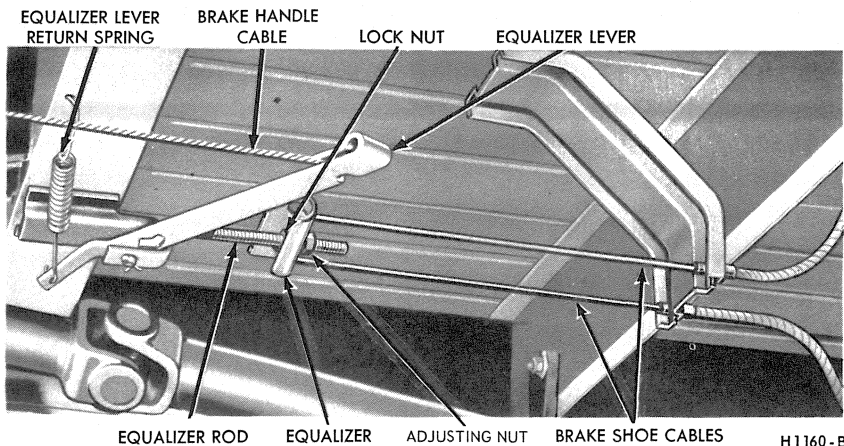


FIG. 16—Parking Brake Linkage

4. Remove the cable from the ratchet bar.
5. Remove the cable from the cable guide.

#### INSTALLATION

1. Place the cable ball in the ratchet bar cable slot, and raise the ratchet bar until the ratchet bar retainer engages the full release stop notch of the ratchet bar.
2. Position the cable in the pulley, and install the pulley in the parking brake bracket with the clevis and cotter pin.
3. Route the cable rearward, through the cable guide, and connect it to the equalizer lever.
4. Check the operation of the brake handle, and adjust the equalizer rod until the cables are free of any slack.

#### PARKING BRAKE EQUALIZER TO REAR WHEEL CABLE

##### REMOVAL

1. Raise the car and remove the hub cap and wheel.
2. Remove the three attaching nuts that hold the brake drum in place, back off the brake shoes, and remove the drum.
3. Loosen the adjusting nut on the equalizer rod, and disconnect the cable from the equalizer (Figs. 16 and 17).
4. Remove the hair pin retainer that holds the cable housing to the bracket on the crossmember and pull the cable and housing out of the bracket.
5. On Econoline models, remove the

6. On Bronco models, remove the retainer securing the cable assembly to the rear spring (Fig. 17). Working on the wheel side of the rear brake assembly (Fig. 1), compress the prongs on the cable retainer so that they can pass through the hole in the carrier plate. Draw the cable retainer out of the hole.
7. With the spring tension off the parking brake lever, lift the cable out of the slot in the lever and remove through the carrier plate hole.

##### INSTALLATION

1. Pull enough of the cable through the housing so that the end of the cable may be inserted over the slot in the parking brake lever (Fig. 1).
2. Pulling the excess slack from the cable, insert the cable housing into the carrier plate access hole so that the retainer prongs expand.
3. Thread the front end of the cable housing through the frame bracket and install the hair pin retainer.
4. On Econoline models, install the rear clip on the cable, and fasten the clip to the bracket on the frame side-member with the attaching bolt, lock washer and nut.
5. On Bronco models, secure the cable assembly to the rear spring with the retainer. Insert the ball end of the cable into the equalizer and tighten the adjusting nut on the equalizer rod slightly.
6. Install the rear drum. Tighten the three attaching nuts that retain the drum, and install the wheel and hub cap.
7. Adjust the rear brake shoes as outlined in Part 2-2, Section 2. Adjust the parking brake linkage as outlined in Part 2-1, Section 2.

#### PARKING BRAKE CONTROL—BRONCO

##### REMOVAL

1. Loosen the adjusting nut at the equalizer if necessary, and remove the ball-end of the control cable from the equalizer lever (Fig. 17).
2. Open the hood and remove the two nuts attaching the parking brake control assembly to the dash panel.
3. Working under the instrument panel, remove the bolt and nut attaching the control assembly to the lower flange of the instrument panel.
4. Remove the forward ball-end of the parking brake cable from the control assembly clevis and remove the control.

##### INSTALLATION

1. Connect the forward ball-end of the parking brake cable to the clevis of the control assembly.
2. Position the control assembly to the lower flange of the instrument panel and install the attaching bolt and nut.
3. Working in the engine compartment, install and tighten the two nuts attaching the parking brake control assembly to the dash panel. Lower the hood.
4. Connect the ball-end of the control cable to equalizer lever (Fig. 17).
5. Adjust the parking brake equalizer lever to its original position. Check cable tension and adjust the parking brake, if necessary, following the instructions given in Parking Brake Adjustment.

#### PARKING BRAKE CONTROL TO EQUALIZER CABLE—BRONCO

##### REMOVAL

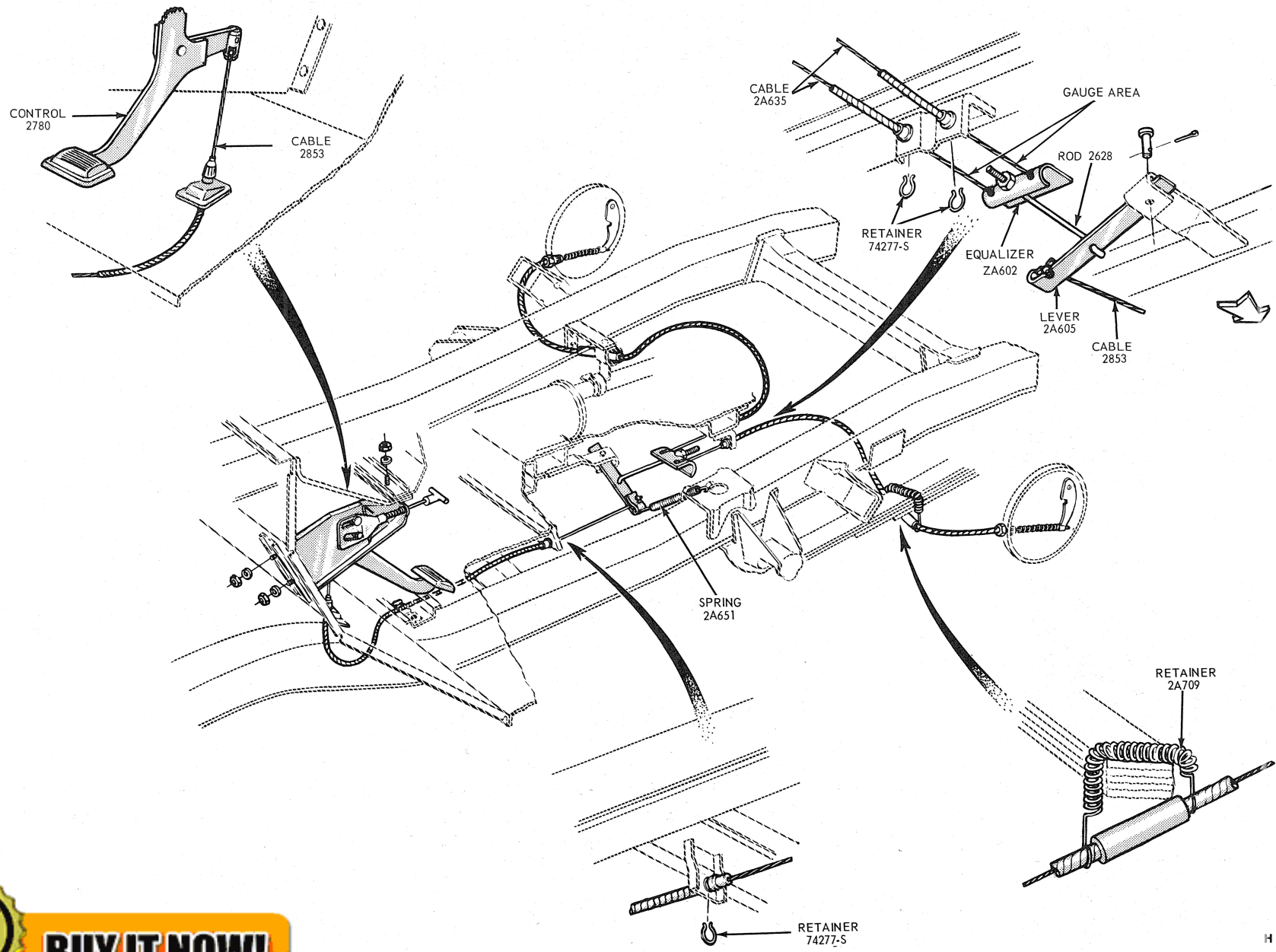
1. Raise the vehicle on a hoist.
2. Loosen lock nut and adjusting nut at the equalizer assembly (Fig. 17) and remove ball end of the brake control to equalizer cable from the equalizer arm. Remove the clip retaining the cable housing to the bracket.
3. Lower the vehicle.
4. From inside of vehicle, disconnect the cable at the parking brake control clevis.
5. Raise the vehicle on a hoist.
6. Pull the parking brake control to equalizer cable through the hole in the dash panel and remove it from the vehicle.

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## INSTALLATION

1. Position the parking brake control to equalizer cable upward through the hole in the dash panel. Position the cable to the mounting bracket.
2. Lower the vehicle on a hoist.

3. Connect the cable to the parking brake control clevis.
4. Raise the vehicle on the hoist.
5. Position the cable housing to the bracket and install the retaining clip.
6. Connect the ball end of cable to

the equalizer arm and install lock nut and adjusting nut.

7. Adjust the parking brakes (Part 2-1, Section 2).
8. Lower the vehicle. Check the operation of the parking brake control.

## 4 MAJOR REPAIR OPERATIONS

### BRAKE DRUM REFINISHING

Minor scores on a brake drum can be removed with a fine emery cloth. A drum that is excessively scored or shows a total indicator runout of over 0.005 inch should be turned down. Remove only enough stock to eliminate the scores and true up the drum. The refinished diameter must not exceed 0.060 inch oversize.

After a drum is turned down, wipe the refinished surface with a cloth soaked in clean denatured alcohol. If one drum is turned down, the opposite drum on the same axle should also be cut down to the same size.

### BRAKE SHOE RELINING

Brake linings that are worn to within 1/32 inch of the rivet head or have been saturated with grease or oil should be replaced. Worn linings can score the brake drum. **When any lining requires replacement, it should be replaced in sets of two—both front or both rear wheels.**

Inspect brake shoes for distortion, cracks and looseness. If any of these conditions exist, the shoe should be discarded. **Do not repair a defective brake shoe.**

1. Wash the brake shoes thoroughly in a cleaning solvent. Remove all burrs and rough spots from the shoe.
2. Check the inside diameter of the brake drum. If the drum is less than 0.030 inch oversize, standard lining may be installed. Oversize lining should be installed, if the drum is 0.030-0.060 inch oversize.
3. Position the new lining on the shoe. Insert and secure the rivets at the center holes. Install the remaining rivets. Install all parts supplied in the kit. **Ford replacement linings are ground, and no further grinding is required.**
4. Check the clearance between the

### DUAL-MASTER CYLINDER OVERHAUL

The master cylinder must be removed from the vehicle to be overhauled. Refer to Part 2-2, Section 3 for the removal and installation procedures.

#### DISASSEMBLY—BRONCO

1. Remove the master cylinder cover and empty the brake fluid from the reservoir. Remove the rubber gasket from the cover (Fig. 3).
2. Unscrew the piston stop from the bottom of the cylinder body. Remove the O-ring seal from the piston stop. Discard the seal.
3. Remove the boot from the master cylinder. Pull the boot rearward on the push rod.
4. Remove the snap ring retaining the primary and secondary piston assemblies within the cylinder body (Fig. 18). Remove the push rod, stop plate and push rod retainer from the master cylinder. Remove the push rod retainer, stop plate and boot from the push rod.
5. Apply an air hose to the rear brake outlet of the cylinder body and blow the secondary piston out of the cylinder body.

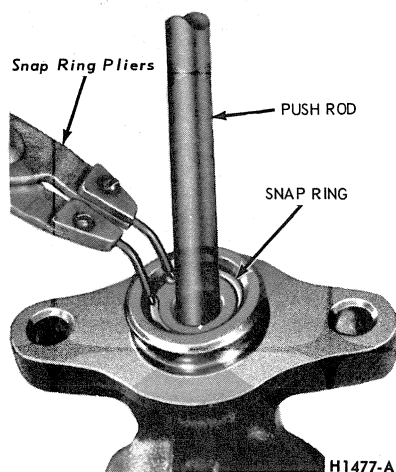


FIG. 18—Removing Snap Ring—Typical

6. With the use of a 6-32 self-tapping screw, pry the tube seats out of the front and rear brake outlet bores in the cylinder body (Fig. 19). Discard the tube seats and the check valves.

7. Remove the return spring and the cup protector from the secondary piston. Discard the piston.

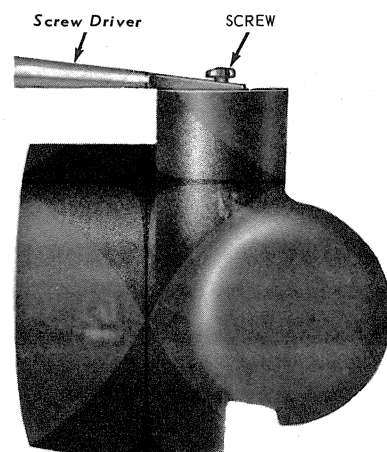


FIG. 19—Removing Tube Seat and Check Valve—Typical

#### DISASSEMBLY—ECONOLINE

1. Remove the retaining screw, washer and master cylinder cover. Empty the reservoir of brake fluid. Remove the rubber gasket from the cover (Fig. 2).
2. Position the master cylinder carefully in a vise, with the push rod end facing upward. **Use care to prevent distortion of the master cylinder due to vise pressure.**
3. Unscrew the piston stop from the bottom of the cylinder body. Remove the O-ring seal from the piston stop.
4. Remove the push rod from the rubber boot by pulling the rod upward. Pull the rubber boot rearward and remove the snap ring retaining the primary and secondary pistons assemblies within the cylinder body. Remove primary piston assembly from the cylinder body. Discard the piston assembly.

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5. Apply an air hose to the rear brake (secondary system) outlet of the cylinder body and blow the secondary piston out of the cylinder body.

6. With the use of a 6-32 self-tapping screw, pry the tube seats out of the front (primary) and rear (secondary) brake system outlet bores in the cylinder body (Fig. 19). Discard the tube seats and the check valves.

7. Remove the return spring and the cup protector from the secondary piston. Discard the piston.

8. If necessary, remove the pivot pin lubrication fitting from the master cylinder assembly.

#### 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 of the parts supplied.**

2. Check all recesses, openings and internal passages to be sure they are open and free from 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 master cylinder bore for signs of etching, pitting, scoring or rust. **Replacement of the master cylinder will be required if any of these conditions exist.**

#### ASSEMBLY—BRONCO

1. Dip all parts except the cylinder body in clean, heavy-duty brake fluid.

2. Position the check valve springs, new check valves and tube seats (flatside toward the check valve) in the front (primary system) and rear (secondary system) brake outlet bores. With the use of tube nuts and a wrench, press the tube seats inward until they bottom (Fig. 20). Remove the tube nuts.

3. Assemble the spring and cup protector to the secondary piston. Install the secondary piston assembly in the master cylinder.

4. Install a new O-ring on the piston stop, and start the stop in the cylinder body.

5. Position the boot, snap ring, stop plate and the push rod retainer. **Make sure the push rod retainer is seated securely on the ball end of the rod.** Seat the push rod in the primary piston assembly.

6. Install the primary piston assembly in the master cylinder, push the piston inward and tighten the piston stop to retain the pistons in the bore.

7. Press the push rod and pistons inward and install the snap ring in the cylinder body. Connect the boot to the lip of the master cylinder.

8. Install the rubber gasket in the master cylinder cover. **Make sure the gasket is properly seated.**

9. Bleed the master cylinder.

#### ASSEMBLY—ECONOLINE

1. Dip all parts except the cylinder body in clean, heavy-duty brake fluid.

2. Position the check valve springs, new check valves and tube seats (flatside toward the check valve) in the front (primary system) and rear (secondary system) brake outlet bores. With the use of tube nuts and a wrench, press the tube seats inward until they bottom

(Fig. 20). Remove the tube nuts.

3. Position the master cylinder in a vise, with the push rod end of the cylinder facing upward. **Use care to prevent damage to the cylinder due to vise pressure.**

4. Assemble the spring and cup protector to the secondary piston. Install the secondary piston assembly in the master cylinder (Fig. 2).

5. Install a new O-ring on the piston stop, and start the stop into the cylinder body.

6. Install the primary piston assembly in the master cylinder. Push the piston inward with the push rod, and tighten the piston stop to retain the pistons in the bore.

7. Push the primary piston inward with the push rod and install the snap ring in the cylinder body.

8. Position the boot on the push rod. Install the push rod in the master cylinder, and connect the boot to the lip of the master cylinder.

9. Install the pivot pin lubrication fitting in the master cylinder, if required.

10. Install the rubber gasket in the master cylinder cover. **Make sure the gasket is properly seated.**

11. Bleed the master cylinder.

#### BLEEDING THE MASTER CYLINDER

Before the master cylinder is installed on the car, the unit must be bled.

1. Support the master cylinder body in a vise and fill both fluid reservoirs with the specified brake fluid.

2. Loosely install plugs in the front and rear brake outlet bores. Depress the push rod several times until air bubbles cease to appear in the brake fluid.

3. Tighten the plugs and attempt to depress the piston. **The piston travel should be restricted after all air is expelled.**

4. Remove the plugs. Install the cover assembly, and make sure the cover retainer is tightened securely.

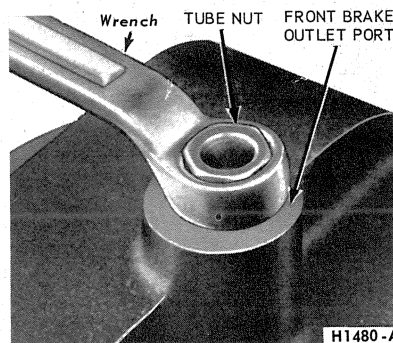


FIG. 20—Installing Tube Seat and Check Valve

## PART 2-3— Specifications

NOTE: All specifications are given in inches unless otherwise noted.

### TORQUE LIMITS (FT-LBS)

Description	Econoline	Bronco	Description	Econoline	Bronco
Master Cylinder Bolt to Brake Pedal Assembly	12-24	8-12	Rear Brake Backing Plate to Axle	50-70	50-70
Brake Tube Fitting	5-7	5-7	Brake Hose	12-18	12-18
Rear Brake Assembly and Bearing Retainer to Rear Axle Housing	30-35	30-35	Brake Line Connection to Rear Axle Housing (Vent)	12-18	
Brake Cylinder to Brake Carrier Plate	11-19	11-19	Front Brake Backing Plate to Spindle	45-60	30-40
Parking Brake Control	8-13	12-15	Wheel Nuts	55-85	65-90
Master Cylinder to Mounting Bracket	19-24	20-28	Brake Pedal Bumper		5-8

### CHECKS AND ADJUSTMENTS

Description	Econoline	Bronco	Description	Econoline	Bronco
Lining Maximum Wear Limit (From Top of Rivets or Shoe Rim)	1/32	1/32	Lining Maximum Clearance to Shoe (Midway Between Rivets)	0.008	0.008
Self-Adjustment Cable Length – End Cable Anchor to End of Cable Hook (All Dimensions + or – 1/64 Inch)			Master Cylinder Stroke	1.160	1.160
			Master Cylinder Fluid Level – Distance From Top of Reservoir – Inches	1/4 to 1/2	1/4 to 1/2

### BORE DIAMETERS – BRAKE DRUM, WHEEL CYLINDER AND MASTER CYLINDER

Models		Brake Drum		Wheel Cylinder Bore Diameter		Master Cylinder Bore Diameter	
		Inside Diameter	① Boring Limit (Maximum)	② Front	② Rear	With Power Brake	Less Power Brake
Econoline		10.000	10.060	1.125	0.8125	—	1.000
Bronco	Rear (2780 Lb Axle)	10.000	10.060	—	0.8125	—	1.000
	Rear (3300 Lb Axle)	11.000	11.000				
	Front	11.000	11.060	—	0.8125	—	—

① Maximum Runout 0.007

② Maximum Allowable Hone 0.003

### LINING DIMENSIONS – INCHES

Description		Econoline				Bronco	
		Front	Rear		Front	Rear	
			2300 Lb Axle	3050 Lb Axle		2780 Lb Axle	3300 Lb Axle
Lining Width	Primary	2.50	1.75	2.50	2.00	2.5	1.75
	Secondary	2.50	1.75	2.50	2.00	2.5	1.75

# Suspension, Steering, Wheels and Tires

GROUP

3

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

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### 1 DIAGNOSIS AND TESTING

Fig. 4 lists various suspension, steering, and wheel and tire trouble symptoms and their possible causes. The possible causes are listed in the order in which they should be checked. For example, refer to the fourth trouble symptom in Fig. 4, Hard Turning When Stationary. When checking the possible causes, check item 1 (tire pressure) and item 2 (tire size) before proceeding with items 4, 11, 13 and 17 as indicated.

#### FRONT WHEEL ALIGNMENT CHECKS

**front wheel alignment without first making a preliminary inspection of the front end parts.**

Check all factors of front wheel alignment before making adjustments.

#### EQUIPMENT INSTALLATION

Equipment used for front wheel alignment inspection must be accurate. If portable equipment is being used, perform all inspection operations on a level floor.

1. Drive the vehicle in a straight line far enough to establish the straight-ahead position of the front wheels, and then place corresponding chalk marks on the steering column and steering wheel hub (Fig. 1).

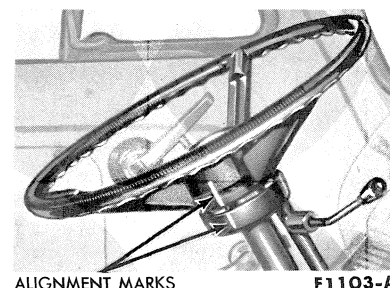


Fig. 1—Straight Ahead Position Marks—Econoline

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 chalk marks to

the axle just

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bring the wheels back to the straight-ahead position.

2. Install the wheel alignment equipment on the vehicle. Whichever type of equipment is used, follow the installation and inspection instructions provided by the equipment manufacturer.

#### CAMBER—ECONOLINE ONLY

Check the camber angle at each front wheel.

Camber is the amount the front wheels are tilted at the top. 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 listed in Part 3-7. The maximum difference between both front wheel camber angles should not exceed  $1/2^\circ$ .

#### CASTER—ECONOLINE ONLY

Check the caster angle at each front wheel.

Caster is the forward or rearward tilt of the top of the spindle bolt. If the spindle bolt tilts to the rear, caster is positive. If the spindle bolt tilts to the front, caster is negative. The correct caster angle, or backward (positive) tilt, is listed in Part 3-7. The maximum difference between both front wheel caster angles should not exceed  $1/2^\circ$ .

The caster angle reading on the gauge is true only when the vehicle frame is horizontal from front to rear. If sagging springs on the front, or large tires on the rear, cause the frame not to be level, the caster angle reading must be modified to take this into consideration. Setting the front wheels on blocks of appropriate height, or letting air out of the rear tires to level the frame are other methods of compensation.

#### TOE-IN

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. Both of these measurements (front and rear of wheels) should be taken at an equal distance from the floor and at the approximate center line of the spindle. The difference between these two distances is the amount that the wheels toe in or toe out. The wheels should always be adjusted to toe in according to specifications.

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.**

#### FRONT WHEEL TURNING ANGLE—ECONOLINE ONLY

When the inside wheel is turned  $20^\circ$ , the turning angle of the outside wheel should be as specified in Part 3-7. The turning angle cannot be adjusted directly, because it is a result of the combination of caster, camber, and toe-in adjustments and should, therefore, be measured only after these adjustments have been made. If the turning angle does not measure to specifications, check the spindle or other suspension parts for a bent condition.

#### 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 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.

## 2 COMMON ADJUSTMENTS AND REPAIRS

### FRONT WHEEL ALIGNMENT ADJUSTMENTS

After front wheel alignment factors have been checked, make the necessary

Be sure that the vehicle is unloaded when making adjustments.

#### CAMBER—ECONOLINE ONLY

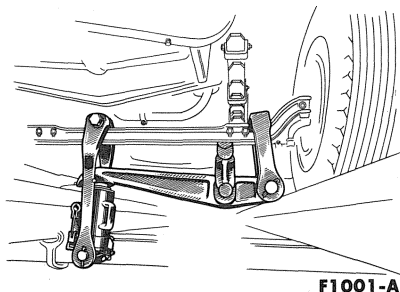
Camber can be adjusted by bending or straightening the front axle beam. Figure 2 shows a typical tool installation for increasing the camber angle.

Figure 3 shows a tool installation for decreasing the camber angle.

In all cases, the bend should be made between the front spring pad and the spindle. Otherwise, the spring pads will be thrown out of parallel with each other.

When making camber adjustments with this type of tool, pull the bottom of





F1001-A

FIG. 2—Typical Tool Installation For Camber Increase

the jack forward as the pressure is applied, so that the tool hangs at about the same angle as the spindle bolt (caster angle). This will prevent fore and aft bends from occurring in the axle beam. Use a combination of blocks or shims that holds the tool in the best position.

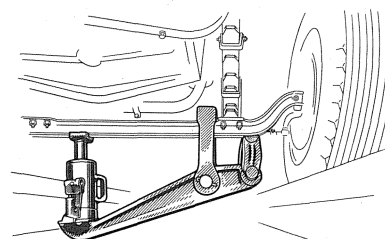
#### CASTER—ECONOLINE ONLY

The caster angle is controlled by the angle of the front spring pads, and changes as the load on the front axle increases or as the springs sag. The spring pads must be parallel to each other. Any change in the caster angle results from a twisted axle or spring sag.

If the springs have sagged, the caster angle can be adjusted by replacing the springs or by installing tapered wedges between the springs and the spring pads. An equal number of wedges should be installed on both sides. Position the thick edge of the wedges toward the rear of the truck to increase the caster, or toward the front to decrease the caster. When installing wedges, be sure that the front spring tie bolts extend through the wedges and into the axle pilot hole.

#### TOE-IN

If the toe-in is incorrect, loosen the clamp bolts at each end of the spindle connecting rod tube. Rotate the tube until the correct toe-in is obtained, and torque the clamp bolts to specifications (Part 3-7). Recheck the toe-in to make sure that no changes occurred when the bolts were tightened. The clamps on Econoline models should be positioned 3/16 inch from the end of the rod with the clamp bolt at right angles and adjacent to the slot in the rod (Part 3-2, Fig. 11). The clamps on Bronco models should be positioned 3/16 inch from the end of the rod with the clamp bolts in a vertical position in front of the tube, with the nut down.



F1002-A

FIG. 3—Typical Tool Installation For Camber Decrease

#### WHEEL BALANCING

Wheel balancing is the proper distribution of weight around a wheel and tire to counteract centrifugal forces acting upon the heavy area. The purpose of wheel balancing is to maintain a true running wheel perpendicular to its rotating axis. A properly balanced wheel will eliminate vibration and abnormal wear of suspension parts and tire wear.

To balance a wheel, carefully follow the instructions provided with the Rotunda Wheel Balancer.

## 3 CLEANING AND INSPECTION

### FRONT END GENERAL INSPECTION

#### ECONOLINE

Do not check and adjust front wheel alignment without first making the following inspection for front end maladjustment, damage, or wear.

1. Check the air pressure in all the tires. Make sure that the pressures agree with those specified for the tires and vehicle model being checked.

2. Raise the front of the vehicle off the floor. Do not use a bumper jack. Grasp each front tire at the front and rear, and push the wheel inward and outward. If any free play is noticed between the brake drum and the brake carrier plate, adjust the wheel bearings. Replace the bearings if they are worn or damaged. Adjust and/or replace worn or damaged bearings as outlined in Part

carrier plate. If the brake carrier plate moves more than 1/32 inch, rebush the spindles as outlined in Part 3-2.

4. Check all steering linkage for wear or maladjustment. Adjust and/or replace worn parts as outlined in Parts 3-4 or 3-5.

5. Check the torque on the steering gear mounting bolts, and tighten if required. Check the front spring clips (U-bolts) and the spring tie bolt, and tighten them if necessary.

6. Rotate each front wheel slowly, and observe the amount of lateral or side runout. If the wheel runout exceeds 1/8 inch, replace the wheel or install the wheel on the rear. Then torque the nuts to specification.

#### BRONCO

The following front end general inspection should be performed before adjusting toe-in or if steering or handling difficulties and/or excessive tire wear are encountered.

1. Check the air pressure in all the

tires. Make sure that the pressures agree with those specified for the tires and vehicle model being checked.

2. Raise the front of the vehicle off the floor. Grasp each front tire at the front and rear, and push the wheel inward and outward. If any free play is noticed between the brake drum and the brake carrier plate, adjust the wheel bearings. Replace the bearings if they are worn or damaged. Adjust and/or replace worn or damaged bearings as outlined in Part 3-6.

3. Check all steering linkage for wear or maladjustment. Adjust and/or replace worn parts as outlined in Parts 3-4 or 3-5.

4. Check the torque on the steering gear mounting bolts, and tighten if required.

5. Rotate each front wheel slowly, and observe the amount of lateral or side runout. If the wheel runout exceeds 1/8 inch, replace the wheel or install the wheel on the rear.

6. Inspect the radius arms to be sure they are not bent or damaged. Inspect



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the bushings at the radius arm to frame and radius arm to axle attachment for wear or looseness. Repair or replace parts as required.

### ECONOLINE AND BRONCO

#### Wheels

Wheel stud nuts should be inspected and tightened to specifications regularly, to avoid accidental loosening of the wheels. Loose wheel stud nuts may cause elongation of the wheel stud holes resulting in shimmy and vibration.

Check for damage that would affect the runout of the wheels. Wobble or shimmy caused by a damaged wheel will eventually damage the wheel bearings. Inspect the wheel rims for dents that could permit air to leak from the tires.

#### Tires

The tires should be checked frequently to be sure that the air pressures agree with those specified for the tires and vehicle model.

Inspect the tire treads, and remove all stones, nails, glass, or other objects that may be wedged in the tread. Check for holes or cuts that may permit air leakage from the tire, and make the necessary repairs.

Inspect the tire side walls for cuts, bruises, and other damage. If internal

damage is suspected, remove the tire from the wheel for further inspection and repair or replacement.

Check the tire valve for air leaks, and replace the valve if necessary. Replace any missing valve caps.

#### Front Wheel Bearings

When the front wheel bearings are excessively worn or damaged, check the bearing cups for proper installation before removing them for replacement. If a cup is improperly seated in the hub, inspect the hub for burrs, rough spots, or other irregular surfaces that would prevent seating the cup properly.

Bearing damage is often caused by lack of lubrication or improper adjustment. When installing bearing cups or cones and rollers, make sure that the specified lubricant is properly used. Adjust the bearings after installation, following the procedure given in Part 3-4.

### CHECKING AND ADDING STEERING GEAR LUBRICANT

#### ECONOLINE

1. Remove the floor mat and the steering gear access plate.
2. Remove the steering gear housing filler plug.
3. With a clean punch or like in-

strument, clean out or push the loose lubricant into the filler plug hole.

4. Slowly turn the steering wheel to the **left** stop. If the lubricant rises within the filler plug hole as the wheel turns, there is sufficient lubricant in the gear. Skip steps 5 through 7 and proceed with step 8. If the lubricant does not rise in the hole, perform all the following steps.

5. Turn the steering gear to the **right** stop in order to position the sector shaft teeth away from the filler plug hole.

6. Remove the cover-to-housing (top) attaching bolt.

7. Fill the gear through the filler plug hole until lubricant comes out of the cover bolt hole. Install the cover attaching bolt.

8. Install the filler plug, the steering gear access plate, and the floor mat.

#### BRONCO

1. Remove the filler plug from the sector shaft cover.

2. Check to see if the lubricant level is visible in the filler plug tower. If the lubricant is visible, replace the filler plug. If the lubricant is not visible, add fluid as outlined in step 3.

3. Add steering gear lubricant until the lubricant level is between the upper and lower baffle in the filler plug tower and install the filler plug.

FIG. 4—TROUBLE SYMPTOMS AND POSSIBLE CAUSES

POSSIBLE CAUSES OF TROUBLE	TROUBLE SYMPTOMS														
	Jerky Steering	Loose Steering	Hard Steering	Hard Turning When Stationary	Steering and Suspension Noises	Shimmy or Wheel Tramp	Pull to One Side	Side-to-Side Wander	Body Sway or Roll	Tire Squeal on Turns	Binding or Poor Recovery	Abnormal or Irregular Tire Wear	Sag at One Wheel	Hard or Rough Ride	Rear Suspension Misalignment (Dog-Tracking)
1. Incorrect Tire Pressure			X	X	X	X	X	X	X	X	X	X	X	X	
2. Tire Sizes Not Uniform			X	X			X	X	X		X	X			
3. Overloaded or Unevenly Loaded Vehicle							X	X			X	X	X		
4. Overloaded Front Axle			X	X											
5. Sagging or Broken Spring					X	X	X	X			X	X	X		
6. Rear Spring Tie Bolt Off Center							X				X			X	
7. Broken Rear Spring Tie Bolts					X	X	X	X			X			X	
8. Rear Spring Front Hanger Mislocated							X				X			X	
9. Bent Spindle Arm							X	X	X	X	X				
10. Bent Spindle							X	X	X	X	X				
11. Lack of Lubrication			X	X	X					X				X	
12. Loose or Weak Shock Absorber					X	X	X	X			X			X	
13. Binding Spindle Bolt Bearings	X		X	X			X								
14. Loose Spindle Bolt Bearings						X					X				
15. Loose, Worn, or Damaged Steering Linkage or Connections	X	X			X	X	X	X	X	X	X				
16. Loose Steering Gear Mountings	X	X			X	X	X								
17. Incorrect Steering Gear Adjustment	X	X	X	X	X	X	X	X	X	X	X				
18. Incorrect Brake Adjustment	X				X	X					X				
19. Incorrect Front Wheel Bearing Adjustment	X	X			X	X	X	X			X				
20. Wheel Out of Balance	X				X						X			X	
21. Incorrect Front Wheel Alignment	X		X		X	X	X	X	X	X	X				
22. Out-of-Round Wheel or Brake Drum					X						X			X	
23. Frame or Underbody Out of Alignment	X						X				X			X	
24. Bent Rear Axle Housing	X				X	X					X			X	
25. Radius Arm Insulators Worn, Missing or Incorrect Part						X									



# PART 3-2— Econoline Suspension

Section	Page	Section	Page
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Front Shock Absorber Replacement .....	3-7	4 Major Repair Operations .....	3-10
Rear Shock Absorber Replacement .....	3-7	Spindle Rebushing .....	3-10
Stabilizer Bar Link Replacement.....	3-7	Spring Leaf and Tie Bolt Replacement.....	3-10

## 1 DESCRIPTION AND OPERATION

### FRONT AXLE

The front axle is of the I-beam type with the front wheel spindles attached to the ends of the axles (Fig. 1).

Each spindle is held in place on the axle by a spindle bolt. Steelbacked, bronze bushings are pressed into the upper and lower ends of the spindle bore to provide bearing surfaces for the spindle bolt. A thrust bearing is installed between the lower end of the spindle bore on the axle and the spindle to support the load on the axle. A spindle arm, is provided on each spindle to attach the steering linkage.

### FRONT AND REAR SPRINGS

Semi-elliptic, leaf-type front and rear springs are used on all vehicles. The springs are mounted parallel to the frame side members, and are held in place on the axles by spring clips (U-bolts). The front end of each spring is mounted to a shackle bracket with a bolt and nut. The rear end is mounted to a shackle assembly. Both the bracket and shackle are mounted on the underbody (Fig. 2).

### SHOCK ABSORBERS

The hydraulic shock absorbers are of the direct, double-acting type. They provide a continuous damping effect both on compression and rebound.

mounting points for quiet operation. Since the shock absorbers are sealed,

non-adjustable units, they must be replaced as complete assemblies.

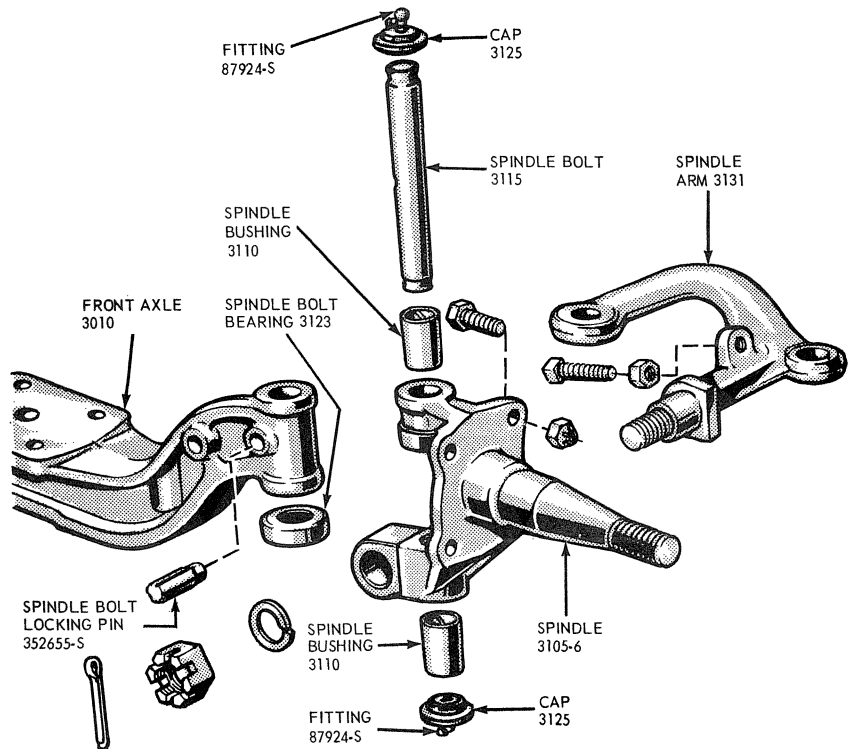


FIG. 1—Spindle Disassembled



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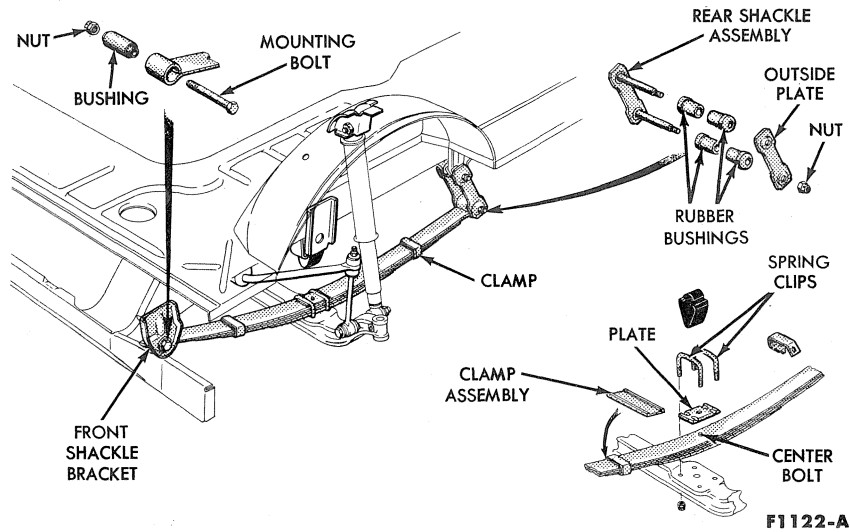


FIG. 2—Front Spring Installation—Econoline

## 2 IN-VEHICLE ADJUSTMENTS AND REPAIRS

### FRONT SHOCK ABSORBER REPLACEMENT

1. Raise the vehicle on a hoist.
2. Remove the shock absorber lower attaching nut and washer (Fig. 3).
3. Remove the upper attaching nut and washer.
4. Remove the upper mounting bolt, and remove the shock absorber from the vehicle.
5. Transfer the sleeve from the lower bushing to the replacement shock absorber. If worn or damaged use a new sleeve.
6. Position the replacement shock absorber to the upper mounting bracket, insert the mounting bolt from the rear, install the attaching nut and washer, and torque to specifications.
7. Position the lower end of the shock absorber to the lower mounting stud, install the attaching nut and washer, and torque to specifications.

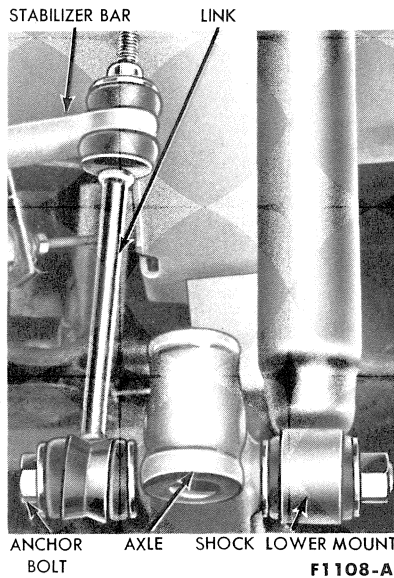


FIG. 3—Shock Absorber and Stabilizer Link Lower Connections

ment shock absorbers. If worn or damaged, use new sleeves.

5. Position the replacement shock absorber with rubber bushings and steel washers to the upper mounting bolt.

6. Swing the lower end of the shock absorber into the mounting bracket on the axle housing and install the washers, mounting bolt, and self-locking nut. Torque the nut to specification.

7. Install the self-locking nut on the upper mounting bolt. Torque the nut to specification.

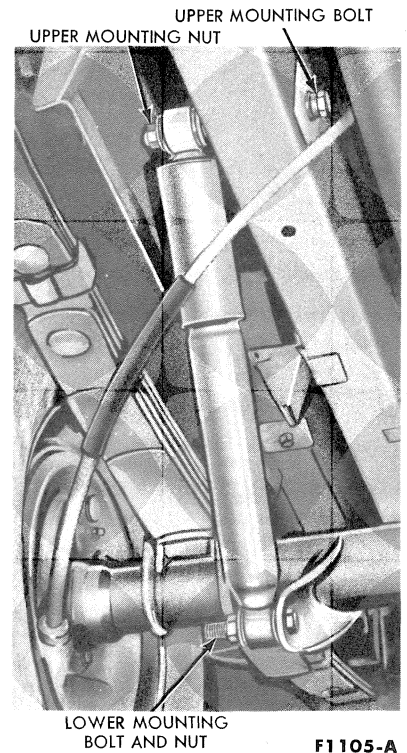


FIG. 4—Rear Shock Absorber Installed

### REAR SHOCK ABSORBER REPLACEMENT

1. Raise the vehicle on a hoist.
2. Remove the shock absorber lower mounting nut and bolt, and swing the lower end free of the mounting bracket on the axle housing (Fig. 4).
3. Remove the attaching nut from

### STABILIZER BAR LINK REPLACEMENT

Perform the following steps at both right and left stabilizer bar links.

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1. Raise the front end of the vehicle. **Do not use a bumper jack.**
2. Remove the nut and washer that connect the link to the stabilizer bar.
3. Remove the nut and washer from the anchor bolt that attaches the lower end of the shock absorber and stabilizer bar link to the axle. Tap the anchor bolt out of the shock absorber, axle, and link (Fig. 3).
4. Position the lower end of the shock absorber and the replacement stabilizer bar link with bushing and washers in line with anchor bolt bore in the axle. Install the anchor bolt through the link, axle and shock absorber, then install the washer and attaching nut to the anchor bolt.
5. Connect the link to the stabilizer bar with washer insulators and attaching nut.
6. Lower the vehicle.

### SPRING BUSHING REPLACEMENT

1. Raise the vehicle on a hoist, position stands under the chassis, and lower the hoist slightly.
2. For a front spring, remove the front splash shield.
3. Remove the attaching nut from the spring front shackle bolt.
4. Install a jack (or a suitable block) between the spring and chassis to relieve the tension, then drive the front bolt from the spring eye and bracket with a drift.
5. Adjust the jack (or block) to move the spring eye down and out of the front shackle bracket.
6. Install a Snap-on bushing remover with proper adapter to the spring eye, and remove the bushing from the eye.

7. Remove the bushing from the tool.

8. Apply Lubriplate (COAZ-19584-A) to the outside of the new bushing, and install the new bushing to the spring eye using the Snap-on tool.

9. After the bushing is installed, remove the tool from the spring eye.

10. Adjust the jack (or block) so as to align the spring eye with the front shackle bracket.

11. Install the shackle bolt and nut and torque to specifications.

12. Remove the jack (or block) from the spring.

13. Position the front splash shield and install the attaching bolts after re-bushing a front spring.

14. Lower the vehicle.

## 3 REMOVAL AND INSTALLATION

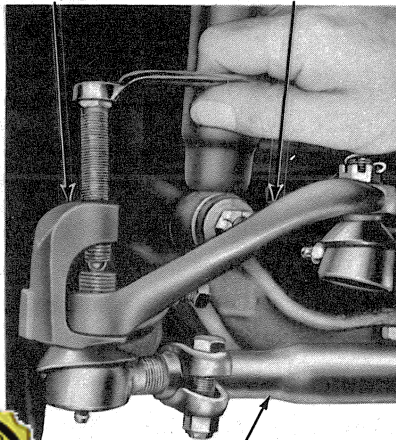
### FRONT AXLE

#### REMOVAL

1. Raise the front of the vehicle and position safety stands.
2. Back off the brake adjustment, and remove both front wheel hub and drum assemblies.
3. Remove the cotter pin and attaching nut and disconnect and remove the spindle connecting rod from the spindle arms using the tool shown in Fig. 5.
4. Remove the cotter pin and retaining nut, and disconnect the steering

Tool-3290-C

SPINDLE ARM



drag link from the left spindle arm using the tool shown in Fig. 3.

5. At each front spindle, perform the following steps (Fig. 1).

a. Remove the spindle arm-to-spindle attaching nut and cotter pin, and drive the arm from the spindle with a soft hammer.

b. Drive the spindle bolt locking pin from the spindle bolt and axle.

c. Remove the threaded caps from the top and bottom of the spindle.

d. With a suitable drift, drive the spindle bolt from the spindle and axle. Remove the spindle and brake carrier plate as an assembly from the axle. Tie the assembly to the chassis with mechanics wire.

6. Position a floor jack under the front axle.

7. At each end of the axle, remove the nut and washer from the anchor bolt that attaches the lower end of the shock absorber and stabilizer link to the axle. Tap the anchor bolt out of the shock absorber, axle and link (Fig. 3).

8. At each front spring, remove the attaching nuts, the two spring clips (U-bolts) and plate (Fig. 2).

9. Lower the jack and slide the axle from under the vehicle.

#### INSTALLATION

1. Place the axle on a floor jack, and position the axle under the vehicle.
2. Attach the axle to the two front

springs by installing the spring clips, plates, and attaching nuts (Fig. 2).

3. At each end of the axle, align the lower end of the shock absorber and stabilizer link with the anchor bolt bore in the axle, then install the anchor bolt through the link, axle, and shock absorber. Install the washer and attaching nut to the anchor bolt (Fig. 3).

4. Remove the floor jack from under the axle.

5. At each end of the front axle, perform the following steps (Fig. 1).

a. Position the carrier plate and spindle assembly with the bearing to the end of the axle, and install the spindle bolt. Install the shims in the amount necessary to take up the clearance between the upper bore of the spindle and the axle. Be sure that the notch in the spindle bolt is aligned with the locking pin hole in the axle.

b. Install the spindle bolt locking pin.

c. Install the threaded caps in the upper and lower ends of the spindle.

d. Install the spindle arm on the spindle and secure with attaching nut and cotter pin.

6. Assemble the ends of the spindle connecting rod (with seals) to the spindle arms, and install the attaching nuts and cotter pins (Fig. 6).

7. Connect the steering drag link to the left arm, and install the attaching nut and cotter pin (Fig. 6).

8. Lubricate all front suspension



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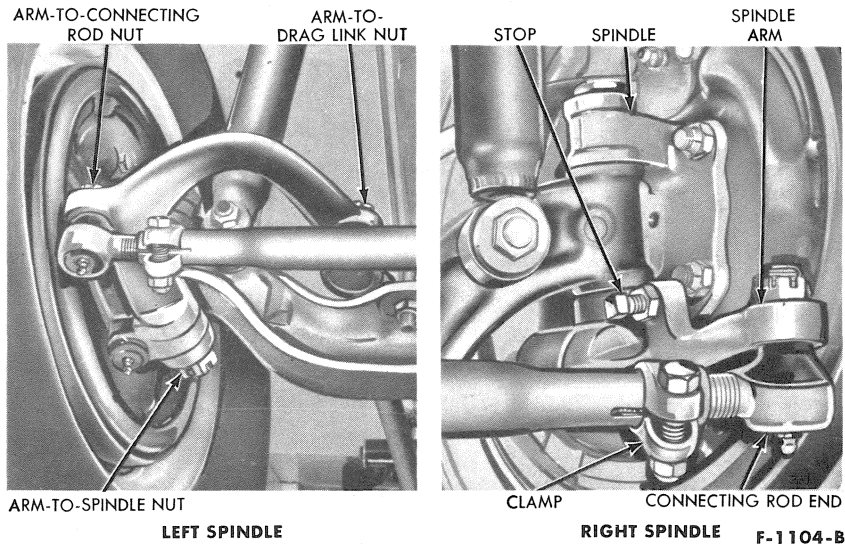


FIG. 6—Spindle Arm Connections

fittings, adjust the brakes, install the wheel hub and drum assemblies, and adjust the front wheel bearings.

9. Remove the safety stands, lower the car, and adjust the tire pressures.

10. Check camber, caster and toe-in. Adjust the toe-in, tighten the spindle connecting rod end clamps, and adjust the spindle stops (Fig. 1). See Part 3-7 for stop adjustment.

## SPINDLE

### REMOVAL

1. Raise the front of the vehicle and install safety stands. **Do not use a bumper jack.**

2. Remove the front wheel hub and drum assembly.

3. Remove the attaching bolts, and remove the brake carrier plate from the spindle. Tie the plate to the chassis with mechanics wire.

4. If the spindle is being replaced, remove the spindle arm-to-spindle attaching nut and cotter pin; then drive the spindle arm from the spindle with a soft hammer (Fig. 6). If the original spindle is to be installed, leave the arm assembled to the spindle, but disconnect the spindle arm from the connecting rod end using the tool shown in Fig. 5. On the left spindle, also disconnect the steering drag link from the spindle arm using the same tool.

5. Drive the spindle bolt locking pin

7. Drive the spindle bolt from the spindle and axle with a suitable drift, and remove the spindle and bearing from the axle.

### INSTALLATION

1. Position the spindle and bearing to the axle, and install the spindle bolt (Fig. 1). Be sure that the notch in the spindle bolt is aligned with the locking pin hole in the axle.

2. Install the spindle bolt locking pin.

3. Install the threaded caps in the upper and lower ends of the spindle bolt.

4. If a new spindle is being installed, assemble the spindle arm to the spindle with attaching nut and cotter pin.

If the original spindle is being installed with the arm assembled, connect the spindle arm to the connecting rod end. On a left spindle, also connect the steering drag link to the spindle arm (Fig. 6).

5. Position the brake carrier plate to the spindle and install the attaching bolts.

6. Lubricate the spindle fittings, adjust the brakes (Part 2-2), install the wheel hub and drum assembly, and adjust the front wheel bearings.

7. Remove the safety stands, lower the vehicle, and adjust the tire pressures.

8. Adjust the toe-in, tighten the spindle connecting rod clamps, and adjust the right and left steering stops (Fig. 6) to specification (Part 3-7).

## FRONT SPRING

### REMOVAL

1. Raise the front end of the vehicle, and support the chassis with safety stands. **Do not use a bumper jack.** Support the front axle with a floor jack or hoist.

2. Remove the front splash shield.

3. Disconnect the lower end of the shock absorber from the anchor bolt in the front axle (Fig. 3).

4. Remove the two spring clips (U-bolts) and the spring clip plate (Fig. 2).

5. Lower the spring, and remove the rear shackle nuts and outside plate.

6. Pull the rear shackle assembly and rubber bushings from the bracket and spring.

7. Remove the nut and mounting bolt that secure the front end of the spring, and remove the spring from the front shackle bracket.

### INSTALLATION

1. Install new rubber bushings in the rear shackle bracket and in the rear eye of the replacement spring.

2. Position the spring assembly and connect the front eye of the spring to the front shackle bracket by installing the front mounting bolt and nut. Do not tighten the nut.

3. Mount the rear end of the spring by inserting the upper stud of the rear shackle assembly through the rear shackle bracket, and the lower stud through the rear eye of the spring (Fig. 2).

4. Install the outside plate to the rear shackle studs, and install the shackle nuts. Do not tighten the nuts at this time.

5. Position the spring center bolt to the pilot hole in the axle, and install the spring clips and plate. Do not tighten the attaching nuts at this time.

6. Raise the axle with the floor jack until the vehicle is free of the stands, and connect the lower end of the shock absorber to the anchor bolt in the front axle (Fig. 3). Install the washer and nut.

7. Torque the spring front mounting bolt and nut, the rear shackle nuts, and spring clip nuts to specifications.

8. Install the front splash shield.

9. Remove the safety stands and lower the vehicle.

## REAR SPRING

### REMOVAL

1. Raise the rear end of the vehicle and support the chassis with safety

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stands. Support the rear axle with a floor jack or hoist.

2. Disconnect the lower end of the shock absorber from the bracket on the axle housing (Fig. 4).

3. Remove the two spring clips (U-bolts) and the spring clip plate (Fig. 7).

4. Lower the spring and remove the rear shackle nuts and outside plate.

5. Pull the rear shackle assembly and rubber bushings from the bracket and spring.

6. Remove the nut and mounting bolt that secure the front end of the spring, and remove the spring assembly from the front shackle bracket.

### INSTALLATION

1. Install new rubber bushings in the rear shackle bracket and in the rear eye of the replacement spring.

2. Position the spring assembly, and connect the front eye of the spring to the front shackle bracket by installing the front mounting bolt and nut. Do not tighten the nut.

3. Mount the rear end of the spring by inserting the upper stud of the rear shackle assembly through the rear shackle bracket, and the lower stud through the rear eye of the spring (Fig. 7).

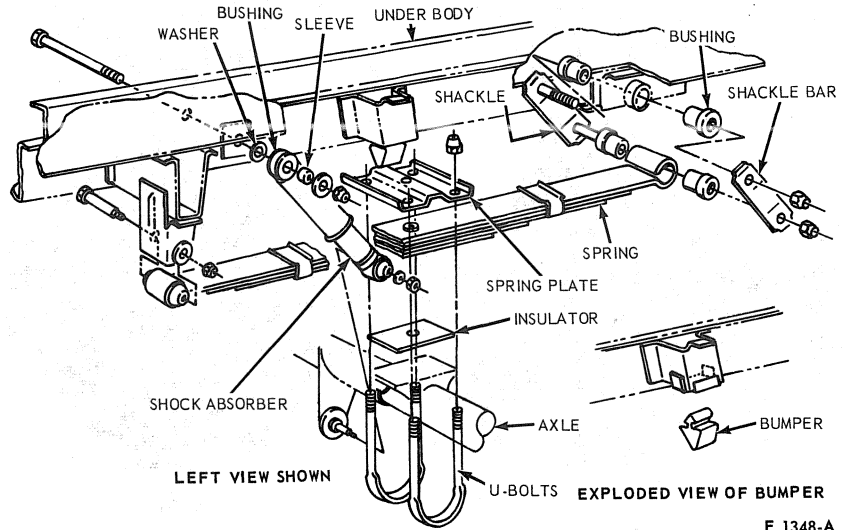


FIG 7—Rear Spring Installation

4. Install the outside plate to the rear shackle studs and install the shackle nuts. Do not tighten the nuts at this time.

5. Position the spring center bolt to the pilot hole in the axle, and install the spring clips and plate. Do not tighten the attaching nuts at this time.

6. Raise the axle with a floor jack or

hoist until the truck is free of the stands and connect the lower end of the shock absorber to the bracket on the axle housing (Fig. 4).

7. Torque the spring front mounting bolt and nut, the rear shackle nuts, and spring clip nuts to specifications.

8. Remove the safety stands and lower the vehicle.

## 4 MAJOR REPAIR OPERATIONS

### SPINDLE REBUSHING

1. Remove the spindle assembly from the axle as outlined in Section 3.

2. Position the spindle in a vise and drive the bushing out of the spindle bore as shown in Fig. 8. Reverse the spindle in the vise, and drive out the other bushing.

3. Clean the spindle bores thoroughly.

4. Position a new bushing in the spindle bore. Drive the bushing into the spindle with the tool shown in Fig. 8. Reverse the spindle in the vise, and install the other bushing in the same manner.

5. Ream the bushings to fit the spindle bolt using the tool shown in Fig. 9.

6. Clean all the metal shavings from bushings, and apply a light coat of

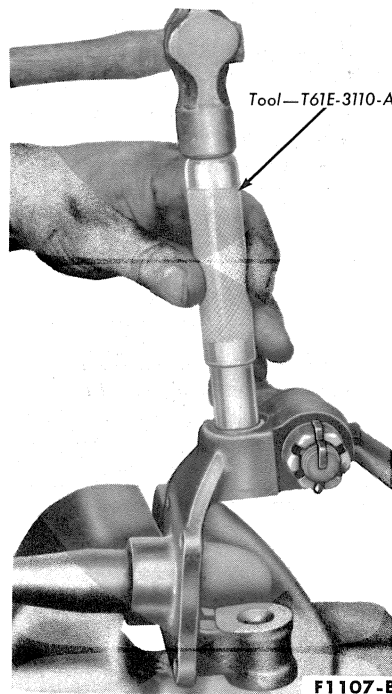


FIG. 8—Removing or Installing Spindle Bushing

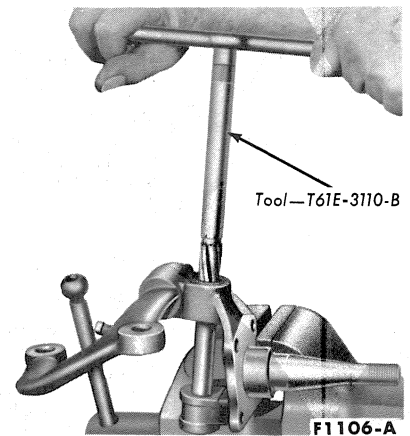


FIG. 9—Reaming Spindle Bushing

### SPRING LEAF AND TIE BOLT REPLACEMENT

1. Remove the spring from the vehicle as outlined in Section 3.

2. Cut and remove the two spring clamps.

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## PART 3-2 – Econoline Suspension

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3-11

3. Cut the nut from the spring tie bolt.
4. Remove the tie bolt and the spring leaf to be replaced.
5. Install the new spring leaf and align the leaves with a suitable drift.
6. Position the spring in a vise, and install the new tie bolt and nut.
7. Tighten the nut, cut off the tie bolt at the nut, and peen the remaining end of the bolt over the nut.
8. Install the two spring clamps.
9. Install the spring in the vehicle as outlined in Section 3.

# PART 3-3— Bronco Suspension

Section	Page	Section	Page
1 Description and Operation .....	3-12	3 Removal and Installation .....	3-15
Front Suspension.....	3-12	Front Axle.....	3-15
Rear Suspension.....	3-12	Spindle.....	3-15
Shock Absorbers .....	3-12	Front Spring.....	3-15
2 In-Vehicle Adjustments and Repairs .....	3-13	Radius Arm .....	3-15
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Rear Shock Absorber Replacement .....	3-13	4 Major Repair Operations .....	3-16
Rear Spring Bushings .....	3-14	Spindle Rebushing .....	3-16
Rear Spring Shackle and/or Bushing .....	3-14		

## 1 DESCRIPTION AND OPERATION

### FRONT SUSPENSION

The front suspension consists of a driving axle which is attached to the vehicle frame with 2 coil springs, 2 radius arms, and a track bar (Fig. 1).

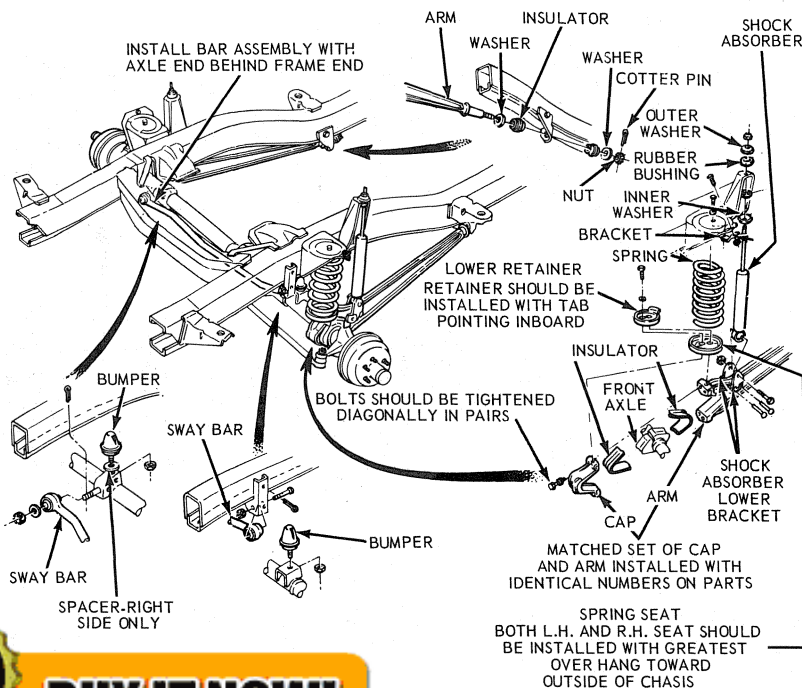
The radius arms clamp around the axle tube on each side and attach to frame brackets behind the front axle.

The radius arm and cap are matched sets and should never be mixed with other sets. They are identified by numbers 1 through 99. The numbers should be together when installing the radius arm and cap.

A coil spring is attached to each radius arm directly above the axle and extends to the frame spring seat (Fig.

1). The shock absorbers are attached to the frame and to brackets on the radius arm.

The track bar is used to retain the front axle in position (side to side) with respect to the vehicle frame. It is attached to a bracket on the left frame side member and extends to the right side of the axle housing.



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### REAR SUSPENSION

Semi-elliptic leaf springs are used on the rear suspension for all models. The springs are mounted outside the frame side members (Fig. 2), and are attached to the axle with two spring clips (U-bolts). The front end of each spring is attached to a hanger, which is part of the frame side member, with a bolt and nut. The rear end of the spring is attached to a shackle assembly with a bolt and nut and the shackle assembly is attached to a hanger (Fig. 2).

The shock absorbers are attached to a bracket which is part of the axle tube and extend up to a frame bracket at a slight forward angle.

### SHOCK ABSORBERS

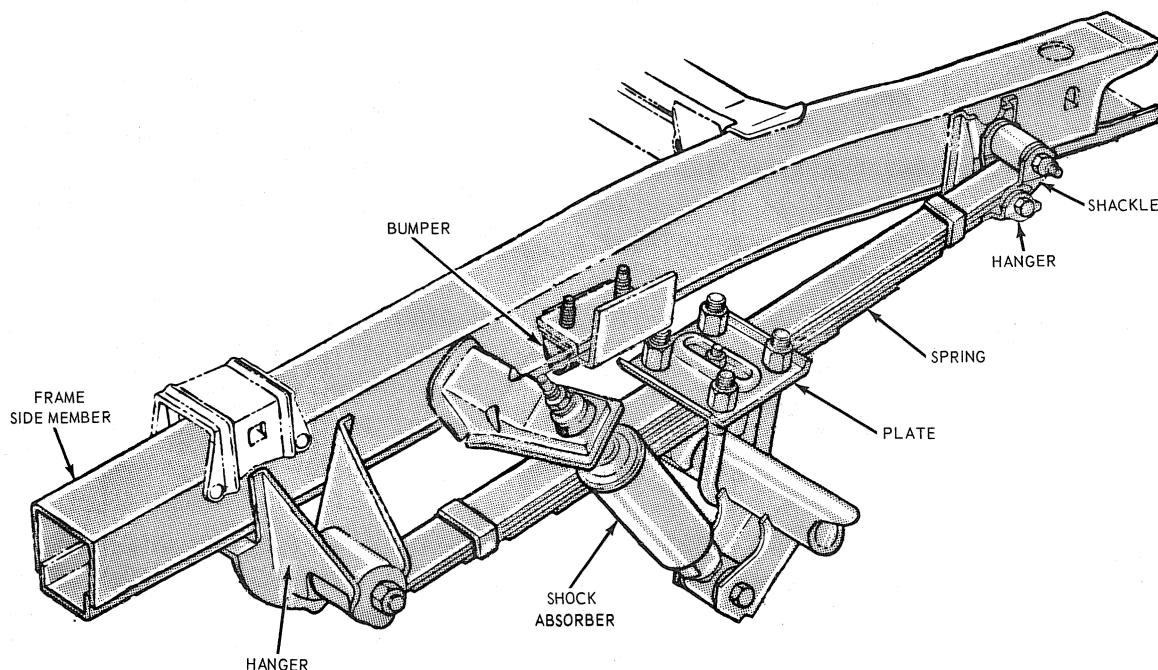
The hydraulic shock absorbers are of the direct, double-acting type. They provide a continuous dampening effect both on compression and rebound. These shock absorbers are of telescopic design with rubber grommets or bushings at the mounting points for quiet operation. Since the shock absorbers are sealed, nonadjustable units, they must be replaced as complete assemblies.



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FIG. 2—Rear Suspension

## 2 IN-VEHICLE ADJUSTMENTS AND REPAIRS

### FRONT SHOCK ABSORBER REPLACEMENT

#### REMOVAL

1. Remove the bolt and nut attaching the shock absorber to the lower bracket on the radius arm (Fig. 3).
2. Remove the nut, washer, and insulator from the shock absorber at the frame bracket and remove the shock absorber.

#### INSTALLATION

1. Position the washer and insulator on the shock absorber rod and position the shock absorber to the frame bracket.
2. Position the insulator and washer on the shock absorber rod and install

4. Torque the attaching bolts and nuts to specification.

### REAR SHOCK ABSORBER REPLACEMENT

#### REMOVAL

1. Raise the vehicle and install safety stands.
2. Remove the shock absorber to frame attaching nut, washer, and bushing from the shock absorber rod (Fig. 4).
3. Remove the shock absorber to axle attaching bolt. Drive the bolt from the axle bracket and shock absorber with a brass drift and remove the shock absorber.

#### INSTALLATION

1. Position the washer and bushing on the shock absorber rod and position the shock absorber to the frame bracket.

2. Position the bushing and washer on the shock absorber rod and install the attaching nut loosely.

3. Position the shock absorber to the axle housing bracket and install the attaching bolt and nut. Torque the bolt and nut to specification.

### TRACK BAR REPLACEMENT

#### REMOVAL

1. Remove the nut and bolt that attaches the track bar to the bracket on the frame left side rail.
2. Remove the nut and the washer that attaches the track bar to the right side of the axle.
3. Lift the track bar and insulators from the axle and the mounting bracket.

#### INSTALLATION

1. Install the insulators in each end of the track bar.



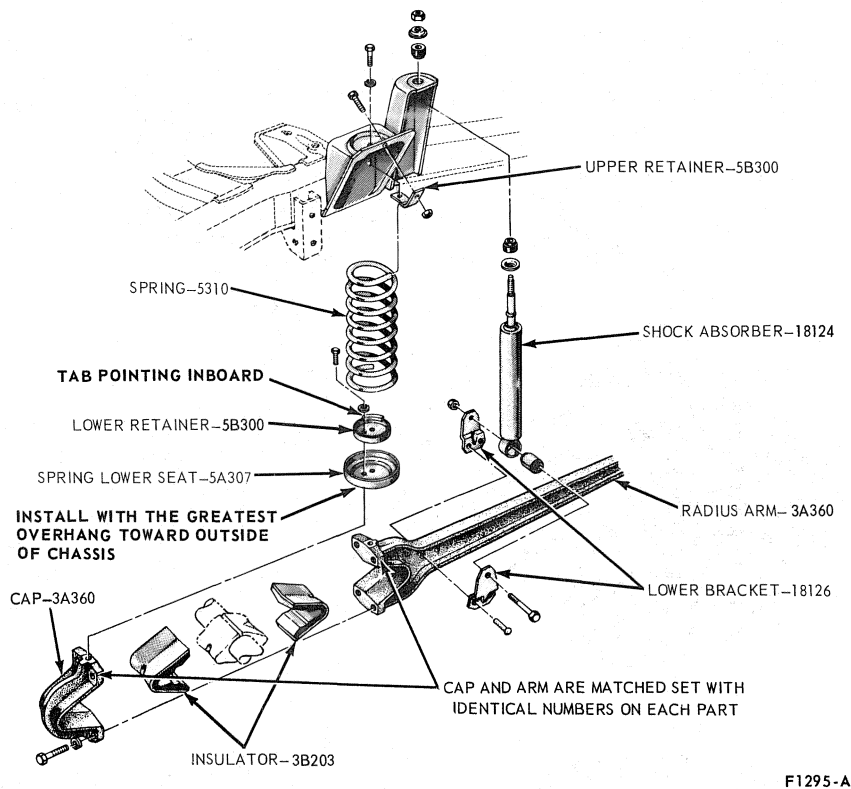
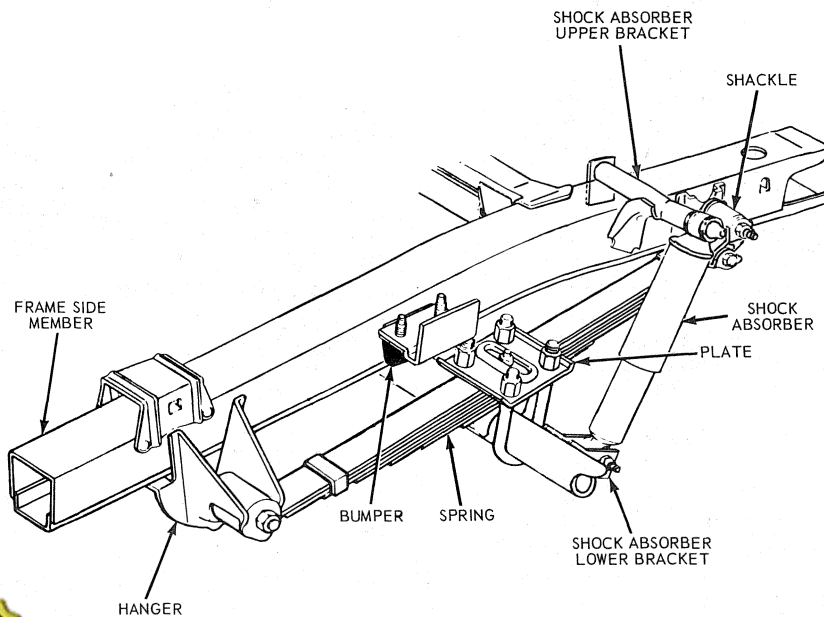


FIG. 3—Front Suspension Disassembled—Bronco



2. Position the right end of the track bar on the stud provided on the axle housing. Install the washer and nut, but do not tighten it at this time.

3. Align the opposite end of the bar with the frame mounting bracket.

4. Install the track bar-to-bracket attaching bolt.

5. Torque the attaching nuts and bolts to specification.

## REAR SPRING BUSHING REPLACEMENT

### REMOVAL

1. Raise the vehicle by the axles and position safety stands under the frame.

2. Disconnect the shock absorber from the axle.

3. Lower the axle to relieve spring tension and remove the nut from the spring to front hanger attaching bolt (Fig. 4). Drive the bolt from the spring and hanger with a drift.

4. Remove the nut from the shackle to hanger attaching bolt and drive the bolt from the shackle and hanger with a drift.

5. Lower the axle to separate the spring ends from the hangers.

6. Remove the nut from the spring to shackle attaching bolt and drive the bolt from the spring and shackle with a drift.

7. Remove the spring rear bushing from the spring with Tool T61P-3355-A

### INSTALLATION

1. Install a new rear bushing in the spring eye with Tool T61P-3355-A.

2. Remove and install the rear spring front bushing with Tool T61P-3355-A as outlined in steps 6 and 7.

3. Position the shackle to the spring rear eye and install the bolt and nut.

4. Raise the axle and spring, and align the spring front bushing with the spring hanger. Install the attaching bolt and nut.

5. Align the shackle with the hanger and install the bolt and nut.

6. Connect the shock absorber to the axle and torque the nut to specification.

7. Torque the spring front and rear attaching bolt nuts to specification. Then, remove the safety stands and lower the vehicle.

## REAR SPRING SHACKLE AND/OR BUSHING

### REMOVAL

1. Raise the vehicle by the axles and



position safety stands under the frame.

2. Disconnect the shock absorber from the axle.

3. Lower the axle to relieve spring tension and remove the nut from the shackle to hanger attaching bolt (Fig. 4).

4. Remove the bolt from the spring shackle and hanger with a drift.

5. Remove the nut from the shackle to spring attaching bolt. Drive the bolt

from the shackle and spring with a drift and remove the shackle.

6. Press the bushings out of the shackle and spring with Tool T61P-3355-A.

### INSTALLATION

1. Press the bushings in the shackle and spring with Tool T61P-3355-A.

2. Position the shackle to the spring and install the attaching bolt and nut (Fig. 4).

3. Position the shackle to the hanger and install the attaching bolt and nut.

4. Connect the shock absorber to the axle and torque the nut to specification.

5. Torque the spring to shackle and the shackle to hanger attaching nuts to specification.

6. Remove the safety stands and lower the vehicle.

## 3 REMOVAL AND INSTALLATION

### FRONT AXLE

Refer to Group 4 for front axle removal and installation procedures.

#### SPINDLE

For spindle removal and installation procedures, refer to Group 4.

### FRONT SPRING REMOVAL

1. Raise the vehicle and remove the shock absorber to lower bracket attaching bolt and nut (Fig. 3).

2. Remove spring lower retainer attaching bolts from inside of the spring coil.

3. Remove spring upper retainer attaching bolts and nuts and remove the upper retainer.

4. Position safety stands under the frame side rails and lower the axle enough to relieve tension from the spring. Remove the spring, lower retainer, and lower the seat from the vehicle.

### INSTALLATION

1. Position the spring, spring lower seat, and the lower retainer (Fig. 3) to the frame spring pocket and the radius arm.

2. Position the upper retainer over the spring coil and loosely install the attaching bolts and nuts.

3. Install the 2 lower retainer attaching bolts and torque to specification.

4. Tighten and torque the upper retainer attaching bolts to specification.

### RADIUS ARM

#### REMOVAL

1. Raise the vehicle and position safety stands under the frame side rails.

2. Remove the shock absorber to lower bracket attaching bolt and nut (Fig. 3), and pull the shock absorber free of the radius arm.

3. Remove spring lower retainer attaching bolts from inside of the spring coil.

4. Remove the cotter pin and nut attaching the radius arm to the frame bracket and remove the radius arm rear insulator.

5. Remove bolts attaching the radius arm cap to the radius arm and remove the cap and insulator. **The cap and radius arm are a matched set with identical numbers on each part and should not be mixed.**

6. Move the axle forward and remove the radius arm and insulator from the axle. Then, pull the radius arm from the frame bracket.

#### INSTALLATION

1. Position the washer and insulator on the rear of the radius arm and insert the radius arm and insulator into the frame bracket.

2. Wire brush radius arm and cap at insulator contact areas, and clean with solvent to remove oil or grease accumulation.

3. Apply the trim cement C2AZ-19525-A to the radius arm, cap and outer side of insulator per directions on cement container.

4. Install insulator to radius arm, and cap.

5. Position the rear insulator and washer on the radius arm and loosely install the attaching nut.

6. Position the radius arm to the axle (Fig. 3).

7. Install the radius arm cap with the numbers on the arm and cap together. Torque the attaching bolts, diagonally in pairs to specification.

8. Position the spring lower seat and retainer to the spring and axle as shown in (Fig. 3) and install the two attaching bolts. Torque the bolts to specification.

9. Torque the radius rod rear attaching nut to specification and install the cotter pin.

10. Position the shock absorber to the lower bracket and install the attaching bolt and nut. Torque the nut to specification and lower the vehicle.

### REAR SPRING

#### REMOVAL

1. Raise the vehicle by the axles and install safety stands under the frame.

2. Disconnect the shock absorber from the axle.

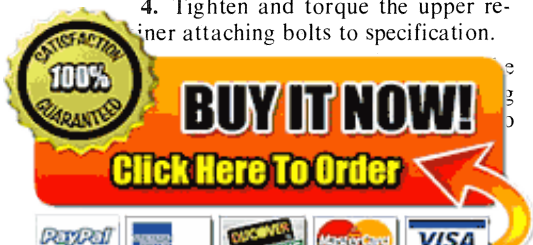
3. Remove the U-bolt attaching nuts and remove the 2 U-bolts and the spring clip plate (Fig. 4).

4. Lower the axle to relieve spring tension and remove the nut from the spring front attaching bolt.

5. Remove the spring front attaching bolt from the spring and hanger with a drift.

6. Remove the nut from the shackle to hanger attaching bolt and drive the bolt from the shackle and hanger with a drift and remove the spring from the vehicle.

7. Remove the nut from the spring rear attaching bolt (Fig. 4). Drive the bolt out of the spring and shackle with a drift.



**INSTALLATION**

1. Position the shackle (closed section facing toward front of vehicle) to the spring rear eye and install the bolt and nut.
2. Position the spring front eye and

bushing to the spring front hanger, and install the attaching bolt and nut.

3. Position the spring rear eye and bushing to the shackle, and install the attaching bolt and nut.
4. Raise the axle to the spring and install the U-bolts and spring clip plate.

5. Torque the U-bolt nuts and the spring front and rear attaching bolt nuts to specification.

6. Connect the shock absorber to the axle and torque the nut to specification.
7. Remove the safety stands and lower the vehicle.

**4 MAJOR REPAIR OPERATIONS****SPINDLE REBUSHING**

Refer to Group 4 of this manual for spindle rebushing procedures.

**REAR SPRING LEAF AND TIE BOLT REPLACEMENT****REMOVAL**

1. Remove the spring from the vehicle as outlined in Section 3.

2. Cut and remove the two spring clamps.

3. Cut the nut from the spring tie bolt.

4. Remove the tie bolt and the spring leaf to be replaced.

**INSTALLATION**

1. Install the new spring leaf and align the leaves with a suitable drift.

2. Position the spring in a vise, and install the new tie bolt and nut.

3. Tighten the nut, cut off the tie bolt at the nut, and peen the remaining end of the bolt over the nut.

4. Install the two spring clamps.

5. Install the spring in the vehicle as outlined in Section 3.

## PART 3-4— Econoline Steering

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1 Description .....	3-17	3 Steering Gear Replacement .....	3-20
2 In-Vehicle Adjustments and Repairs.....	3-17	4 Major Repair Operations .....	3-20
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Steering Wheel Spoke Position Adjustment .....	3-19	Disassembly .....	3-20
Checking Alignment of Steering Gear Shaft and Column .....	3-19	Cleaning and Inspection.....	3-21
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		Spindle Arm Connecting Rod Replacement.....	3-23

### 1 DESCRIPTION

The steering gear is of the worm and recirculating ball type. The sector shaft rotates in bushings that are pressed into the gear housing and cover.

The worm bearing preload is controlled by a bearing adjuster which is

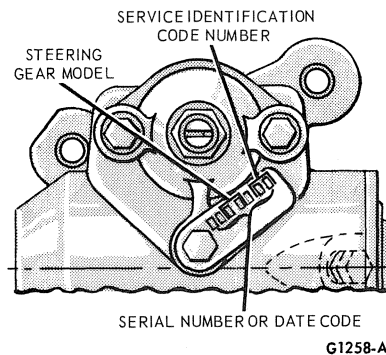


FIG. 1—Steering Gear Identification Tag

threaded into the housing. The sector shaft mesh load is controlled by an adjusting screw located in the housing cover.

A steering gear identification tag is provided under one of the cover attaching bolts (Fig. 1).

### 2 IN-VEHICLE ADJUSTMENTS AND REPAIRS

#### STEERING WORM AND SECTOR GEAR ADJUSTMENTS

The ball nut assembly and the sector gear must be adjusted properly to maintain minimum steering shaft end play (a factor of preload adjustment) and minimum backlash between sector gear and ball nut. There are only two possible adjustments within the recirculating

way, pull up the rubber seal, and remove the steering column floor pan cover (six attaching screws).

2. Raise the front of the vehicle and install safety stands.

3. Disconnect the drag link from the Pitman arm using tool 3290-C.

4. Remove the horn button or ring and spring assembly.

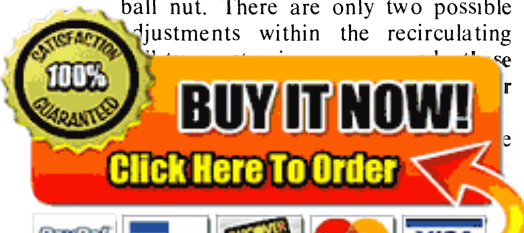
5. Remove the steering wheel, spring, and sleeve (Fig. 2).

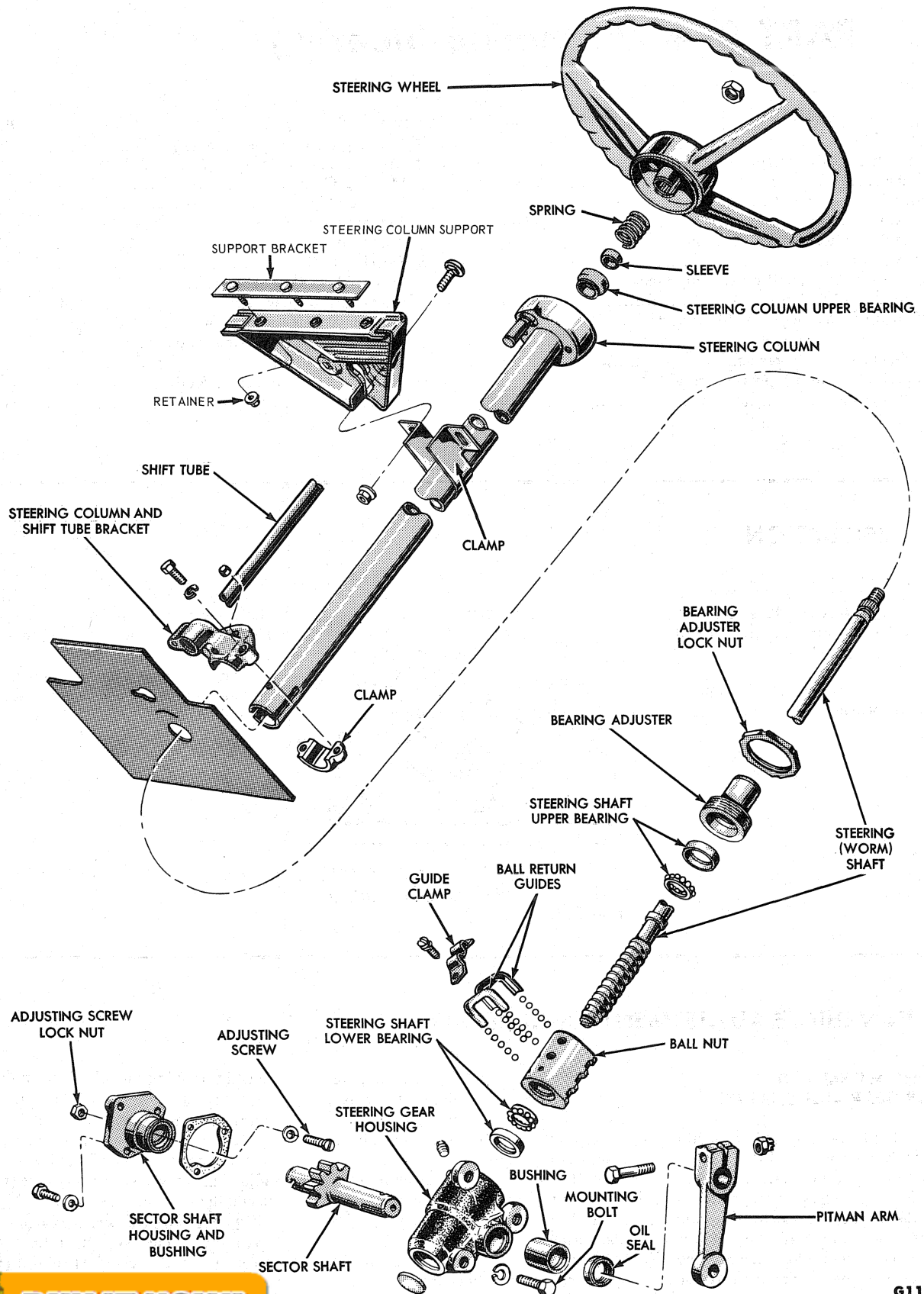
6. Check the alignment of the shaft in relation to the bearing. The shaft must not contact bearing when rotated

360° by moving the wheels from side to side. Adjust the steering column tube as detailed on page 19 if required.

7. Loosen the nut which locks the sector adjusting screw, and turn the adjusting screw counterclockwise (from inside the vehicle).

8. Measure the worm bearing preload by attaching an in-lb torque wrench to the steering wheel nut (Fig. 3). Read the torque required to rotate the input shaft approximately 1 1/2 turns either side of center. If the torque or preload is not within specifications,





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adjust the steering gear as explained in the next step.

9. Loosen the steering shaft bearing adjuster lock nut, and tighten or back off the bearing adjuster to bring the preload within the specified limits. Tighten the lock nut and recheck the preload.

10. Turn the steering wheel slowly to either stop. **Turn gently against the stop to avoid possible damage to the ball return guides.** Then rotate the wheel approximately 2 1/4 turns to center the ball nut.

11. Turn the sector adjusting screw clockwise until the specified pull is obtained to rotate the worm past its center (Fig. 2). With the steering gear positioned on center and the sector shaft retained to prevent rotation, check the lash between the ball nuts, balls and worm shaft by applying a 15 in-lb torque on the steering gear input shaft, in both right and left turn directions. Total travel of steering wheel at the rim should not exceed 1 1/4 inches when applying a 15 in-lb torque on the steering wheel nut.

12. Tighten the sector adjusting screw locknut, and recheck the backlash adjustment.

13. Tighten the steering column bracket bolts. Connect the drag link to the Pitman arm. Torque the nut to specification, and install the cotter pin.

14. Tighten the column-to-instrument panel clamp bolts, install the horn button or ring and spring assembly.

15. Install steering column floor pan cover. Place rubber seal and floor mat in position.

### STEERING WHEEL SPOKE POSITION ADJUSTMENT

When the steering gear is on the high point, the front wheels should be in the straight-ahead position and the steering wheel spokes should be in their normal position with the Pitman arm pointing downward. If the spokes are not in their normal position, they can be adjusted without disturbing the toe-in adjustment as detailed under Steering Wheel Replacement

### CHECKING ALIGNMENT OF STEERING GEAR SHAFT AND COLUMN

The steering gear shaft must be

this alignment whenever a steering gear assembly is removed and replaced, or when the steering gear housing is loosened or detached from the mounting plate, or when the steering column is loosened or detached from the instrument panel.

1. Raise the front end of the vehicle and position safety stands under the front axle.

2. Remove the horn button or ring, steering wheel, spring, and column bearing sleeve.

3. Inspect the steering shaft for contact with the steering column bearing inner race. If the steering shaft contacts the bearing inner race (centering sleeve removed) **during part of the 360° rotation**, no adjustment is required. The desired adjustment is no contact with the bearing inner race, but contact as stated is permissible.

4. If the steering shaft contacts the bearing inner race (centering sleeve removed) **at all times during the 360° rotation**, a binding condition exists and the steering column must be adjusted.



FIG. 3—Checking Steering Gear Preload

### ADJUSTING STEERING GEAR SHAFT AND COLUMN ALIGNMENT

#### LESS THAN 4000 MILES

If the steering shaft contacts the column bearing inner race at all times during 360° degree rotation, and records indicate that the condition has been present in the vehicle for less than 4,000 miles, align as follows:

1. Loosen the steering column support attaching nuts and the clamp attaching nuts.

2. Check the steering gear mounting bolt torque. Tighten the bolts to specification (Part 3-5).

3. Tighten the steering column support nuts and steering column clamp nuts sufficiently to position the steering column but still permit movement for adjustment.

4. Rotate the steering column and shift tube bracket to center the shift tube over the top of the steering column tube (centerline of shift tube 19/16 inches from the steering gear box mounting surface).

5. Adjust the column so that the steering gear shaft does not contact the column bearing inner race. If this is not possible, partial contact with the inner race **during 360° rotation** is acceptable.

6. Check for free rotation of the steering shaft, then tighten the shift tube bracket. Torque the steering column support attaching nuts and the clamp attaching nuts to specification (Part 3-7).

#### OVER 4000 MILES

When the steering shaft contacts the steering column bearing inner race at all times during 360° degree rotation, and records indicate this condition has been present in the vehicle for more than 4,000 miles, attach a pull scale in the undercut below the spline in the shaft and pull the shaft to the center of the column in the direction opposite to the bind. If the effort required to center the shaft is more than 35 lbs., replace the steering shaft and worm assembly. If the effort is less than 35 lbs., align the column as detailed under the paragraph LESS THAN 4000 MILES.

### STEERING WHEEL REPLACEMENT

#### REMOVAL

1. Remove the horn button or ring and spring.

2. Remove the nut from the end of the steering shaft, and remove the steering wheel from the shaft with the tool shown in Fig. 4.

#### INSTALLATION

1. With the front wheels straight forward, position the steering wheel on the steering shaft so that the spokes are properly centered.

2. Install the steering wheel nut on the shaft, and torque it to specification and stake the nut.

3. Place the horn contact in the steering wheel.

4. Install the horn button or ring and spring.

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## STEERING COLUMN UPPER BEARING REPLACEMENT

### REMOVAL

1. Disconnect the horn and turn signal wires, and remove the horn ring or button and spring.
2. Lift the horn contact from the steering wheel. Remove the nut from the end of the shaft and remove the steering wheel.
3. Lift the spring and the sleeve off the steering shaft. Fold the floor mat out of the way, pull up the rubber seal, and remove the steering column floor pan cover (six attaching screws).
4. Disconnect the shift rods from the shift tube arms.
5. Loosen the steering column support attaching nuts.
6. Remove the two bolts that secure the clamp to the support.

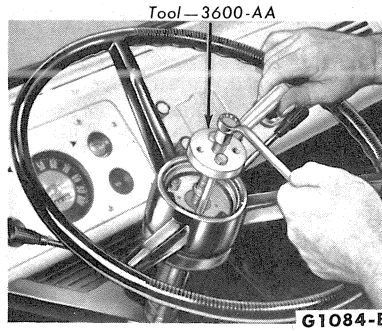


FIG. 4—Removing Steering Wheel

7. Loosen the two screws that secure the lower clamp to the column.
8. Slide the steering column up above the end of the steering gear shaft, and remove the spring and sleeve. (Fig. 3).

9. Remove the column upper bearing using tools T58L-101-A and T59L-100-B.

### INSTALLATION

1. Install the new bearing in the column.
2. Slide the column down over the steering gear shaft.
3. Check and adjust the steering gear shaft and column alignment.
4. Position the sleeve and spring on the steering shaft.
5. Install the steering wheel and horn contact and stake the nut.
6. Install the horn button or ring and connect the horn and turn signal wires.
7. Connect the shift rods to the shift tube arms, install the steering column floor pan (six attaching screws), and install the rubber seal.

## 3 STEERING GEAR REPLACEMENT

### REMOVAL

1. Disconnect the horn and turn signal wires under the instrument panel and free them from the retaining clip.
2. Fold the floor mat out of the way, pull up the rubber seal, and remove the steering column floor pan cover (six attaching screws).
3. Loosen the three steering column support attaching bolts.
4. Remove the two clamp bolts and nuts that secure the steering column clamp to the support (Fig. 2).
5. Disconnect the transmission shift rods from the shift tube arms.
6. Remove the three steering gear mounting bolts, and remove the nut and bolt that clamp the Pitman arm to the steering gear sector shaft.
7. Using a thin chisel, spread the Pitman arm. Partially remove the Pitman arm from the sector shaft, then move the steering gear and sector shaft assembly from the Pitman arm (Fig. 2).
8. Lift the steering column, shift tube and steering gear assembly out through the passenger compartment

and position on a work bench.

9. Remove the horn button and spring assembly, then remove the steering wheel and horn contact.
10. Remove the two clamp bolts and the clamp that holds the steering column to the column and shift tube bracket.
11. Slide the steering column and shift tube assembly from the steering gear housing and worm shaft. Catch the worm shaft upper bearing sleeve and spring.

### INSTALLATION

1. Slide the steering column and shift tube assembly over the worm shaft so that the boss in the column and shift tube bracket pilots into the hole in the steering column (Fig. 2).
2. Position the clamp to the steering column and bracket and install the two clamp attaching bolts. Do not tighten the clamp bolts at this time.
3. Install the steering column and steering gear assembly through the passenger compartment. With the steering

gear input shaft centered and the front wheels in the straight ahead position, pilot the sector into the Pitman arm.

4. Start the gear housing mounting bolts.
5. Position the Pitman arm on the sector shaft and install the bolt and nut that clamps the arm to the shaft (Fig. 2).
6. Connect the transmission shift rods to the shift tube arms.
7. Install the two steering column clamp-to-support attaching bolts.
8. Adjust the steering column shaft and column alignment as detailed in Section 2.
9. Place the sleeve and the spring on the steering shaft (Fig. 2) and install the steering wheel and stake the nut.
10. Position the horn contact in the steering wheel and install the horn button or ring.
11. Connect the horn and turn indicator wires.
12. Position the floor pan and secure it with six screws. Position the floor mat.

## 4 MAJOR REPAIR OPERATIONS

### STEERING GEAR

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mately 2 1/4 turns from either stop.

2. After removing the sector adjusting screw lock nut and the housing cover bolts and identification tag (Fig. 2), remove the sector shaft with the

cover. Remove the cover from the shaft by turning the screw clockwise. **Keep the shim with the screw.**

3. Loosen the adjuster nut, and remove the adjuster assembly and the



steering shaft upper bearing.

4. Carefully pull the steering shaft and ball nut from the housing, and remove the steering shaft lower bearing. **To avoid possible damage to the ball return guides, keep the ball nut from running down to either end of the worm.**

**Disassemble the ball nut only if there is indication of binding or tightness.**

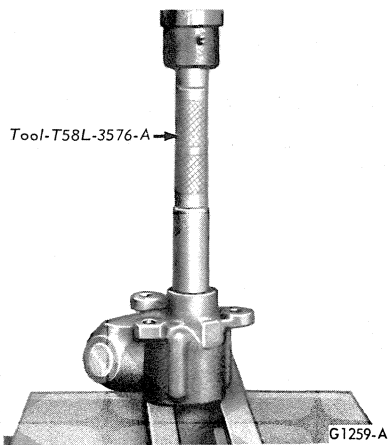
5. Remove the ball return guide clamp and the ball return guides from the ball nut. **Keep the ball nut clamp-side up until ready to remove the balls.**

6. Turn the ball nut over, and rotate the worm shaft from side to side until all 62 balls have dropped out of the nut into a clean pan. With the balls removed, the ball nut will slide off the worm.

Remove bearing races, seals, or bushings only if preliminary inspection shows damage.

7. Bump the housing and the bearing adjuster on a wood block to remove the bearing races.

8. Press the sector shaft bushing from the housing (Fig. 5).



**FIG. 5—Removing Sector Shaft Bushing**

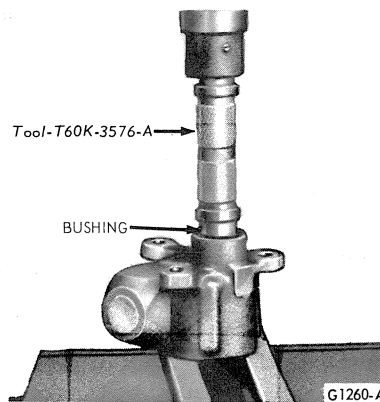
#### CLEANING AND INSPECTION

Wash all parts in a cleaning solvent, dry with a lint-free cloth. **The bearing should not be spun dry with compressed air.** Inspect the shaft and worm for scoring, cracks or checks, and for straightness of the shaft. Check the splines and the threads on the sector shaft for wear and burrs. Inspect the gear teeth for scoring, pitting and other wear. Inspect the ball bearings for free movement, and the cups for wear or

#### ASSEMBLY

1. If the sector shaft bushing has been removed, press a new bushing into the housing (Fig. 6).

2. Press a new oil seal into the housing as shown in Fig. 7.



**FIG. 6—Installing Sector Shaft Bushing**

3. Position a bearing race in the housing and in the bearing adjuster (Fig. 2).

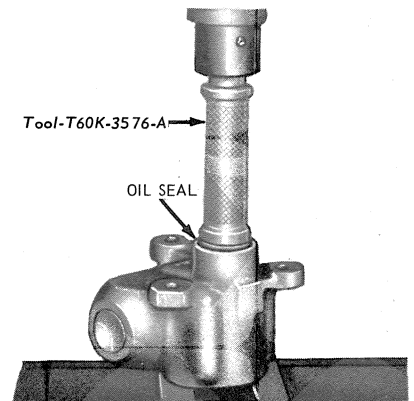
4. Swab the inside diameter of the ball nut and the outside diameter of the worm with gear lubricant (C3AZ-19578-A). Lay the steering shaft on a bench, and position the ball nut on the shaft with the guide holes up and the shallow end of the teeth to the left of the steering wheel position. Align the grooves in the worm and in the ball nut by sighting through the ball guide holes.

5. Count 31 balls, and drop as many of them as possible into one of the guide holes, slowly turning the worm away from the holes, until that circuit is full or until rotation is stopped by the end of the worm. If the balls are stopped by the end of the worm, hold in those already positioned, and turn the worm in the opposite direction. The filling of the circuit can then be continued until most of the balls are in place.

6. Lay one half of the ball return guide on the bench, and place the remainder of the 31 balls in it. Position the second half of the guide and, holding the two halves together, plug each open end with gear lubricant so the balls will stay in the guide when it is installed.

7. Push the guide into the guide holes of the ball nut, tapping lightly with the wooden handle of a screw driver if necessary.

8. Assemble the second ball return circuit in the same way as the first.



**FIG. 7—Installing Sector Shaft Oil Seal**

9. Install the ball return guide clamp and screws. Check the ball nut to see that it rotates freely. Torque the screws to specification.

10. Coat the threads of the steering shaft bearing adjuster, the housing cover bolt, and the sector adjusting screw with a suitable oil-resistant sealing compound. **Do not apply sealer to female threads, and especially avoid getting any sealer on the steering shaft bearings.**

11. Coat the bearings, bushings, and gear teeth with gear-lubricant (C3AZ-19578-A).

12. Clamp the housing in a vise, with the sector shaft axis horizontal, and position the steering shaft lower bearing in its cup.

13. Position the steering shaft and ball nut assemblies in the housing.

14. Position the steering shaft upper bearing on the top of the worm. Install the steering shaft bearing adjuster and the adjuster nut. Leave the nut loose.

15. After installing the steering wheel nut on the steering shaft, adjust the worm bearing preload, using an in-lb torque wrench.

16. Position the sector adjusting screw and adjuster shim, and check the end clearance which should not exceed 0.002 inch between the screw head and the end of the sector shaft. If clearance is greater than 0.002 inch, replace the shim.

17. Start the sector shaft pilot into the housing cover, and then, using a screwdriver through the hole in the cover, turn the adjusting screw counter-clockwise to pull the pilot into the cover.

18. Install a new gasket on the housing cover.

19. Rotate the steering shaft until the ball nut teeth are in position to mesh with the sector gear, tilting the

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housing so that the ball nut will tip toward the housing cover opening.

20. Push the housing cover and sector shaft assemblies into place, and install the two housing cover lower bolts and the identification tag. The upper

bolt should be installed when lubricant is put into the gear housing. **Do not tighten the cover bolts until it is certain that there is some lash between ball nut and sector gear teeth.**

21. After loosely installing the sector

shaft adjusting screw lock nut, adjust the sector shaft mesh load (backlash). See Part 3-7 for the specified mesh load. Remove the steering wheel nut.

## 5 STEERING LINKAGE REPAIR

The steering linkage consists of the Pitman arm, the drag link, the spindle arms and the spindle connecting rod (tie rod).

### PITMAN ARM REPLACEMENT

#### REMOVAL

1. Raise the front of the vehicle and position safety stands under the front axle.

2. Disconnect the clutch pedal return spring. Remove the clutch pedal to pivot attaching bolt and washer, and pull the pedal from the pivot shaft so that the pedal will not obstruct the removal of the Pitman arm (Fig. 8).

3. Remove the cotter pin and nut and disconnect the drag link from the Pitman arm using tool 3290-C.

4. Remove the bolt and nut that clamps the Pitman arm to the sector shaft.

5. Spread the Pitman arm with a thin chisel and remove the arm from the shaft.

#### INSTALLATION

1. Position the Pitman arm on the sector shaft. Install the clamp bolt and nut, and torque to specification.

2. Connect the drag link to the sector shaft arm and install the nut and cotter pin.

3. Position the clutch pedal on the pedal pivot shaft and install the retaining bolt and washer. Connect the clutch pedal return spring.

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

### DRAG LINK REPLACEMENT

#### REMOVAL

1. Raise the front of the vehicle and install safety stands under the axle.

2. Remove the cotter pin and nut, and disconnect the rear end of the drag link from the spindle arm (Fig. 9). Use tool 3290-C.

3. Remove the cotter pin and nut, and disconnect the front end of the drag

link from the Pitman arm using tool 3290-C.

#### INSTALLATION

1. Connect the front end of the new drag link to the sector shaft arm, and install the attaching nut and cotter pin (Fig. 8).

2. Connect the rear end of the drag link to the spindle arm and install the attaching nut and cotter pin (Fig. 9).

3. Transfer the two lubrication fittings to the new drag link, and lubricate after installation.

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

### SPINDLE ARM REPLACEMENT

#### REMOVAL

1. Raise the vehicle and install safety stands.

2. Remove the cotter pin and nut, and disconnect the spindle connecting rod from the spindle arm using tool

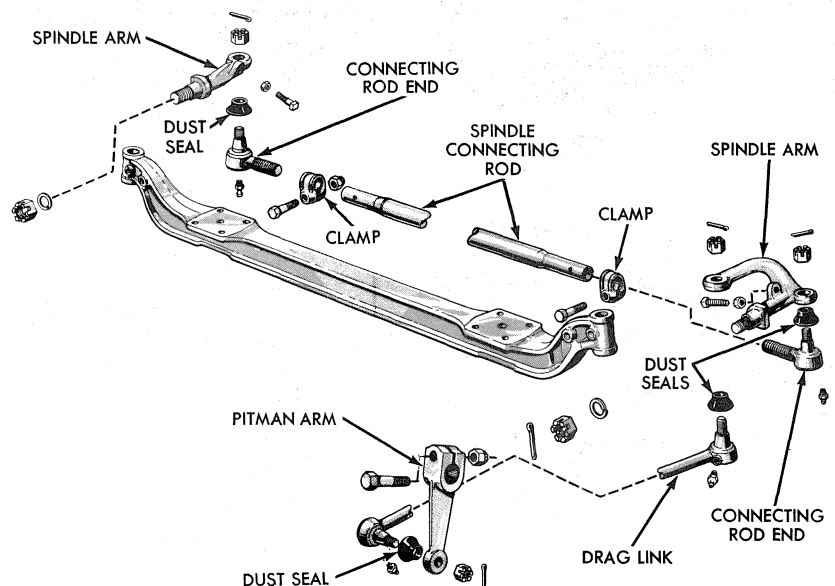
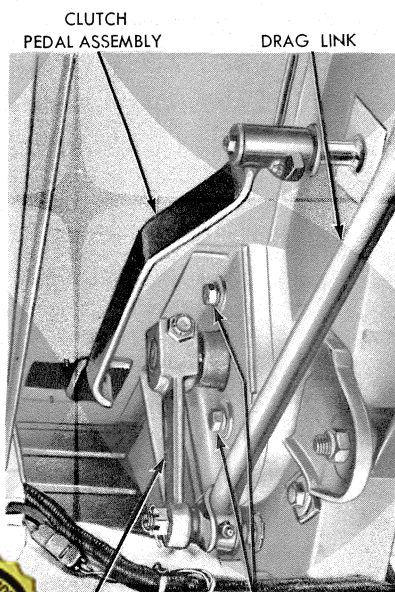


FIG. 9—Steering Linkage

G1116-A

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3290-C. On a left spindle arm also disconnect the drag link from the spindle arm using the same tool.

3. Remove the cotter pin and retaining nut and drive the spindle arm from the spindle with a soft hammer.

#### INSTALLATION

1. Position the new spindle arm on the spindle and secure with the attaching nut and cotter pin.

2. Connect the spindle connecting rod to the spindle arm, and secure it with an attaching nut and cotter pin. On a left spindle arm, also connect the drag link to the arm. Secure it with an attaching nut and a cotter pin.

3. Remove the stands, and lower the vehicle.

#### SPINDLE ARM CONNECTING ROD END REPLACEMENT

##### REMOVAL

The spindle arm connecting rod ends have non-adjustable ball studs. A rod end should be replaced when excessive looseness at the ball is noticed.

1. Remove the cotter pin and the

retaining nut, and disconnect the spindle arm from the connecting rod using tool 3290-C.

2. Loosen the clamp bolt, and turn the rod end out of the rod (Fig. 9).

#### INSTALLATION

1. After lubricating the threads of the new rod end, turn it into the rod about the same distance as the old rod end was installed. This will provide an approximate toe-in setting.

2. Install the ball stud in the spindle arm, tighten the nut to the specified torque, and install the cotter pin.

3. Check the toe-in. If necessary loosen the other connecting rod end clamp, and adjust the toe-in. Be sure to tighten the rod end clamps after adjusting the toe-in. The clamps should be positioned 3/16 inch from the end of the rod, and with the clamp bolt horizontally located below the rod.

#### SPINDLE ARM CONNECTING ROD REPLACEMENT

##### REMOVAL

The spindle arm connecting rod

should be replaced if the end threads are stripped or if it is damaged. Do not attempt to straighten a bent rod.

1. Loosen both connecting rod end clamps (Fig. 9).

2. Unthread the connecting rod until it drops off both ends. One rod end has a right thread, the other has a left thread.

#### INSTALLATION

1. Lubricate the threads on the connecting rod ends, place the clamps on the new connecting rod, and start the rod about one thread on one end.

2. Start the other end and continue to turn the rod until the rod ends have entered the rod about the same distance as the old rod was installed. This will provide an approximate toe-in setting.

3. Check the toe-in and adjust if necessary. Be sure to tighten the connecting rod end clamps after adjusting the toe-in. Position the clamps 3/16 inch from the end of the rod with the clamp bolt horizontally located below the rod.

# PART 3-5— Bronco Steering

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2 In-Vehicle Adjustments and Repairs .....	3-24	5 Steering Linkage Repair.....	3-27
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Worm and Roller Mesh Adjustment .....	3-25	Drag Link Replacement.....	3-27
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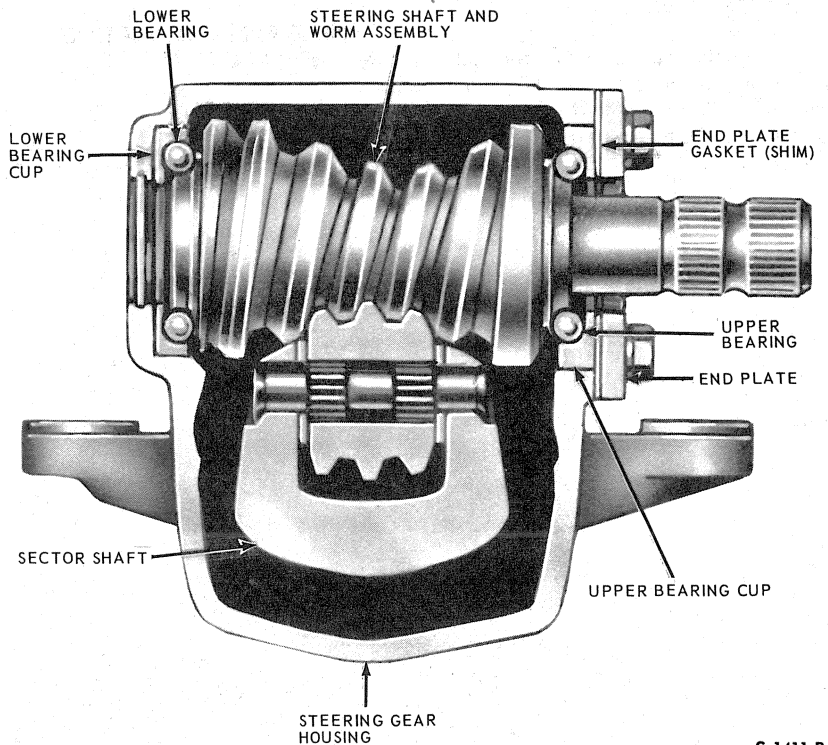
## 1 DESCRIPTION AND OPERATION

### STEERING GEAR

The steering gear is a worm and roller type gear. It is attached to the frame side rail forward of the front axle and steering linkage.

The worm, which is part of the input shaft, rotates on ball bearings and preload is obtained by shim gaskets between the end plate and the housing (Fig. 1). The sector shaft and roller, which is combined as an integral unit, rotates in bushings in the lower part of the housing. Worm and roller adjustment is controlled by an adjusting screw in the top end of the sector shaft. This screw is threaded into the housing cover and is used to adjust the mesh of the worm and roller by pushing the sector shaft roller against the worm.

When the input shaft is rotated, the worm also rotates in the same direction. As the worm rotates the sector shaft roller follows the worm and rotates the sector shaft for a turn. When the input shaft is returned to the straight ahead position, the worm and roller return the sector shaft to the straight ahead position.



G 1411-B

FIG. 1—Steering Gear Sectional View

## 2 IN-VEHICLE ADJUSTMENTS AND REPAIRS

### WORM BEARING PRELOAD ADJUSTMENT

Check the worm bearing preload before checking and adjusting the worm and roller mesh. Be sure to check the worm and roller mesh after checking and adjusting the worm bearing preload.

1. Disconnect the Pitman arm from

the sector shaft with Tool 3600-AA.

2. Disconnect the wire socket at the horn relay. Remove the horn button and spring.

3. Turn the steering wheel to the end of its travel in either direction.

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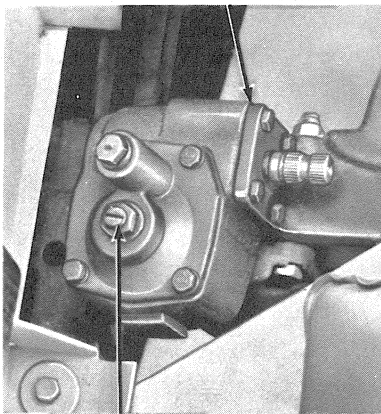
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4. Place an in-lb torque wrench on the steering wheel attaching nut, and measure the torque required to keep the wheel moving at a constant rate for approximately 2 1/2 turns. If the torque, or preload is not within specifications, remove or add gasket shims between the worm shaft bearing retainer cover and the steering gear housing (Fig. 2) to adjust the worm bearing preload to specification. Install the cover and torque the attaching bolts to specification.

5. Check the steering gear lubricant level and add lubricant as necessary (Part 3-1).

WORM BEARING PRELOAD SHIMS



WORM AND ROLLER MESH ADJUSTMENT

G 1408-A

**FIG. 2—Steering Gear Adjustments**

### WORM AND ROLLER MESH ADJUSTMENT

The worm bearing preload should always be checked and adjusted, if necessary, before the worm and roller mesh is checked and adjusted.

1. Disconnect the Pitman arm from the sector shaft with Tool 3600-AA.
2. Install an in-lb torque wrench on the steering wheel nut, and measure the torque required to turn the wheel through the straight-ahead (high point)

position. **The high point is the point of least clearance between the worm and roller, and is at the mid-point of the worm and roller travel.**

3. To adjust the mesh, loosen the adjusting screw lock nut (Fig. 2), and adjust the worm and roller mesh by turning the adjusting screw inward (clockwise) to tighten the mesh, or by turning it outward (counterclockwise) to loosen the mesh.

4. After adjusting the mesh, hold the adjusting screw stationary with a screwdriver and tighten the lock nut.

5. Check the mesh adjustment. If the mesh is still not correct, repeat the adjustment procedure.

### DRAG LINK BALL SOCKET PLUG ADJUSTMENT

Check the ball stud for end play. If end play exists, the spring, seats, or ball stud are probably damaged. A disassembled view of the ball stud socket is shown in Fig. 6.

1. Remove the cotter pin from the end of the drag link.
2. Tighten the threaded plug in the end of the socket until the spring is fully compressed (ball seat bottoms on spring seat). Then back off the plug approximately 1 turn to the point where the slot in the plug lines up with the cotter pin holes in the drag link.
3. Install a new cotter pin through the end of the drag link to lock the plug.

### STEERING COLUMN SHIFT TUBE REPLACEMENT

#### REMOVAL

1. Disconnect the horn and turn signal wires at the steering column connectors located under the instrument panel.
2. Depress the horn button; rotate it counterclockwise and remove the horn button and spring from the steering wheel.
3. Remove the steering wheel attaching nut and remove the steering wheel with Tool 3600-AA.

4. Remove the gear shift lever from the shift lever hub.

5. Remove flange bolt attaching nuts, and pull up on the flange. Remove the spring and centering sleeve from the steering shaft and the flange and shift lever hub from the steering column tube (Fig. 3).

6. Pull up on the shift tube and remove it from the steering column.

#### INSTALLATION

1. Position the shift tube over the steering shaft and insert it into the steering column and through the shift levers at the base of the column (Fig. 3).

2. Position the shift lever hub on the steering column tube, taking care not to damage the horn and turn signal wires.

3. Position the flange bolts to the flange and start the nuts on the bolts about 2 turns.

4. Position the flange to the shift lever hub and the steering column tube while pulling the turn signal and horn wires down through the column.

5. Engage the heads of the 2 flange bolts in the slots of the steering column tube and tighten the flange bolt nuts.

6. Install the gear shift lever in the shift lever hub.

7. Install the centering sleeve, spring, and steering wheel on the steering shaft and install the attaching nut. Torque the nut to specification and apply 2 drops of Loctite sealer (C3AZ-19554-A) to the junction of the steering shaft and nut threads or stake the nut to the shaft.

8. Install the spring and horn button on the steering wheel hub.

9. Connect the turn signal and horn wires at the steering column connectors and check the operation of the horn and turn signals.

10. Check the shift operation through all gears.

## 3 STEERING GEAR REMOVAL AND INSTALLATION

### REMOVAL

1. Raise the vehicle on a hoist and remove the Pitman arm attaching nut

3. Remove 3 steering gear to frame side rail attaching bolts and nuts and lower the vehicle.

4. Remove the flex coupling bolt and nut from the coupling clamp (Fig. 3). Loosen the clamp on the steering shaft at the end of the steering column and

separate the coupling from the steering gear input shaft by pushing the steering shaft toward the steering column. Discard the clamp, bolt and nut.

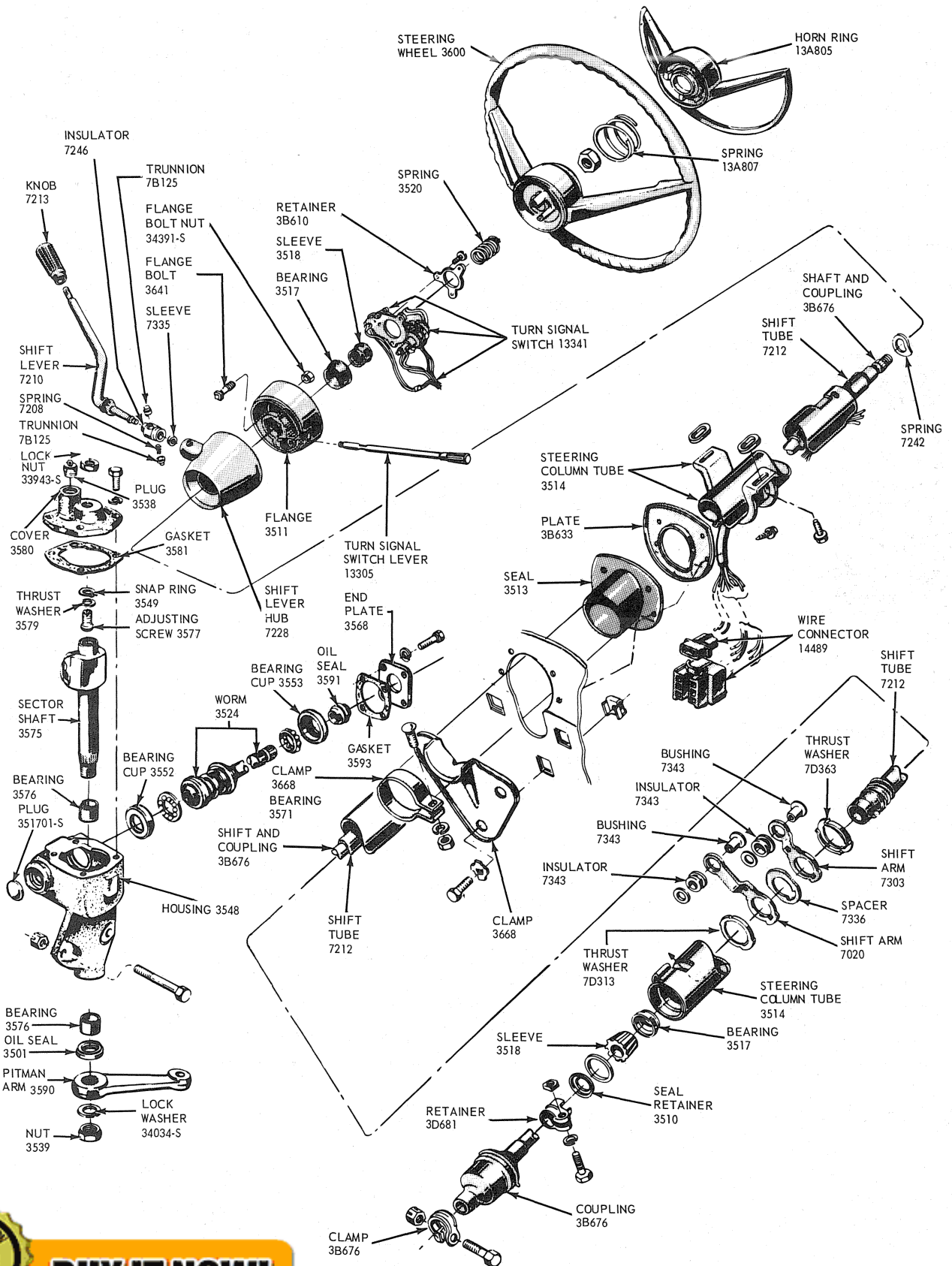
5. Remove and discard the flex coupling clamp from the steering gear input shaft, and remove the steering gear from the frame side rail.

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**INSTALLATION**

1. Position the steering gear to the frame side rail and install the attaching bolts and nuts.
2. Position the steering shaft flex coupling and a new clamp to the steering gear input shaft and install the

clamp bolt and nut (Fig. 3). Torque the bolt and nut to specification.

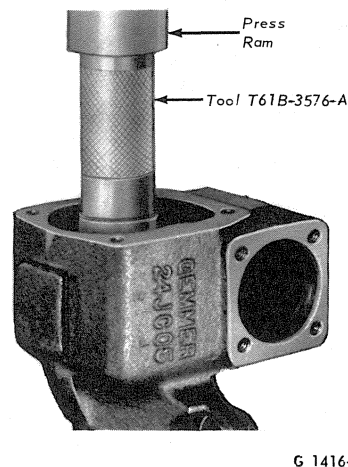
3. Position a new steering shaft clamp at the end of the steering column and tighten the bolt and nut to specification.
4. Raise the vehicle and torque the

steering gear attaching bolts and nuts to specification.

5. Position the Pitman arm on the sector shaft and install the washer and attaching nut. Torque the nut to specification, lower the vehicle, and fill the gear with lubricant (SAE-90 EP Engine Oil, Ford Spec. M568-C).

**4 STEERING GEAR OVERHAUL****DISASSEMBLY**

1. Mount the steering gear housing in a vise, and center the gear.
2. Loosen (back-off) the sector shaft adjusting screw lock nut.
3. Place a drain pan under the sector shaft.
4. Remove the screws that hold the sector shaft cover (Fig. 3) on the housing. Then, remove the cover and sector shaft as an assembly, and allow the lubricant to drain in the pan.
5. Remove the input shaft end plate attaching screws and remove the plate, shims, gaskets, worm upper bearing cup, upper bearing and the worm shaft from the housing.
6. Remove the lower bearing from the gear housing.
7. Remove the worm shaft lower bearing cup plug from the steering gear housing with a drift.
8. Working through the plug opening, drive the lower bearing race from the housing with a brass drift.
9. Remove the sector shaft oil seal from the housing.
10. If the sector shaft bushings are worn or damaged, remove them from the housing with a cape chisel.
11. Position the sector shaft and cover in a vise; remove the adjusting screw lock nut; turn the adjusting screw in, and remove the sector shaft from the cover.



**FIG. 4—Installing Sector Shaft Bushings**

12. Remove the sector shaft adjusting screw from the sector shaft if it is damaged, by removing the snap ring and thrust washer.

**ASSEMBLY**

1. Install the sector shaft and adjusting screw in the cover, and install the lock nut loose.
2. Install new sector shaft bushing in the steering gear housing with Tool T61B-3576-A (Fig. 4).

3. Install the worm shaft lower bearing cup in the housing with a brass drift. Be sure the bearing cup is seated against the housing shoulder. Install a new bearing cup plug in the housing.

4. Position the worm shaft lower bearing in the race, and install the worm in the housing.

5. Install the worm shaft upper bearing and cup.

6. Install a new seal in the input shaft cover and install the cover using the same thickness of gaskets as was removed. Install the input shaft cover bolts and torque to specification.

7. Check the worm bearing preload with an in-lb torque wrench. Refer to Worm Bearing Preload Adjustment in Section 2 and adjust the preload to specification.

8. Install the sector shaft seal in the housing with the metal side of the seal out.

9. Lubricate the worm gear and install the sector shaft and cover in the housing using a new gasket. Torque the cover bolts to specification.

10. Position an in-lb torque wrench on the input shaft and adjust the worm and roller mesh as outlined in Section 2.

11. Fill the steering gear with lubricant (SAE-90EP Engine Oil, Ford Spec. M568C) to the bottom of the filler plug tower.

**5 STEERING LINKAGE REPAIR****PITMAN ARM REPLACEMENT****REMOVAL**

1. Raise the vehicle and disconnect the drag link from the Pitman arm.

**INSTALLATION**

1. Position the Pitman arm to the sector shaft and install the lock washer and attaching nut. Torque the nut to specification.

2. Position the drag link ball stud to the Pitman arm and install the attaching nut. Torque the nut to specification and continue to tighten the nut until the

nut castellations are aligned with the hole in the stud and install the cotter pin.

3. Lubricate the drag link end and lower the vehicle.

**DRAG LINK REPLACEMENT****REMOVAL**

1. Raise the vehicle and disconnect



the drag link from the spindle connecting rod end.

2. Disconnect the drag link from the steering gear Pitman arm (Fig. 6) and remove the drag link from the vehicle.

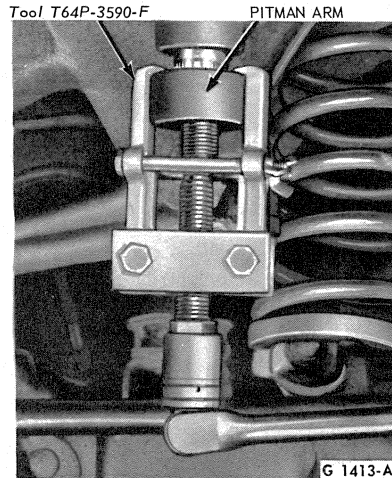


FIG. 5—Removing Pitman Arm

### INSTALLATION

1. Position new dust seals (Fig. 6) on the drag link ball stud and position the drag link to the Pitman arm. Install the attaching nut and torque it to specification. Continue to tighten the nut until the nut castellations are aligned with the hole in the ball stud and install the cotter pin.

2. Install new seals over the other drag link ball stud and position the drag link to the spindle connecting rod end. Install the attaching nut and torque it to specification. Continue tightening the nut until the nut castellations are aligned with the hole in the ball stud and install the cotter pin.

3. Install the lubrication fittings and lubricate the drag link with the specified lubricant and lower the vehicle.

### SPINDLE ARM REPLACEMENT

The spindle arm is part of the spindle and cannot be replaced without replacing the spindle. The spindle procedures are outlined in Group 4.

### SPINDLE CONNECTING ROD END REPLACEMENT

#### REMOVAL

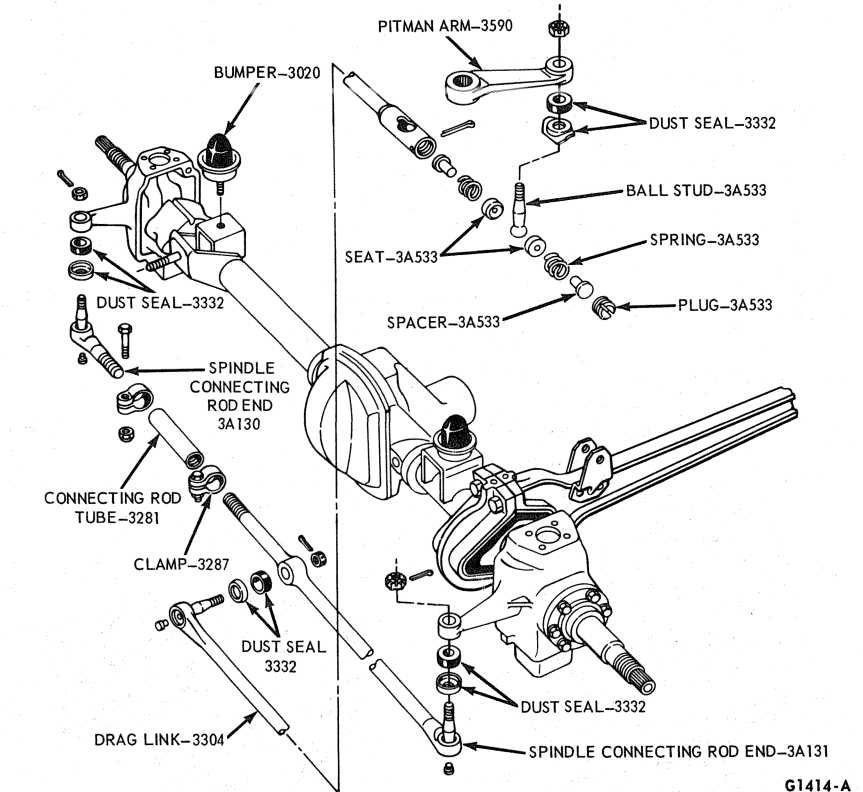


FIG. 6—Steering Linkage Disassembled

2. Disconnect the right spindle connecting rod end from the right spindle arm.

3. Disconnect the left spindle connecting rod end from the left spindle arm and remove the spindle connecting rod ends from the vehicle.

### INSTALLATION

1. Position the connecting rod ends in a vise and loosen the connecting rod tube clamps (Fig. 6).

2. Remove the right (short) rod end from the connecting rod tube and remove the tube from the left (long) connecting rod end.

3. Clean and oil all threads on components that are to be re-used.

4. Install the connecting rod tube and clamps on the left spindle connecting rod end. Do not tighten the clamps.

5. Install the right connecting rod end in the tube and remove the assembly from the vise.

6. Position new dust seals (Fig. 6) on the left spindle connecting rod end and position the end to the left spindle arm.

7. Install the connecting rod end attaching nut and torque it to specification. Continue to tighten the nut until the slots on the nut are aligned with the hole in the ball stud and install the cotter pin.

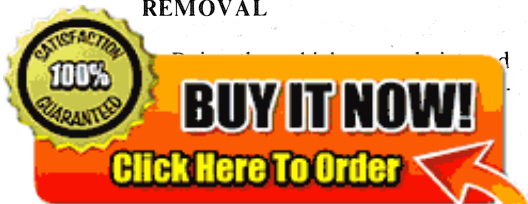
8. Position new dust seals on the right spindle connecting rod end and position the end to the right spindle arm. Install the attaching nut and torque it to specification. Continue to tighten the nut until the nut castellations are aligned with the hole in the ball stud and install the cotter pin.

9. Position new seals (Fig. 6) on the drag link ball stud and position the drag link to the spindle connecting rod end. Install the attaching nut and torque it to specification. Continue to tighten the nut until the nut castellations are aligned with the hole in the ball stud and install the cotter pin.

10. Lubricate the spindle connecting rod ends and the drag link.

11. Check and correct the tire pressures to specification and lower the vehicle.

12. Check and adjust toe-in and tighten the connecting rod tube clamps to specification.



# PART 3-6—Wheels and Tires

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## 1 DESCRIPTION AND OPERATION

### ECONOLINE

#### FRONT WHEEL

Each front wheel and tire is bolted to its respective front hub and brake drum assembly. Two opposed tapered roller bearings are installed in each hub. A grease retainer is installed at the inner end of the hub to prevent lubricant from leaking into the drum. The entire assembly is secured to its spindle by the adjusting nut, nut lock and cotter pin (Fig. 1).

#### REAR WHEEL

The rear brake drum assembly is attached to studs on the rear axle shaft flange by three speed nuts. The wheel and tire mounts on the same rear axle shaft flange studs and is held against the hub and drum by the wheel nuts. The rear wheel bearing is pressed onto the axle shaft just inside the shaft flange, and the entire assembly is secured to the rear axle housing by the bearing retainer plate which is bolted to the housing flange.

The inner end of each axle shaft is splined to the differential in the rear axle.

### BRONCO

#### FRONT WHEEL

Each front wheel and tire assembly is bolted to its respective front hub and brake drum assembly. Two opposed

tapered roller bearings are installed in each hub. The entire assembly is retained to the spindle by the adjusting nut, lock ring, and a lock nut (Fig. 2).

#### REAR WHEEL

The rear brake drum assembly is the same as the Econoline models.

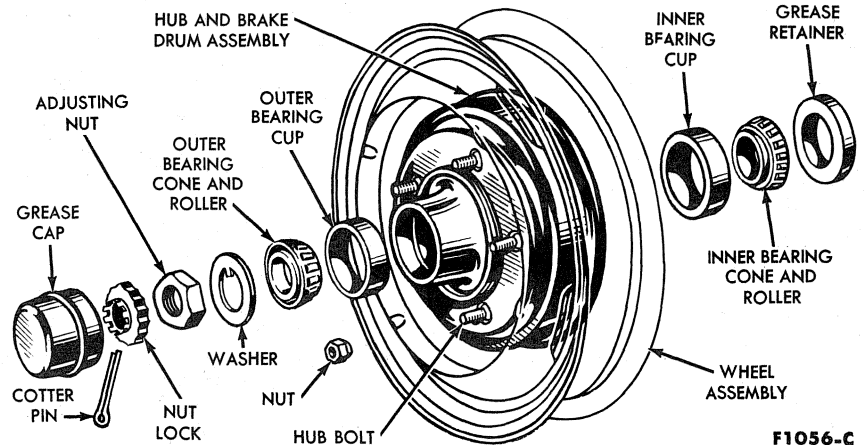


FIG. 1—Front Hub, Bearings and Grease Retainer

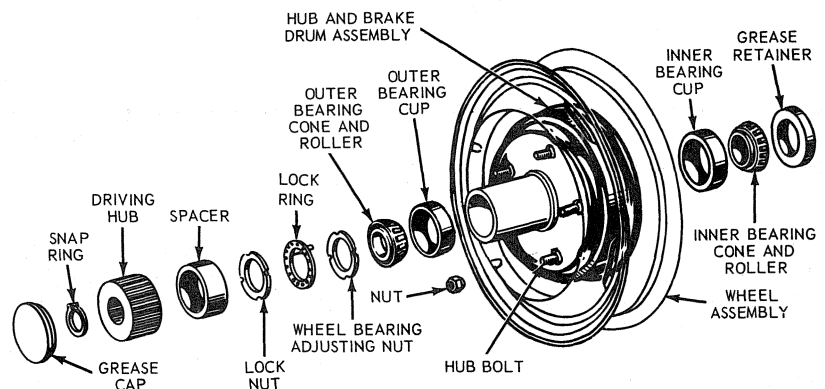


FIG. 2—Front Wheel and Hub Installation

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## 2 IN-VEHICLE ADJUSTMENT AND REPAIR

### ECONOLINE

#### FRONT WHEEL BEARING ADJUSTMENT

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

1. Raise the vehicle until the wheel and tire clear the floor.
2. Pry off the hub cap or 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 cotter pin and nut lock.
4. While rotating the wheel, hub, and drum assembly, torque the adjusting nut to 15-20 ft-lbs to seat the bearings (Fig. 3).
5. Locate the nut lock on the adjusting nut so that the castellations on the lock are aligned with the cotter pin hole in the spindle.
6. Back off both the adjusting nut and the nut lock together until the next castellation on the nut lock aligns with the cotter pin hole in the spindle.
7. Install a new cotter pin, and bend the ends of the cotter pin around the castellated flange of the nut lock.

8. Check the front wheel rotation. 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.

### BRONCO

#### FRONT WHEEL BEARING ADJUSTMENT

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

1. Raise the vehicle and install safety stands.
2. Back off the brake adjusting screw, if necessary. Remove the wheel cover, if installed.
3. Remove the front hub grease cap. Remove the driving hub retaining snap ring and slide the splined driving hub from between the axle shaft and the wheel hub (Fig. 2). Remove the driving hub spacer. (If equipped with free-running lock-out hubs, refer to Front Wheel Drive Lock-Out Hubs Removal in Group 4.)
4. With Tool T59T-1197-B and a torque wrench, tighten the bearing adjusting nut (Fig. 2) to 50 ft-lb, while rotating the wheel back and forth to seat the bearings.
5. Continue rotating the wheel and then, loosen and re-torque the adjusting nut to 30-40 ft-lb.
6. Back the adjusting nut off approximately 1/2 turn (135-150°). Assemble the lock ring by turning the nut to the nearest hole where the dowel pin will enter.
7. Install the outer lock nut and torque to 50 ft-lb. Final end-play of the wheel on the spindle should be 0.001 to 0.010 inch.
8. Install the driving hub, spacer, snap ring and hub grease cap. Apply a thin coat of non-hardening sealer to the seating edge of the grease cap, before installation. (If equipped with free-running lock-out hubs, refer to Front Wheel Drive Lock-Out Hub Installation in Group 4.)
9. Adjust the brake, if backed off to permit drum removal.

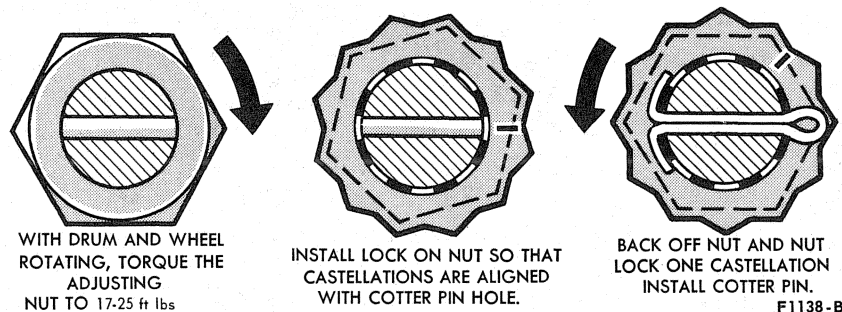


FIG. 3—Front Wheel Bearing Adjustment—Econoline

## 3 REMOVAL AND INSTALLATION

### ECONOLINE AND BRONCO

#### WHEEL AND TIRE REMOVAL

1. Pry off the wheel hub cap or

2. Remove the wheel hub nuts from the studs, and pull the wheel and tire from the hub and drum.

#### REMOVING TIRE FROM WHEEL

The tire can be demounted on a mounting machine. Be sure that the

outer side of the wheel is positioned downward. If tire irons are used follow the procedure given here:

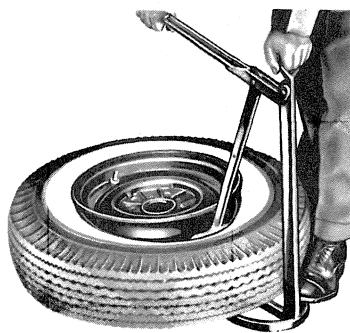
1. Remove the valve cap and core, and deflate the tire completely.
2. With a bead loosening tool, break loose the tire side walls from the wheel (Fig. 4).
3. Position the outer side of the

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F1058-A

FIG. 4—Bead Loosening Tool

wheel downward, and insert two tire irons about eight inches apart between the tire inner bead and the back side of the wheel rim. Use only tire irons with rounded edges or irons designated for removing tubeless tires.

4. Leave one tire iron in position, and pry the rest of the bead over the rim with the other iron. Take small bites with the iron around the tire in order to avoid damaging the sealing surface of the tire bead.

5. Stand the wheel and tire upright with the tire outer bead in the drop center well at the bottom of the wheel. Insert the tire iron between the bead and the edge of the wheel rim, and pry the wheel out of the tire.

### MOUNTING TIRE TO WHEEL

1. If a used tire is being installed remove all dirt from the tire.

If a tire is being mounted to the original wheel, clean the rim with emery cloth or fine steel wool. Check the rim for dents and remove any wheel balancing weights.

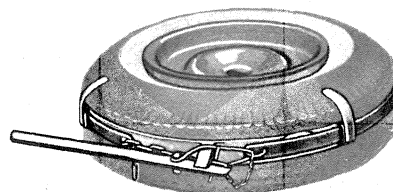
If a new wheel is being installed, coat a new valve with RUGLYDE or similar rubber lubricant and position the valve to the new wheel. Use a rubber hammer or a valve replacing tool to seat the valve firmly against the inside of the rim.

2. Apply RUGLYDE or a similar rubber lubricant to the sealing surface on both tire beads. With the outer side of the wheel down, pry the beads over the wheel rim with two tire irons. Do not use a hammer or mallet to force the beads over the rim.

3. Align the balance mark on the tire with the valve on the wheel.

4. Hold the beads against the rim flanges by positioning a tire mounting band over the tire (Fig. 5). If a mounting band is not available, tie a tourniquet of heavy cord around the circumference of the tire. Tighten the cord with a tire iron. Center the tire on the wheel with a rubber mallet.

5. Give the tire a few quick bursts of air to seat the beads properly, then,



F1021-A

FIG. 5—Tubeless Tire Mounting Band

inflate the tire to 40 psi pressure. Check to see that the bead positioning rings (outer rings near the side walls) are evenly visible just above the rim flanges all the way around the tire. If the rings are not even, deflate the tire completely and inflate it again.

6. When the rings are properly positioned, deflate the tire to the recommended pressure.

### WHEEL AND TIRE INSTALLATION

1. Clean all dirt from the hub and drum.

2. Position the wheel and tire on the hub and drum. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and drum.

3. Lower the vehicle to the floor, and torque the hub nuts to specification.

## 4 MAJOR REPAIR OPERATIONS

### ECONOLINE

#### FRONT WHEEL GREASE SEAL AND BEARING REPLACEMENT AND/OR REPACKING

If bearing adjustment will not eliminate looseness or rough and noisy operation, the hub and bearings should be cleaned, inspected, and repacked. If the bearing cups or the cone and roller assemblies are worn or damaged, they should be replaced.

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

2. Insert a narrow screwdriver through the brake adjusting hole at the inner side of the brake backing plate, and disengage the adjusting lever from the adjusting screw. While holding the adjusting lever away from the screw,

notches in the adjusting screw; otherwise the self adjusting mechanism will not function properly.

3. Remove the wheel cover or hub cap. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone and roller assembly (Fig. 1).

4. Pull the wheel, hub, and drum assembly off the wheel spindle.

5. Remove the grease retainer and the inner bearing cone and roller assembly from the hub.

6. Clean the lubricant off the inner and outer bearing cups with solvent and inspect the cups for scratches, pits, excessive wear, and other damage. If the cups are worn or damaged, remove them with a drift.

7. Soak a new grease retainer in light engine oil at least 30 minutes before installation. Thoroughly clean the inner and outer bearing cones and rollers with solvent, and dry them thor-

oughly. Do not spin the bearings with compressed air.

Inspect the cone and roller assemblies for wear or damage, and replace them if necessary. The cone and roller assemblies and the bearing cups should be replaced as a unit if damage to either is encountered.

8. Thoroughly clean the spindle and the inside of the hub with solvent to remove all old lubricant.

Cover the spindle with a clean cloth, and brush all loose dust and dirt from the brake assembly. To prevent getting dirt on the spindle, carefully remove the cloth from the spindle.

9. If the inner and/or outer bearing cup(s) were removed, install the replacement cup(s) in the hub with the tool shown in Fig. 7. Be sure to seat the cups properly in the hub.

10. Pack the inside of the hub with specified wheel bearing grease. Add lubricant to the hub only until the

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grease is flush with the inside diameter of both bearing cups (Fig. 8).

11. All old grease should be completely cleaned from the bearings before repacking them with new grease. Pack the bearing cone and roller assemblies with wheel bearing grease. A bearing packer is desirable for this operation. If a packer is not available, work as much lubricant as possible between the rollers and cages. Lubricate the cone surfaces with grease.

12. Place the inner bearing cone and roller assembly in the inner cup, and install the new grease retainer as shown in Fig. 9. The opposite end of the tool T60K-1217-A shown in Fig. 9 can also be used to install the retainer. **Be sure that the retainer is properly seated.**

13. Adjust the brake shoes as outlined in Part 2.

14. Install the wheel, hub, and drum assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

15. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut (Fig. 1).

16. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.

17. Install the hub cap or wheel cover.

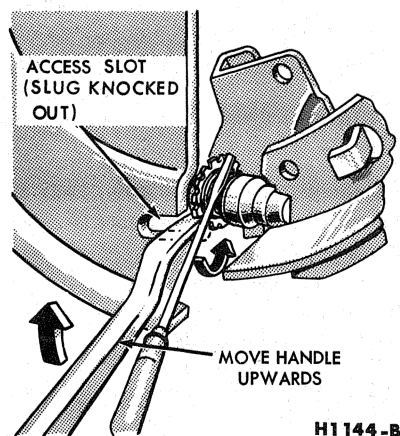


FIG. 6—Backing Off Brake Adjustment

new assembly. The new grease retainer should be soaked in light engine oil at least 30 minutes before installation.

1. Raise the vehicle until the wheel and tire clear the floor. Pry off the hub cap or wheel cover, and remove the wheel and tire from the hub and drum assembly.

2. Remove the hub and drum from the wheel spindle as outlined in steps 2 and 3 of the foregoing procedure.

3. Remove the protective coating from the new hub and drum with carburetor degreaser. Install new inner and outer bearing cups in the new hub with the tool shown in Fig. 7. **Be sure to seat the cups properly in the hub.**

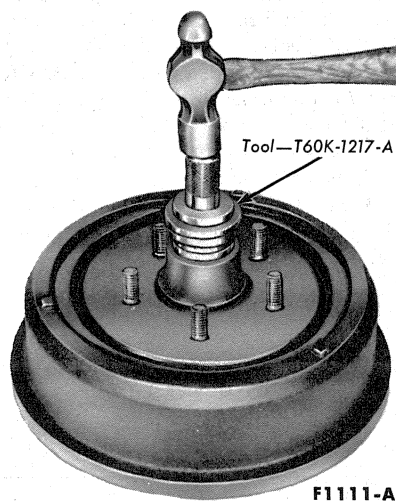


FIG. 7—Installing Front Wheel Bearing Cup

4. Grease and install the new parts as outlined in steps 10 through 12 of the foregoing procedure.

5. Adjust the brake shoes as outlined in Part 2.

6. Install the new hub and drum assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer.**

7. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut (Fig. 1).

8. Position the wheel and tire on the new hub and drum assembly. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and drum.

9. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cup. Install the grease cup.

10. Install the hub cap or wheel cover.

## BRONCO

### FRONT WHEEL GREASE SEAL AND BEARING REPLACEMENT AND/OR REPACKING

If bearing adjustment will not eliminate looseness or rough and noisy operation, the hub and bearings should be cleaned, inspected, and repacked. If the bearing cups or the cone and roller assemblies are worn or damaged, they should be replaced.

1. Raise the vehicle and install safety stands.

2. Back off the brake adjusting screw, if necessary. Remove the wheel cover, if installed.

3. Remove the front hub grease cap. Remove the driving hub retaining snap ring (Fig. 2) and slide the splined driving hub from between the axle shaft and the wheel hub. Remove the driving hub spacer. (If equipped with free-running lock-out hubs, refer to Front Wheel Drive Lock-Out Hub Removal.)

4. With Tool T59T-1197-B, remove the lock nut, washer, and wheel bearing adjusting nut (Fig. 2) from the spindle. Remove the wheel, hub and drum as an assembly. The wheel outer bearing will be forced off the spindle at the same time. Protect the spindle and inner bearing cone from dirt.

5. Remove the grease retainer and the inner bearing cone and roller assembly from the hub with Tool 1175-AE, and T50T-100-A.

6. Clean the lubricant off the inner and outer bearing cups with solvent and inspect the cups for scratches, pits, excessive wear, and other damage. If the cups are worn or damaged, remove them with a drift.

7. Soak a new grease retainer in light engine oil at least 30 minutes before installation. Thoroughly clean the inner and outer bearing cones and rollers with solvent, and dry them thoroughly. **Do not spin the bearings with compressed air.**

Inspect the cone and roller assemblies for wear or damage, and replace them if necessary. **The cone and roller assemblies and the bearing cups should be replaced as a unit if damage to either is encountered.**

8. Thoroughly clean the spindle and the inside of the hub with solvent to remove all old lubricant.

Cover the spindle with a clean cloth, and brush all loose dust and dirt from

FRONT HUB AND DRUM ASSEMBLY REPLACEMENT

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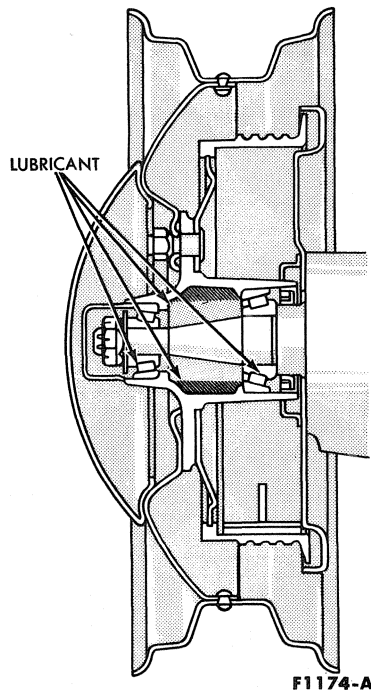


FIG. 8—Front Wheel Hub Lubrication

the brake assembly. To prevent getting dirt on the spindle, carefully remove the cloth from the spindle.

9. If the inner bearing cup was removed, install the cup or a new cup in the hub. **Be sure to seat the cup properly in the hub.**

10. Install the outer bearing cup in the hub with Tool T53T-1239-A, details 2 and 6. **Be sure the cup is properly seated in the hub.**

11. Pack the inside of the hub with specified wheel bearing grease. Add lubricant to the hub only until the grease is flush with the inside diameter of both bearing cups.

12. All old grease should be completely cleaned from the bearings before repacking them with new grease. Pack the bearing cone and roller assemblies with wheel bearing grease. A bearing packer is desirable for this operation. If a packer is not available, work as much lubricant as possible between the rollers and cages. Lubricate the cone surfaces with grease.

13. Place the inner bearing cone and roller assembly in the inner cup, and install the new grease retainer with Tool T53T-7065-B. **Be sure that the retainer is properly seated.**

14. Install the wheel, hub, and drum assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

15. Install the wheel outer bearing cone and adjusting nut. Adjust the front wheel bearings as detailed in Section 2 under Front Wheel Bearing Adjustment (steps 5 through 10).

#### FRONT HUB AND DRUM ASSEMBLY REPLACEMENT

When the hub and drum assembly is replaced, new bearings, cups, and grease retainer must be installed in the new assembly. The new grease retainer should be soaked in light engine oil at least 30 minutes before installation.

1. Raise the vehicle until the wheel and tire clear the floor. Pry off the hub cap or wheel cover, and remove the wheel and tire from the hub and drum assembly.

2. Remove the hub and drum from the wheel spindle.

3. Remove the protective coating from the new hub and drum with carburetor degreaser. Install new inner and

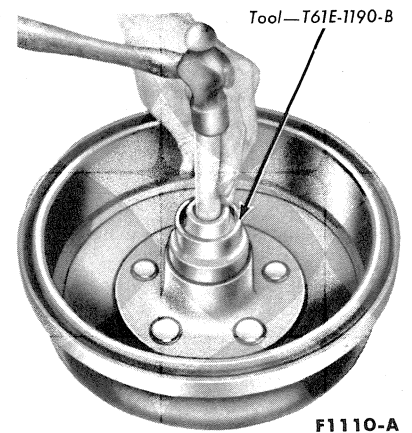


FIG. 9—Installing Front Wheel Grease Retainer

outer bearing cups in the new hub. **Be sure to seat the cups properly in the hub.**

4. Grease and install the new parts as outlined in steps 11 through 15 of the foregoing procedure.

5. Adjust the brake shoes as outlined in Group 2.

6. Install the new hub and drum assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer.**

7. Install the outer bearing cone, lock ring, and lock nut. Adjust the wheel bearing as detailed in Section 2. Install the spacer, driving hub, snap ring and grease cap Fig. 10.

8. Position the wheel and tire on the new hub and drum assembly. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and drum.

9. Install the hub cap or wheel cover.

# PART 3-5 – Specifications

## ECONOLINE

### FRONT WHEEL ALIGNMENT AND GENERAL SPECIFICATIONS

Wheel Alignment	Checking Specifications			Optimum Re-Setting Specifications
	Min.	Max.	Maximum Variation Between Wheels	Desired Alignment
Caster	+4 1/4°	+5 3/4°	1/2°	+5°
Camber	+1/8°	+3/4°	1/4°	+1/2°
Toe-In (Inch)	1/16 in.	1/8 in.	—	3/32 in.

### GENERAL SPECIFICATIONS

Front Wheel Turning Angle (Angle of inside wheel when outside wheel is turned 20°)	21 1/2°
King Pin Inclination	7 1/2°
Wheel Inside Turning Angle	33°
Wheel Base	90 inches
Tread	Front—60 inches Rear—60 1/4 inches

### FRONT SUSPENSION TORQUE LIMITS

Description	Ft-lbs
Spring to Front Hanger	30-50
Spring Shackles at Rear to Body and Spring	20-32
Spring to Front Axle—Spring Clip Nuts	50-60
Shock Absorber Mounting Bolt and Nut—Upper and Lower	40-50
Stabilizer to Body	25-35
Stabilizer to Link	12-17
Stabilizer Link to Front Axle	40-50

### REAR SUSPENSION TORQUE LIMITS

Description	Ft-lbs
Spring to Front Hanger	30-50
Spring Shackles at Rear to Body and Spring	20-32
Spring to Rear Axle—Spring Clip Nuts	30-40
Shock Absorber Mounting Bolt and Nut—Upper and Lower	40-50

### WHEELS AND TIRES

Pickup and Regular Van and Bus		Wheels
Standard	RPO	
6.95 x 14 (4 Ply)		14 x 5.5J
	6.95 x 14 (8 Ply)	14 x 5.5J
	Ⓢ 7.35 x 14 (8 Ply)	14 x 5.5J
	Ⓢ 7.00 x 14 (8 Ply)	14 x 5.5J
	Ⓢ Ⓢ 7.00 x 14 (10 Ply Nylon)	14 x 5.5J
Super Van and Bus		Wheels
Standard	RPO	
6.95 x 14 (4 Ply)		14 x 5.5J
	6.95 x 14 (8 Ply)	14 x 5.5J
	Ⓢ Ⓢ 7.00 x 14 (8 Ply)	14 x 5.5J
	Ⓢ Ⓢ 7.00 x 14 (10 Ply Nylon)	14 x 5.5J

Ⓢ Mandatory for 4930 GVW  
 Ⓢ Tube Type  
 Ⓢ Not recommended for front

### FRONT SPRINGS

No. of Leaves	Capacity at Pad	Length		Width
		(Inches)		
Ⓢ 5 (Std)	855	48	2 1/4	Mandatory for
Ⓢ 5 (optional)	955	48	2 1/4	
Ⓢ 6 (optional)	1075	48	2 1/4	
Ⓢ With 170 CID Engine only Ⓢ Mandatory with 240 CID Engine				
5 (std)	1025	47 5/8	2 1/4	
6 (optional)	1230	47 5/8	2 1/4	

### SPECIAL TOOLS

Tool No.	Description
T58L-101-A	Puller Attachment
T59L-100-B	Short Impact Slide Hammer
3290-C	Tie Rod Ball End Remover
Any Standard	Caster Correction Tool
T61E-3110-A	Spindle Bushing Remover and Installer
T61E-3110-B	Spindle Bushing Reamer
T60K-1217-A	Front Wheel Bearing Cup and Grease Retainer Installer
T61E-1190-B	Front Wheel Hub Grease Retainer Installer
3600-AA	Steering Wheel Remover
T58L-3576-A	Sector Shaft Bushing Remover and Replacer
T60K-3576-A	Sector Shaft Bushing Remover and Replacer



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**STEERING GEAR**

Type Ratio Steering Wheel Diameter	Recirculating Ball 19.9 17 inches
Sector Shaft End Play— Steering Linkage Disconnected	No Perceptible End Play
Worm Bearing Preload (Torque required to rotate the input shaft approximately 1 1/2 turns either side of center with the Pitman arm disconnected.)	
Total Preload—Mesh Load plus Worm Bearing Preload (Pull to Rotate Worm Past Center High Spot.)	
With the steering gear mounted in the vehicle or in suitable fixture and positioned on center and the sector shaft retained to prevent rotation, apply a 15 in-lb. torque on the steering gear input shaft, in both right and left turn directions.	The total angular travel of the input shaft can not exceed 1 1/4 inches travel at the outer rim of the steering wheel with 8 in-lb net meshload.
Sector Adjusting Screw Head to End of Sector Shaft Maximum Clearance	

**TORQUE LIMITS**

Description	Ft.-Lbs.
Pitman Arm to Sector Shaft	90-105
Spindle Connecting Rod and End Assembly to Spindle Arm Slotted Nut	45-55
Spindle Connecting Rod Clamp to Adjusting Sleeve Lock Nut	25-35
Steering Wheel Attaching Nut	25-35 ①
Steering Gear Cover to Housing Attaching Bolt	12-20
Steering Column Bracket to Instrument Panel Nut	12-18
Pitman Arm to Drag Link Attaching Nut	45-55
Spindle Arm to Drag Link Attaching Nut	45-55
Mesh Load Adjusting Screw Locknut	32-40
Preload Adjuster Lock Nut	45-60
Steering Gear to Underbody	30-40
Ball Guide Clamp Screw	18-42 in-lbs
Spindle Arm to Spindle Nut	75-250

① Stake nut to shaft.

**SPINDLE ARM STOP ADJUSTMENTS (Inches)**

Tire Size	Wheel Type and No. of Studs	Wheel Size	Wheel No.	Left and Right
6.95 x 14	DISC-5	5.5J	B9AA-D	2 7/16
7.35 x 14	DISC-5	5.5J	B9AA-D	2 5/32
7.00 x 14	DISC-5	5.5J	B9AA-D	2

**BRONCO**

**FRONT WHEEL ALIGNMENT AND GENERAL SPECIFICATIONS**

Wheel Alignment	Checking Specifications			Optimum Re-Setting Specifications
	Min.	Max.	Maximum Variation Between Wheels	Desired Alignment
Caster				
Camber				
Toe-In (Inch)	1/16	1/4		1/8
<b>GENERAL SPECIFICATIONS</b>				
Wheel Base				92 Inches
Thread				57 1/2 Inches ①

① With 3300 lb. Axle 56 3/4 Inches

**FRONT SUSPENSION**

**TORQUE LIMITS**

Application	Ft.-Lbs
Radius Arm to Bracket	80-120
Spring retainer to Upper Spring Seat	25-35
Lower Spring Seat to Radius Arm	45-55
Track Bar Pivot to: Frame Axle	70-90 155-205
Radius Arm Cap to Radius Arm	90-110 ①
Front Shock to Lower Shock Bracket	40-60
	15-25

**REAR SUSPENSION TORQUE LIMITS**

Application	Ft.-Lbs
Shackle Assy. to Hanger	60-80
Spring Assy. to Front Hanger and Shackle	110-130
Rear Spring to Axle U-Bolt	45-60
Universal Joint U-Bolt	20-25
Universal Joint to Transfer Case Companion Flange	40-50
Rear Shock Absorber to: Upper Mounting Lower Bracket	15-25 40-60

**TIRE PRESSURES**

TIRE SIZE AND PLY RATING	RIM TYPE	PRESSURE (psi)	
		Front	Rear
Tubeless Tires			
7.35 x 15 4PR PT	5 1/2 K	30	30
7.75 x 15 4PR PT	5 1/2 K	30	30
7.75 x 15 8PR PT	5 1/2 K	30	30
8.15 x 15 4PR PT	5 1/2 K	30	30
8.15 x 15 8PR PT	5 1/2 K	30	42
9.15 x 15 4PR PT	5 1/2 K	30	30
Tube Tires			
6.50 x 16 6PR TT	5 K	35	45

**STEERING GEAR**

Type	Worm & Roller
Ratio	24 to 1
Steering Wheel Diameter	17 Inches

**PRE-LOAD ADJUSTMENTS**

Worm Bearing Preload (Torque required to rotate the input shaft approx. 1-1/2 turns either side of center with the Pitman arm disconnected.	2-6 in-lbs
Total Preload – Mesh Load Plus Worm Bearing Preload (Pull to Rotate Worm Past Center High Spot).	10-13 in-lbs
With the steering gear mounted in the vehicle or in suitable fixture and positioned on center and the sector shaft retained to prevent rotation, apply a 15 in. lb. torque on the steering gear input shaft, in both right and left turn directions.	The total angular travel of the input shaft can not exceed 1-1/4 inches travel at the outer rim or the steering wheel with 8 in-lb (5 in-lb $\odot$ net meshload
Sector Adjusting Screw Head to End of Sector Shaft Maximum Clearance	0.002 in max.

**TORQUE LIMITS**

Description	Ft-Lbs
Spindle Connecting Rod and End Assembly to Spindle Arm Slotted Nut	60-75
Spindle Connecting Rod Clamp to Adjusting Sleeve Lock Nut	35-45
Steering Wheel Attaching Nut	35-55 $\odot$
Steering Gear Cover to Housing Attaching Bolt	18-22
Steering Column Bracket to Instrument Panel Nut	10-15
Pitman Arm to Drag Link Attaching Nut	—
Spindle Arm to Drag Link Attaching Nut	60-75
Preload Adjuster Lock Nut	16-20
Steering Gear to Underbody or Frame	60-80
Spindle Arm to Spindle Nut	105-135
Steering Coupling Shaft to Steering Gear and Shaft	45-55
Steering Column to Clutch and Brake Pedal Bracket	12-16
Lower Bearing Retainer Clamp to Steering Shaft	12-16

$\odot$  Stake nut to shaft to lock in place

# Rear Axles and 4-Wheel Drive Front Axles

GROUP

4

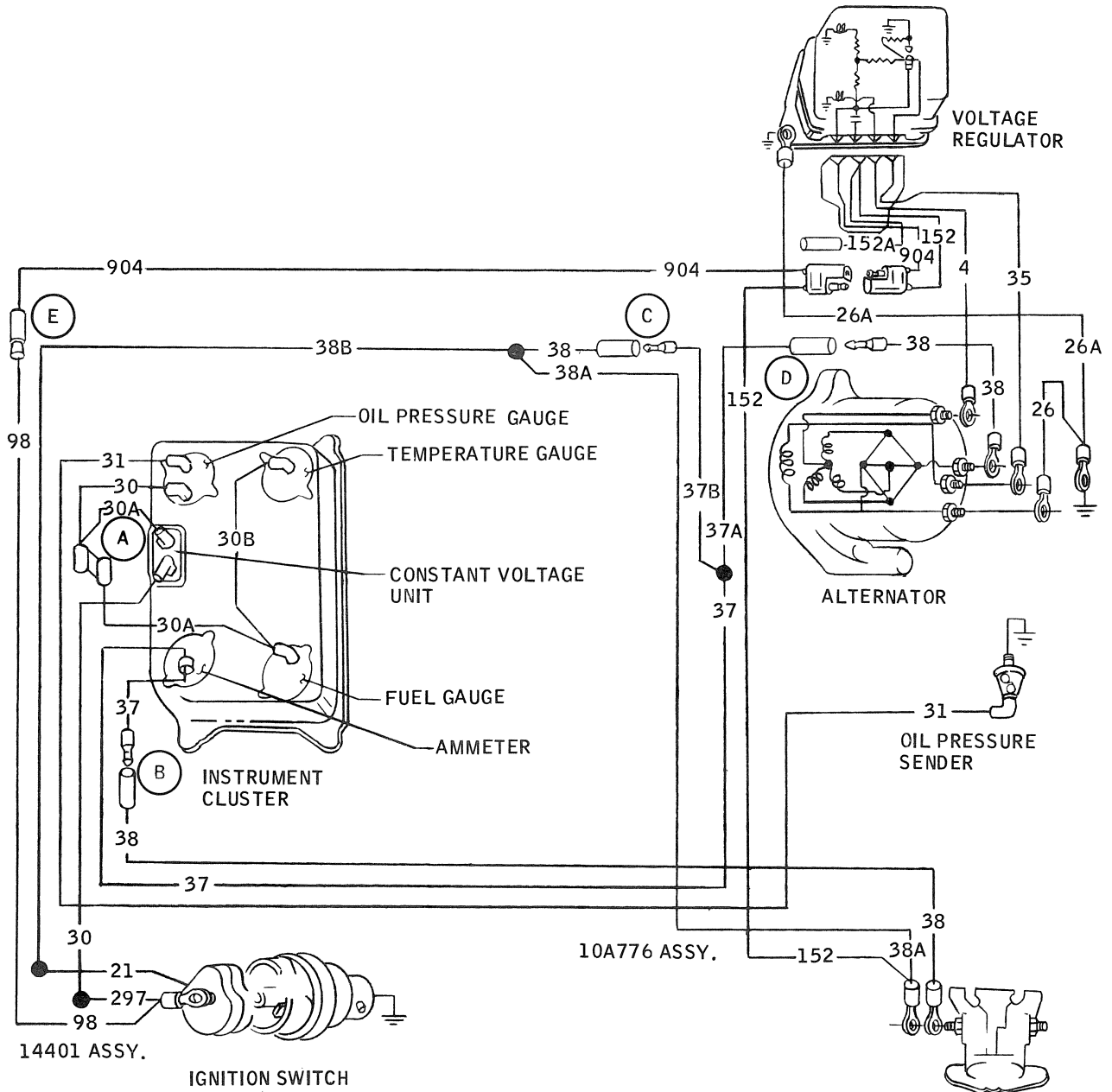
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