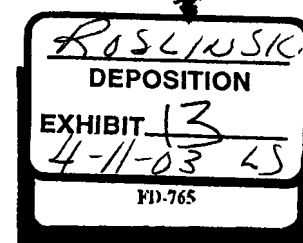


FILE NAME: Ford (FD)

DATE: 1970-1982

DOC#: FD089

DOCUMENT DESCRIPTION: Industry Warning Information



WARNINGS IN SHOP MANUALS
(Asbestos Cases)

The following is a review of Ford Motor Company car and truck shop manuals from 1950 to 1982 directed to any warnings in the manuals about asbestos dust in brake repairs. Since much of the language is repeated from year to year and within the various shop manuals issued in any given year, samples of each type of warning (or lack thereof) are attached as exhibits A through I. Reference will be made to a particular exhibit and the language contained therein.

1970	Car	Volume 1	12-01-08	A
1974	Car	Volume 1	12-01-12	A
1975	Car	Volume 1	12-01-23	A
1975/76	Car	Volume 1	12-01-24	A
1977	Car	Volume 1	12-01-29	B
1977	Truck	Volume 1	12-01-22	C
1978	Car	Volume 1	12-01-32	D
1978	Truck	Volume 1	12-01-22	C
1979	Car	Volume 1	12-01-31	D
1980	Light Truck	BCE*	12-01-20	E
1980	Medium/Heavy Truck	BCE	12-01-20	E
1980	Fairmont/Zephyr T-Bird/Cougar	BCE	12-01-22	D
1980	Pinto/Bobcat Mustang/Capri Granada/Monarch/ Versailles	BCE	12-01-28	D
1980	Ford/Mercury Lincoln Continental/ Continental/Mark VI	BCE	12-01-20	E
1981	Lincoln	BCE	12-01-22	E
1981	Escort/Lynx	BCE	12-01-27	F
1981	Light Truck	BCE	12-01-18	E
1981	Medium/Heavy Truck	BCE	12-01-24	E
1981	Courier	BCE	12-01-6	A

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WARNINGS IN SHOP MANUALS
Page 2

1982	Lincoln Town/Mark VI Ford/Mercury	BCE	12-01-22	E
	Lincoln Continental T-Bird/XR-7 Fairmont/Zephyr Granada/Cougar			
1982	Mustang/Capri	BCE	12-01-25	E
1982	Escort/Lynx	BCE	12-01-25	I
1982	Light Truck	BCE	12-01-	H
1982	Medium/Truck	BCE	12-10-6	G
1982	Courier	BCE	12-01-05	A

*BCE - Body, Chassis, Electrical

be inspected for wear or damage:

9. On floating caliper type disc brakes, the caliper assembly must be removed from the spindle prior to removal of the shoe and lining assemblies.

10. On floating caliper type disc brakes the calipers must not be interchanged from one side to the other. When the caliper is installed on its proper anchor plate and spindle, the bleeder screw will point to the rear of the vehicle. If a caliper is installed on the wrong side of the vehicle, it is not possible to bleed the system properly.

11. Do not attempt to clean or restore oil or grease soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets.

DRUM BRAKES

1. Remove the wheel from the drum, and remove the drum as outlined in Part 12-02.

2. Brush all dust from the backing plates and interior of the brake drums.

3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn within 1/32 inch of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that had been contaminated with oil, grease or brake fluid. Replace lining in axle sets. Prior to replacement of lining, the drum diameter should be checked to determine if oversize linings must be installed.

4. Check the condition of brake shoes, retracting springs, hold-down springs, and drum for signs of overheating. If the shoes have a slight blue coloring, indicating overheating,

replacement of the retracting and hold-down springs is strongly recommended. Overheated springs lose their pull and could cause the new lining to wear prematurely, if they are not replaced. If the brake drums are heat spotted, indicating a overheated condition, they should be replaced.

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

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

7. Inspect the brake drum and, if necessary, refinish. Refer to Part 12-02 for refinishing.

BRAKE BOOSTER

Check the booster operation as noted in Part 12-01. Power Brake Functional Test. If the brake booster is damaged or inoperative replace it with a new booster. The brake booster is serviced only as an assembly.

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 connection.

Always bleed the applicable primary or secondary brake system after primary or secondary brake system hose or line replacement. Centralize the pressure differential valve after bleeding the system.

BRAKE TUBING

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 brake fluid 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

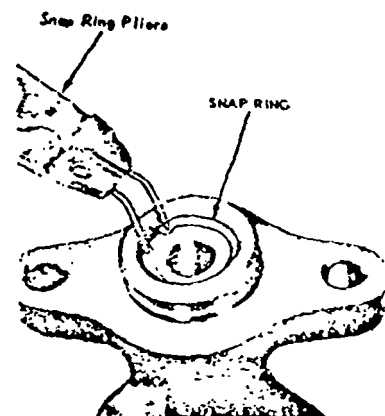
A flexible brake hose should be replaced if it shows signs of softening, cracking, or other damage.

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 thread the hose assembly into the front wheel 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. Thread the hose 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.

6. Clean all parts in clean isopropyl alcohol, and inspect the parts for chipping, excessive wear or damage. When using a master cylinder repair kit, install all the parts supplied.
 7. Be sure that all recesses, openings and internal passages are open and clean. Place all parts on a clean pan or paper.
 8. Inspect the master cylinder bore for signs of etching, pitting, scoring or rust. If necessary to hone the master cylinder bore to repair damage, do not exceed allowable hone specifications.
- Assembly**
1. Dip all parts except the master cylinder body in clean brake fluid (ESA-M6C25-A) Ford Part No. C6AZ-19542-A or DOT-3 equivalent.
 2. Carefully insert the complete secondary piston and return spring assembly in the master cylinder bore (Fig. 23).
 3. Install the primary piston assembly in the master cylinder bore.
 4. Depress the primary piston and install the snap ring in the cylinder bore groove.
 5. Install the push rod, boot and retainer on the push rod, if so equipped. Install the push rod assembly into the primary piston. Make sure the retainer is properly seated and holding the push rod securely.
 6. Position the inner end of the push rod boot (if so equipped) in the master cylinder body retaining groove.
 7. Install the secondary piston stop bolt, if used, with an O-ring if screw is on bottom outside of master cylinder casting.
 8. Install the bleed screw (if so equipped). Install the gasket (diaphragm) in the master cylinder filler cover. Position the gasket as shown in Fig. 23. Make sure the gasket is securely seated.

9. Install the cover and gasket on the master cylinder and secure the cover into position with the retainer.



H107-C

FIG. 24 Removing Snap Ring—Typical

CLEANING AND INSPECTION

DISC BRAKES

1. Remove the wheel and tire from the hub and rotor.
 2. Inspect brake shoes and lining for wear. If the lining is worn to within 1/8 inch of the shoe, replace all (4) shoe and lining assemblies (complete axle set) on front or rear wheels as appropriate.
 3. Visually check the caliper. If the caliper housing is leaking, it should be replaced. If a seal is leaking, the caliper must be disassembled and new seals installed. If a piston is seized in the bore, a new caliper housing is required.
- Refer to Part 12-20 for brake rotor resurfacing procedure.

DISC BRAKE SERVICE PRECAUTIONS

1. Grease or any other foreign material must be kept off the linings surfaces of the rotor, and external surfaces of the hub during service operations. In handling the rotor and caliper assemblies, avoid deformation of the brake rotor and nicking or scratching of brake linings.
2. If a caliper piston is removed for any reason, the piston seal must be replaced.
3. During removal and installation of a wheel assembly, exercise care not to interfere with and damage the caliper splash shield or the bleeder screw fitting.

4. Front wheel bearing end play is critical and must be within specifications.
5. Be sure the vehicle is centered on the hoist before servicing any front end components, to avoid bending or damaging the rotor splash shield on full right or left wheel turns.
6. Riding of the brake pedal (common on left-foot applications) must be avoided during vehicle operation.
7. The wheel and tire must be removed separately from the brake rotor, unlike drum brakes where the wheel, tire and drum can be removed as a unit.
8. Do not attempt to clean or restore oil or grease-soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets.

DRUM BRAKES

1. Remove the wheel from the drum, and remove the drum as outlined in Part 12-02.
2. Use an industrial type vacuum cleaner to remove all dust from the backing plates and interior of the brake drums.
3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn within 1/32 inch of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that had been contaminated with oil, grease or brake fluid. Replace lining in axle

sets. Prior to replacement of lining, the drum diameter should be checked to determine that the brake drum braking surface diameter is within specification. If the braking surface diameter exceeds specification, the drum must be replaced.

4. Check the condition of brake shoes, retracting springs, hold-down springs, and drum for signs of overheating. If the shoes have a slight blue coloring, indicating overheating, the retracting and hold-down springs should be replaced. Overheated springs lose their pull and could cause the new lining to wear prematurely, if not replaced. If the brake drums are heat spotted, indicating an overheated condition, they should be replaced.
5. Inspect all other brake parts and replace any that are worn or damaged.
6. Inspect the brake drum and, if necessary, refinish. The maximum inside braking surface diameter is shown on each brake drum (Fig. 23). If the maximum inside braking surface diameter shown on the drum is exceeded either by wear or refinishing, the drum must be replaced. Refer to Part 12-02 for refinishing.

BRAKE BOOSTER

Check the booster operation as noted under Power Brake Functional Test. If the brake booster is damaged or inoperative, replace it with a new booster.

8. Remove the line and inspect the flare for cracks or poor flare form. If the flare is not correct, cut it off and repeat the process.

The finished flare must be square with the line, free of cracks and have a smooth mating surface to ensure a leakproof connection.

Flaring a Line (Flaring-Bar Type)

Refer to Figs. 15 and 17.

1. Cut off and straighten the required length of line. (A line cutting tool will simplify making a clean and square cut).
2. Square off the ends of the line with a file, and chamfer the end of the line to be flared.
3. Insert the line through its appropriate ribbed hole in the bar assembly until the end of the line sticks out about as

far as the thickness of the adaptor above the bar, or even with the bar, depending on the tool used.

4. Fit the adaptor onto the line and slide the bar into the yoke. Lock the bar in position with the line beneath the yoke screw.
5. Form the single flare by tightening the yoke screw securely.
6. Release the screw and remove the adaptor.
7. Form the double flare by tightening the yoke screw again, with second adaptor fitted, depending on the tool used.
8. Release the screw bar, and flared line. Inspect the flare for cracks or poor flare form, and repeat the process if the flare is not correct.
9. Repeat Steps 3 through 6 at the opposite wheel cylinder.

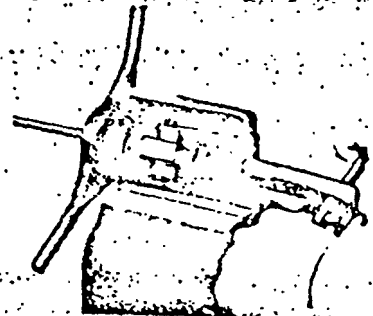


FIG. 17 Line Flaring (Flaring Bar Type)

BRAKE HOSE

Replace a flexible brake hose if it shows signs of softening, cracking or other damage.

When installing a new brake hose, position the hose to avoid contact with other vehicle parts.

REMOVAL AND INSTALLATION

BRAKE DRUM

All Vehicles thru 9000 Series

Use the following service procedures for both hydraulic and air brakes. Since the F-100 thru F-350, E-100-E-350 and Bronco rear drums, and the P-500 (front and rear) procedures apply to hydraulic brakes only, they are covered in Part 12-02.

FRONT BRAKE DRUM

1. Raise the vehicle until the tire clears the floor and remove the wheel and tire from the hub. Loosen the brake shoe adjusting screw until the shoes no longer touch the brake drum. Remove the grease cap and the gasket (if equipped) from the hub.
2. On vehicles with 9,000 lb front axles and hydraulic brakes, remove the locknut, locking ring, dimpled washer and adjusting nut. On all other axles, remove the cotter pin, adjusting nut and flat washer from the spindle.
3. Remove the outer bearing cone and roller assembly. Pull the hub and drum assembly off the wheel spindle.

4. Remove the front wheel-to-hub retaining nuts (or rim and tire attaching nuts). Remove the wheel (or rim and tire) from the hub and drum.
5. Remove the brake drum retainers and attaching bolts, screws or bolts and nuts.
6. Remove the brake drum from the hub.
7. Check the drum for damage or wear, and repair or replace if necessary. If a new drum will be installed, be sure to remove the protective coating with degreaser.
Install new grease retainer seals whenever a wheel and hub is removed.
8. Place the brake drum to the hub and install the retainers and retaining bolts, screws, or bolts and nuts.
9. Install the hub and drum on the wheel spindle. Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.
10. On vehicles with 9,000 lb front axles and hydraulic brakes install the outer

bearing cone and roller assembly, and the bearing adjusting nut. On all other axles, install the outer bearing cone and roller and flat washer on the spindle. Install the adjusting nut.

11. Install the wheel and tire on the hub. Then install the clamps (if applicable) and the wheel stud nuts.
12. While rotating the wheel, tighten the adjusting nut to specification. Adjust wheel bearings as described in Group 11.
13. On vehicles with 9000 lb front axle and hydraulic brakes, install the dimpled washer with the dimple indexed in one of the holes in the adjusting nut. Install the locking ring lock nut and tighten to specification. Bend the locking ring over a flat of the lock nut.
14. Install the gasket (if equipped) and the grease cap, and tighten the wheel stud nuts to specification. Install the hub cap (if equipped), and adjust the brakes as described in this Part.

OVERHAUL

An industrial type vacuum cleaner in place of compressed air, is recommended to remove any dust and dirt present on brake linings, pads, rotors and drums ect. when performing wheel brake repairs. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment.

BRAKE DRUM REFINISHING

E-100—E-350, F-100—F-350, U-100

Minor scores on a brake drum can be removed with fine emery cloth, provided the emery is thoroughly cleaned off the drum after the operation.

A badly scored, rough, or out-of-round drum should be ground or turned

on a drum lathe. Do not remove any more material from the drum than necessary to provide a smooth surface for the brake shoe contact. Brake drum maximum braking surface diameter is shown on each brake drum (Fig. 19). Brake drums which exceed the maximum braking surface diameter shown on the

installed. If a piston is seized in the bore, a new caliper housing is required.

Refer to Part 12-20 for disc brake rotor resurfacing procedure.

DISC BRAKE SERVICE PRECAUTIONS

1. Grease or any other foreign material must be kept off the linings surfaces of the rotor, and external surfaces of the hub during service operations. In handling the rotor and caliper assemblies, avoid deformation of the brake rotor and nicking or scratching of brake linings.
2. If a caliper piston is removed for any reason, the piston seal must be replaced.
3. During removal and installation of a wheel assembly, exercise care not to interfere with and damage the caliper splash shield or the bleeder screw fitting.
4. Front wheel bearing end play is critical and must be within specifications.
5. Be sure the vehicle is centered on the hoist before servicing any front end components, to avoid bending or damaging the rotor splash shield on full right or left wheel turns.
6. Riding of the brake pedal (common on left-foot applications) must be avoided during vehicle operation.
7. The wheel and tire must be removed separately from the brake rotor, unlike drum brakes where the wheel, tire and drum can be removed as a unit.
8. Do not attempt to clean or restore oil or grease-soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets.
9. On Fairmont/Zephyr only, always replace rubber caliper insulators and plastic sleeves when replacing linings. Do not lubricate the slide pins.

DRUM BRAKES

1. Remove the wheel from the drum, and remove the drum as outlined in Part 12-02.
2. Use an industrial vacuum cleaner to remove all dust from the backing plates and interior of the brake drums.
3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn within 1/32 inch of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that has been contaminated with oil, grease or brake fluid. Replace lining in axle sets. Prior to replacement of lining, the drum diameter should be checked to determine that the brake drum braking surface diameter is within specification. If the braking surface diameter exceeds specification, the drum must be replaced.
4. Check the condition of brake shoes, retracting springs, hold-down springs, and drum for signs of overheating. If the shoes have a slight blue coloring, indicating overheating, the retracting and hold-down springs should be replaced. Overheated springs lose their pull and could cause the new lining to wear prematurely, if

not replaced. If the brake drums are heat spotted, indicating an overheated condition, they should be replaced.

5. Inspect all other brake parts and replace any that are worn or damaged.
6. Inspect the brake drum and, if necessary, refinish. The maximum inside braking surface diameter is shown on each brake drum (Fig. 33). If the maximum inside braking surface diameter shown on the drum is exceeded either by wear or refinishing, the drum must be replaced. Refer to Part 12-02 for refinishing.

BRAKE BOOSTER

Check the booster operation as noted under Power Brake Functional Test. If the brake booster is damaged or inoperative, replace it with a new booster. The brake booster is serviced only as an assembly, including the check valve.

BRAKE TUBING

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.

HYDRAULIC LINES

Double wall 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 connection.

Always bleed the applicable primary or secondary brake system after primary or secondary brake system hose or line replacement. Centralize the pressure differential valve after bleeding the system.

All brake tubing should be double flared properly to provide good leakproof connections. Clean the brake tubing by flushing with clean brake fluid 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

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. On all vehicles except Fairmont/Zephyr, place a new copper gasket over the hose fitting and thread the hose assembly into the front wheel cylinder or caliper. Fairmont/Zephyr front hose does not require a copper gasket and is reusable. Engage the opposite end of the hose to the bracket on the frame. The white stripe on the hose should show no evidence of twisting. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut.

OVERHAUL

Removal of dust and dirt from brake assemblies should be done by using the Rotunda brake vacuum (model 34-0009) or Rotunda brake parts washer (model 650016) or an equivalent. Brake assembly dust and dirt should not be removed by either blowing off with an air gun or vacuuming with a standard industrial vacuum cleaner because a health hazard from breathing in asbestos dust may develop. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment.

BRAKE DRUM REFINISHING

Minor scores on a brake drum can be removed with fine emery cloth, provided the emery is thoroughly cleaned off the drum after the operation.

A badly scored, rough, or out-of-round drum should be ground or turned on a drum lathe. (Refer to the lathe manufacturers instructions.) Do not remove any more material from the drum than is necessary to provide a smooth surface for the brake shoe contact. Brake drum maximum braking surface diameter is shown on each brake drum (Fig. 13). Brake drums which exceed the maximum braking surface diameter shown on the brake drum, either through wear or refinishing, must be replaced. The maximum braking surface diameter specification, which is shown on each brake drum (Fig. 13), allows for a 1.52mm (0.060 inch) machining cut over the original nominal drum diameter plus .762mm (0.030 inch) additional wear before reaching the drum-disc diameter.

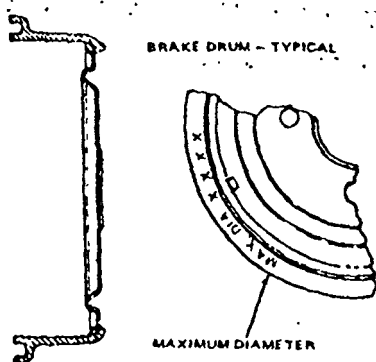


FIG. 13 Rear Brake Drum Maximum Inside Braking Surface Diameter Marking Location—E-100—E-350, Bronco, and F-100—F-350

FRONT DISC BRAKES

1. Remove the shoe and linings as described in Part 12-24 Disc Brakes—Light and Heavy Duty—Sliding Caliper.
2. Measure the thickness of the brake lining. If the lining thickness at any point on the assembly is less than .794mm (1/32 inch) above the backing plate or rivets, or if the lining shows evidence of brake

fluid or oil contamination that is causing a brake pull, replace all four shoe and lining assemblies.

3. To check rotor runout, first eliminate the wheel bearing end play by tightening the adjusting nut. Then check to be sure the rotor can still be rotated.
4. Clamp a dial indicator to the spindle so the stylus contacts the rotor approximately one inch from the outer edge. Rotate the rotor and take an indicator reading. If the reading exceeds .254mm (0.010 inch) total lateral runout within a six inch radius on the indicator, replace or re-surface the disc brake rotor. The following requirements must be met when re-surfacing disc brake rotors.

Use a disc brake lathe to re-finish the disc brake rotors. (Follow the manufacturers instructions.)

No more than .508mm (0.020 inch) of material may be machined equally off each surface (A and B, Fig. 14). If rotor thickness falls below the minimum shown on each rotor, it must be replaced.

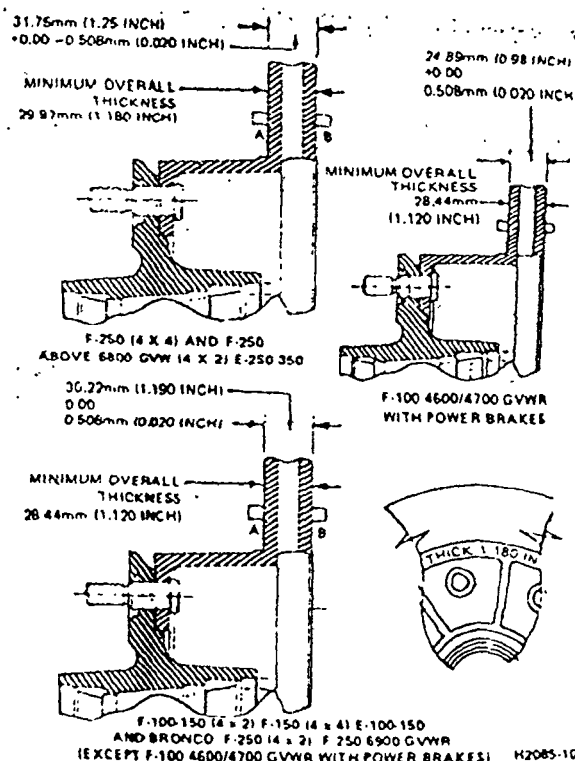


FIG. 14 Disc Brake Rotor Service Limits

The finished braking surfaces of the rotor must be flat and parallel within 0.025mm (0.001-inch); lateral runout must not exceed 0.076mm (0.003 inch) total indicator reading, and the surface finish of the braking surfaces must be 16 to 80 micro inches.

When the runout check is finished, adjust the bearings as described in Part 11-10, Wheel Hubs and Bearings—Front (except Front Wheel Drive) to prevent bearing failure.

5. Check the rotor for scoring. Remove minor scores with a fine emery cloth. If the rotor is excessively scored, re-finish or replace the rotor if necessary.

5. Be sure vehicle is centered on hoist before servicing any front end components, to avoid bending or damaging rotor splash shield on full right or left wheel turns.
6. Riding of brake pedal (common on left-front applications) must be avoided during vehicle operation.
7. The wheel and tire must be removed separately from the brake rotor, unlike drum brakes where the wheel, tire and drum can be removed as a unit.
8. Do not attempt to clean or restore oil or grease-soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets and the rotor braking surfaces wiped clean.
9. Do not lubricate caliper slide pins.
10. Calipers must be installed with bleed screws in an upward position for proper bleeding of air from brake system.

Drum Brakes

1. Remove wheel, tire and drum assembly from spindle.
2. Use an industrial vacuum cleaner to remove all dust from backing plates and interior of the brake drums.

WARNING: Never inhale dust from brake linings. Asbestos dust when inhaled can be injurious to health. Do not blow out dust with an air line. A vacuum cleaner equipped for this purpose, brush or rag should be carefully used to remove any dust. Any dust should be contained in a sealed bag for disposal.

3. Inspect brake shoes for excessive lining wear or shoe damage. If lining is damaged or worn within 1/32 inch of the rivet heads on riveted linings or within 0.060 inch of the shoe on bonded linings, they must be replaced. Replace any lining that has been contaminated with oil, grease, or brake fluid. Replace lining in axle sets. Prior to replacement of lining, drum diameter should be checked to determine that brake drum braking surface diameter is within specifications. If braking surface diameter exceeds specification, drum must be replaced.

4. Check condition of brake shoes, retracting spring, hold-down springs, and drum for signs of overheating. If shoes have a slight blue coloring, indicating overheating, retracting and hold-down springs should be replaced. Overheated springs lose their pull and could cause new lining to wear prematurely, if not replaced. If brake drums are heat spotted, indicating an overheated condition, they should be replaced.

5. Refer to part 11-15, for hub nut tightening procedure.

Brake Booster

Check booster operation as noted under Power Brake Functional Test. If brake booster is damaged or inoperative, replace it with a new booster. The brake booster is serviced only as an assembly, including the check valve.

Brake Tubing

If a section of 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 body contours, be careful not to kink or crack tube.

Hydraulic Lines

Double wall steel tubing is used throughout the brake system with the exception of the flexible hoses at the front and rear wheels.

Always bleed applicable primary or secondary brake system after primary or secondary brake system hose or line replacement. Centralize pressure differential valve after bleeding system.

All brake tubing should be properly double flared to provide good leakproof connections. Clean brake tubing by flushing with clean brake fluid before installation.

When connecting a tube to a hose, tube connector, or brake cylinder, tighten the tube fitting nut to specified torque with the D81L-600-A inch-pound torque wrench.

G REMOVAL AND INSTALLATION

The following apply to vehicles equipped with either air or hydraulic brakes.

WARNING: Never inhale dust from brake linings. Asbestos dust when inhaled can be injurious to health. Do not blow out dust with an air line. A vacuum cleaner equipped for this purpose, brush or rag should be carefully used to remove any dust. Any dust should be contained in a sealed bag for disposal.

CAST SPOKE WHEELS

Removal

1. Raise the vehicle until the tire clears the floor and install safety stands. Remove the tire and rim assembly by removing the clamps and nut.
2. Remove the cast spoke wheel and drum assembly from the front or rear axle.
3. Remove the drum from the cast spoke wheel by removing the nuts, bolts and washers.
4. Check the drum for damage or wear and repair or replace if necessary. If a new drum will be installed, remove the protective coating with a degreaser.

NOTE: Replace the drum with the same type and size. Failure to do so will affect vehicle performance. Replace cast drums with cast drums. Replace centrifuge drums only with centrifuge drums.

Installation

1. Assemble the drum to the cast spoke spider. Tighten the nuts to 299-352 N·m (220-260 ft-lbs).

2. Assemble the cast spoke spider and drum assembly to the front or rear axle. Adjust the wheel bearings and the axle shaft installation, if necessary, per the appropriate Section in Group 11.
3. Install the tire and wheel assembly on the cast spoke wheel. Refer to Section 11-01, Wheels, Rims and Tires for the procedure.
4. Tighten the front and rear wheel clamps to 299-352 N·m (220-260 ft-lbs).

DISC WHEELS—OUTBOARD MOUNTED DRUMS

Removal

1. Raise the vehicle until the tire clears the floor and install safety stands. Remove the nuts retaining the tire and wheel assembly to the hub (Fig. 6).
2. Remove the drum from the hub.
3. Check the drum for damage or wear and repair or replace as necessary. If a new drum is installed, be sure to remove the protective coating with degreaser.

NOTE: Replace drums with drums of the same type. Failure to do so will affect vehicle track and performance. Replace cast drums only with cast drums. Replace centrifuge drums only with centrifuge drums.

Check wheel grease seals for leakage. If the hub is removed from the axle, install new wheel grease seals.

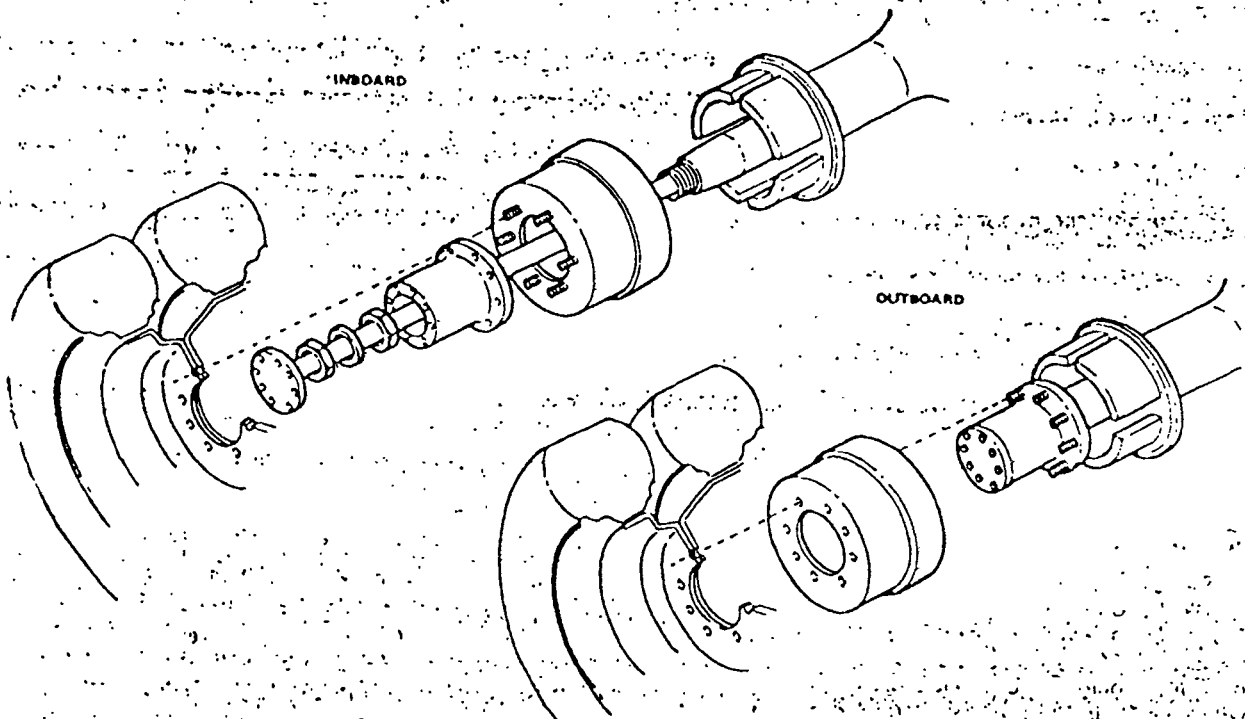


FIG. 6 Brake Drum Mountings

1985 Med/Hvy Truck Strip Manual Body Chassis Etc p. 12-10-6

1. Insert the line through its appropriate ribbed hole in the bar assembly until the end of the line sticks out about as far as the thickness of the adaptor above the bar, or even with the bar, depending on the tool used.
2. Fit the adaptor onto the line and slide the bar into the yoke. Lock the bar in position with the line beneath the yoke screw.
3. Form the single flare by tightening the yoke screw securely.
4. Release the screw and remove the adaptor.
5. Form the double flare by tightening the yoke screw again, with second adaptor fitted, depending on the tool used.

8. Release the screw bar, and flared line. Inspect the flare for cracks or poor flare form, and repeat the process if the flare is not correct.
9. Repeat Steps 3 through 6 at the opposite wheel cylinder.

BRAKE HOSE

Replace a flexible brake hose if it shows signs of softening, cracking or other damage.

When installing a new brake hose, position the hose to avoid contact with other vehicle parts.

OVERHAUL

WARNING: Never inhale dust from brake linings. Asbestos dust when inhaled can be injurious to health. Do not blow out dust with an air line. A vacuum cleaner equipped for this purpose, brush or rag should be carefully used to remove any dust. Any dust should be contained in a sealed bag for disposal.

Removal of dust and dirt from brake assemblies should be done by using the Rotundo brake vacuum (model 34-0009) or Rotundo brake parts washer (model E50016) or an equivalent. Brake assembly dust and dirt should not be removed by either blowing off with an air gun or vacuuming with a standard industrial vacuum cleaner because a health hazard from breathing in asbestos dust may develop. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment.

BRAKE DRUM REFINISHING

Minor scores on a brake drum can be removed with fine emery cloth, provided the emery is thoroughly cleaned off the drum after the operation.

A badly scored, rough, or out-of-round drum should be ground or turned on a drum lathe. (Refer to the lathe manufacturers instructions.) Do not remove any more material from the drum than is necessary to provide a smooth surface for the brake shoe contact. Brake drum maximum braking surface diameter is shown on each brake drum (Fig. 13). Brake drums which exceed the maximum braking surface diameter shown on the brake drum, either through wear or refinishing, must be replaced. The maximum braking surface diameter specification, which is shown on each brake drum (Fig. 13), allows for a 1.52mm (0.060 inch) machining cut over the original nominal drum diameter plus .762mm (0.030 inch) additional wear before reaching the drum-disc diameter.

FRONT DISC BRAKES

1. Remove the shoe and linings as described in Section 12-24 Disc Brakes—Light and Heavy Duty—Sliding Caliper.

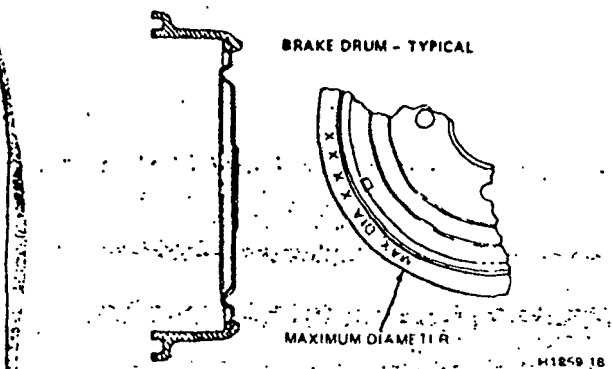


FIG. 13 Rear Brake Drum Maximum Inside Braking Surface Diameter Marking Location—E-100—E-350, Bronco, and F-100—F-350

2. Measure the thickness of the brake lining. If the lining thickness at any point on the assembly is less than .794mm (1/32 inch) above the backing plate or rivets, or if the lining shows evidence of brake fluid or oil contamination that is causing a brake pull, replace all four shoe and lining assemblies.
3. To check rotor runout, first eliminate the wheel bearing end play by tightening the adjusting nut. Then check to be sure the rotor can still be rotated.
4. Clamp a dial indicator to the spindle so the stylus contacts the rotor approximately one inch from the outer edge. Rotate the rotor and take an indicator reading. If the reading exceeds .254mm (0.010 inch) total lateral runout within a six inch radius on the indicator, replace or re-surface the disc brake rotor. The following requirements must be met when re-surfacing disc brake rotors.

Use a disc brake lathe to re-finish the disc brake rotors. (Follow the manufacturers instructions.)

No more than .508mm (0.020 inch) of material may be machined equally off each surface (A and B, Fig. 14). If rotor thickness falls below the minimum shown on each rotor, it must be replaced.

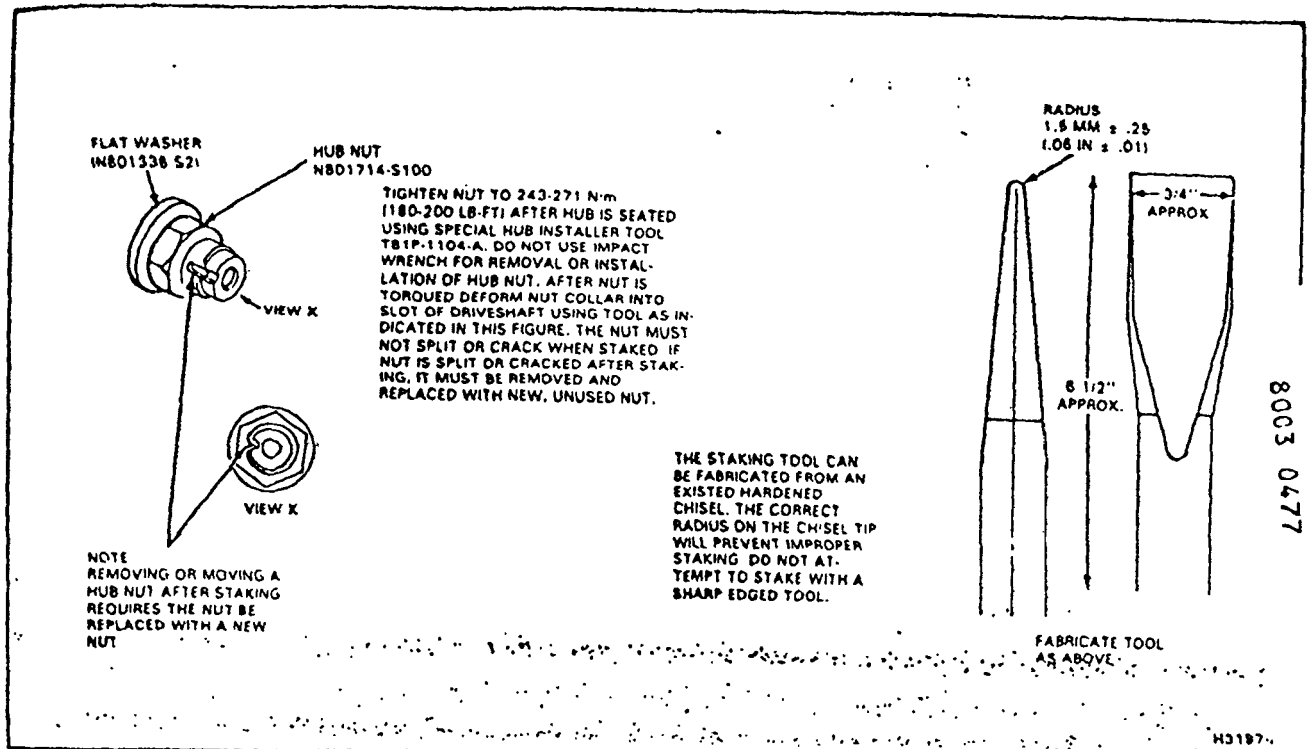


FIG. 11 Hub Nut Installation

Refer to Section 11-12, Front Hubs for nut tightening procedure.

Drum Brakes

5. Be sure vehicle is centered on hoist before servicing any front end components, to avoid bending or damaging rotor splash shield on full right or left wheel turns.
6. Riding of brake pedal (common on left-front applications) must be avoided.
7. The wheel and tire must be removed separately from the brake rotor, unlike drum brakes where the wheel, tire and drum can be removed as a unit.
8. Do not attempt to clean or restore oil or grease-soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets and the rotor braking surfaces wiped clean.
9. Do not lubricate caliper slide pins.
10. Calipers must be installed with bleed screws in an upward position for proper bleeding of air from brake system.

1. Remove wheel and tire assembly and drum assembly from spindle.

2. Remove drum assembly from spindle. Use an industrial vacuum cleaner to remove all dust from backing plates and interior of the brake drums.

WARNING: Dust and dirt conditions present on wheel brake assemblies and rotors and drums, may contain asbestos fibers that can represent a potential health hazard when made airborne by cleaning with compressed air.

All wheel brake assemblies should therefore be cleaned only with a vacuum cleaner suitable for use with asbestos fibers. This type of vacuum cleaner is available through the Rotunda Dealer Equipment Catalog. Dust and dirt from the vacuum cleaner should be disposed of in a manner that prevents dust exposure.

Any service done on brake linings, pads, rotors and drums, should be done using properly exhaust ventilated equipment.

be inspected for wear or damage.

9. On floating caliper type disc brakes, the caliper assembly must be removed from the spindle prior to removal of the shoe and lining assemblies.

10. On floating caliper type disc brakes the calipers must not be interchanged from one side to the other. When the caliper is installed on its proper anchor plate and spindle, the bleeder screw will point to the rear of the vehicle. If a caliper is installed on the wrong side of the vehicle, it is not possible to bleed the system properly.

11. Do not attempt to clean or restore oil or grease soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets.

DRUM BRAKES

1. Remove the wheel from the drum, and remove the drum as outlined in Part 12-02.

2. Brush all dust from the backing plates and interior of the brake drums.

3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn within 1/32 inch of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that had been contaminated with oil, grease or brake fluid. Replace lining in axle sets. Prior to replacement of lining, the drum diameter should be checked to determine if oversize linings must be installed.

4. Check the condition of brake shoes, retracting springs, hold-down springs, and drum for signs of overheating. If the shoes have a slight blue coloring, indicating overheating,

replacement of the retracting and hold-down springs is strongly recommended. Overheated springs lose their pull and could cause the new lining to wear prematurely, if they are not replaced. If the brake drums are heat spotted, indicating a overheated condition, they should be replaced.

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

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

7. Inspect the brake drum and, if necessary, refinish. Refer to Part 12-02 for refinishing.

BRAKE BOOSTER

Check the booster operation as noted in Part 12-01. Power Brake Functional Test. If the brake booster is damaged or inoperative replace it with a new booster. The brake booster is serviced only as an assembly.

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 connection.

Always bleed the applicable primary or secondary brake system after primary or secondary brake system hose or line replacement. Centralize the pressure differential valve after bleeding the system.

BRAKE TUBING

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 brake fluid 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

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 thread the hose assembly into the front wheel 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. Thread the hose 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.

6. Clean all parts in clean isopropyl alcohol, and inspect the parts for chipping, excessive wear or damage. When using a master cylinder repair kit, install all the parts supplied.
 7. Be sure that all recesses, openings and internal passages are open and clean. Place all parts on a clean pan or paper.
 8. Inspect the master cylinder bore for signs of etching, pitting, scoring or rust. If necessary to hone the master cylinder bore to repair damage, do not exceed allowable hone specifications.
- Assembly**
1. Dip all parts except the master cylinder body in clean brake fluid (ESA-M6C25-A) Ford Part No. C6AZ-19542-A or DOT-3 equivalent.
 2. Carefully insert the complete secondary piston and return spring assembly in the master cylinder bore (Fig. 23).
 3. Install the primary piston assembly in the master cylinder bore.
 4. Depress the primary piston and install the snap ring in the cylinder bore groove.
 5. Install the push rod, boot and retainer on the push rod, if so equipped. Install the push rod assembly into the primary piston. Make sure the retainer is properly seated and holding the push rod securely.
 6. Position the inner end of the push rod boot (if so equipped) in the master cylinder body retaining groove.
 7. Install the secondary piston stop bolt, if used, with an O-ring if screw is on bottom outside of master cylinder casting.
 8. Install the bleed screw (if so equipped). Install the gasket (diaphragm) in the master cylinder filler cover. Position the gasket as shown in Fig. 23. Make sure the gasket is securely seated.

9. Install the cover and gasket on the master cylinder and secure the cover into position with the retainer.

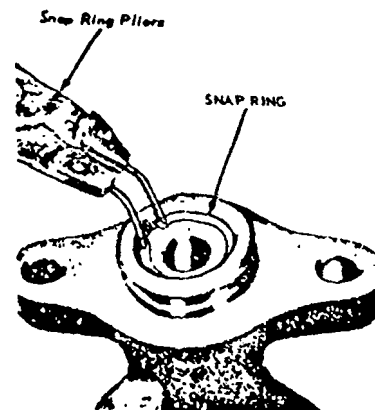


FIG. 24 Removing Snap Ring—Typical

CLEANING AND INSPECTION

DISC BRAKES

1. Remove the wheel and tire from the hub and rotor.
2. Inspect brake shoes and lining for wear. If the lining is worn to within 1/8 inch of the shoe, replace all (4) shoe and lining assemblies (complete axle set) on front or rear wheels as appropriate.
3. Visually check the caliper. If the caliper housing is leaking, it should be replaced. If a seal is leaking, the caliper must be disassembled and new seals installed. If a piston is seized in the bore, a new caliper housing is required.

Refer to Part 12-20 for disc brake rotor resurfacing procedure.

4. Front wheel bearing end play is critical and must be within specifications.
5. Be sure the vehicle is centered on the hoist before servicing any front end components, to avoid bending or damaging the rotor splash shield on full right or left wheel turns.
6. Riding of the brake pedal (common on left-foot applications) must be avoided during vehicle operation.
7. The wheel and tire must be removed separately from the brake rotor, unlike drum brakes where the wheel, tire and drum can be removed as a unit.
8. Do not attempt to clean or restore oil or grease-soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets.

sets. Prior to replacement of lining, the drum diameter should be checked to determine that the brake drum braking surface diameter is within specification. If the braking surface diameter exceeds specification, the drum must be replaced.

4. Check the condition of brake shoes, retracting springs, hold-down springs, and drum for signs of overheating. If the shoes have a slight blue coloring, indicating overheating, the retracting and hold-down springs should be replaced. Overheated springs lose their pull and could cause the new lining to wear prematurely, if not replaced. If the brake drums are heat spotted, indicating an overheated condition, they should be replaced.
5. Inspect all other brake parts and replace any that are worn or damaged.
6. Inspect the brake drum and, if necessary, refinish. The maximum inside braking surface diameter is shown on each brake drum (Fig. 23). If the maximum inside braking surface diameter shown on the drum is exceeded either by wear or refinishing, the drum must be replaced. Refer to Part 12-02 for refinishing.

DISC BRAKE SERVICE PRECAUTIONS

1. Grease or any other foreign material must be kept off the linings surfaces of the rotor, and external surfaces of the hub during service operations. In handling the rotor and caliper assemblies, avoid deformation of the brake rotor and nicking or scratching of brake linings.
2. If a caliper piston is removed for any reason, the piston seal must be replaced.
3. During removal and installation of a wheel assembly, exercise care not to interfere with and damage the caliper splash shield or the bleeder screw fitting.

DRUM BRAKES

1. Remove the wheel from the drum, and remove the drum as outlined in Part 12-02.
2. Use an industrial type vacuum cleaner to remove all dust from the backing plates and interior of the brake drums.
3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn within 1/32 inch of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that had been contaminated with oil, grease or brake fluid. Replace lining in axle

BRAKE BOOSTER

Check the booster operation as noted under Power Brake Functional Test. If the brake booster is damaged or inoperative, replace it with a new booster.

8. Remove the line and inspect the flare for cracks or poor flare form. If the flare is not correct, cut it off and repeat the process.

The finished flare must be square with the line, free of cracks and have a smooth mating surface to ensure a leakproof connection.

Flaring a Line (Flaring-Bar Type)

Refer to Figs. 15 and 17.

1. Cut off and straighten the required length of line. (A line cutting tool will simplify making a clean and square cut).
2. Square off the ends of the line with a file, and chamfer the end of the line to be flared.
3. Insert the line through its appropriate ribbed hole in the bar assembly until the end of the line sticks out about as

far as the thickness of the adaptor above the bar, or even with the bar, depending on the tool used.

4. Fit the adaptor onto the line and slide the bar into the yoke. Lock the bar in position with the line beneath the yoke screw.
5. Form the single flare by tightening the yoke screw securely.
6. Release the screw and remove the adaptor.
7. Form the double flare by tightening the yoke screw again, with second adaptor fitted, depending on the tool used.
8. Release the screw bar, and flared line. Inspect the flare for cracks or poor flare form, and repeat the process if the flare is not correct.
9. Repeat Steps 3 through 6 at the opposite wheel cylinder.

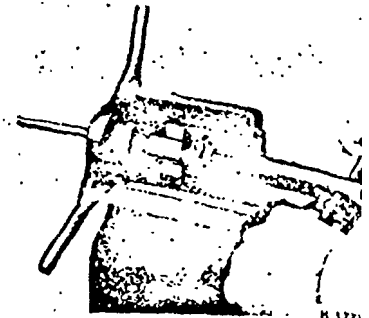


FIG. 17 Line Flaring (Flaring Bar Type)

BRAKE HOSE

Replace a flexible brake hose if shows signs of softening, cracking, or other damage.

When installing a new brake hose position the hose to avoid contact with other vehicle parts.

REMOVAL AND INSTALLATION

BRAKE DRUM

All Vehicles thru 9000 Series

Use the following service procedures for both hydraulic and air brakes. Since the F-100 thru F-350, E-100-E-350 and Bronco rear drums, and the P-500 (front and rear) procedures apply to hydraulic brakes only, they are covered in Part 12-02.

FRONT BRAKE DRUM

1. Raise the vehicle until the tire clears the floor and remove the wheel and tire from the hub. Loosen the brake shoe adjusting screw until the shoes no longer touch the brake drum. Remove the grease cap and the gasket (if equipped) from the hub.
2. On vehicles with 9,000 lb front axles and hydraulic brakes, remove the locknut, locking ring, dimpled washer and adjusting nut. On all other axles, remove the cotter pin, adjusting nut and flat washer from the spindle.
3. Remove the outer bearing cone and roller assembly. Pull the hub and drum assembly off the wheel spindle.

4. Remove the front wheel-to-hub retaining nuts (or rim and tire attaching nuts). Remove the wheel (or rim and tire) from the hub and drum.
5. Remove the brake drum retainers and attaching bolts, screws or bolts and nuts.
6. Remove the brake drum from the hub.
7. Check the drum for damage or wear, and repair or replace if necessary. If a new drum will be installed, be sure to remove the protective coating with degreaser.

Install new grease retainer seals whenever a wheel and hub is removed.

8. Place the brake drum to the hub and install the retainers and retaining bolts, screws, or bolts and nuts.
9. Install the hub and drum on the wheel spindle. Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.
10. On vehicles with 9,000 lb front axles and hydraulic brakes install the outer

bearing cone and roller assembly, and the bearing adjusting nut. On all other axles, install the outer bearing cone and roller and flat washer on the spindle. Install the adjusting nut.

11. Install the wheel and tire on the hub. Then install the clamps (if applicable) and the wheel stud nuts.
12. While rotating the wheel, tighten the adjusting nut to specification. Adjust wheel bearings as described in Group 11.
13. On vehicles with 9000 lb front ax and hydraulic brakes, install the dimpled washer with the dimple indexed in one of the holes in the adjusting nut. Install the locking ring lock nut and tighten to specification. Bend the locking ring over a flat of the lock nut.
14. Install the gasket (if equipped) and the grease cap, and tighten the wheel stud nuts to specification. Install the hub cap (if equipped), and adjust brakes as described in this Part.

OVERHAUL

An industrial type vacuum cleaner in place of compressed air, is recommended to remove any dust and dirt present on brake linings, pads, rotors and drums ect, when performing wheel brake repairs. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment.

BRAKE DRUM REFINISHING

E-100—E-350, F-100—F-350, U-100

Minor scores on a brake drum can be removed with fine emery cloth, provided the emery is thoroughly cleaned off the drum after the operation.

A badly scored, rough, or out-of-round drum should be ground or turned

on a drum lathe. Do not remove more material from the drum than necessary to provide a smooth surface for the brake shoe contact. Brake drum maximum braking surface diameter shown on each brake drum (Fig. 1). Brake drums which exceed the maximum braking surface diameter shown on

installed. If a piston is seized in the bore, a new caliper housing is required.

Refer to Part 12-20 for disc brake rotor resurfacing procedure.

DISC BRAKE SERVICE PRECAUTIONS

1. Grease or any other foreign material must be kept off the linings surfaces of the rotor, and external surfaces of the hub during service operations. In handling the rotor and caliper assemblies, avoid deformation of the brake rotor and nicking or scratching of brake linings.
2. If a caliper piston is removed for any reason, the piston seal must be replaced.
3. During removal and installation of a wheel assembly, exercise care not to interfere with and damage the caliper splash shield or the bleeder screw fitting.
4. Front wheel bearing end play is critical and must be within specifications.
5. Be sure the vehicle is centered on the hoist before servicing any front end components, to avoid bending or damaging the rotor splash shield on full right or left wheel turns.
6. Riding of the brake pedal (common on left-foot applications) must be avoided during vehicle operation.
7. The wheel and tire must be removed separately from the brake rotor, unlike drum brakes where the wheel, tire and drum can be removed as a unit.
8. Do not attempt to clean or restore oil or grease-soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets.
9. On Fairmont/Zephyr only, always replace rubber caliper insulators and plastic sleeves when replacing linings. Do not lubricate the slide pins.

DRUM BRAKES

1. Remove the wheel from the drum, and remove the drum as outlined in Part 12-02.
2. Use an industrial vacuum cleaner to remove all dust from the backing plates and interior of the brake drums.
3. Inspect the brake shoes for excessive lining wear or shoe damage. If the lining is worn within 1/32 inch of the rivet heads or if the shoes are damaged, they must be replaced. Replace any lining that has been contaminated with oil, grease or brake fluid. Replace lining in axle sets. Prior to replacement of lining, the drum diameter should be checked to determine that the brake drum braking surface diameter is within specification. If the braking surface diameter exceeds specification, the drum must be replaced.
4. Check the condition of brake shoes, retracting springs, hold-down springs, and drum for signs of overheating. If the shoes have a slight blue coloring, indicating overheating, the retracting and hold-down springs should be replaced. Overheated springs lose their pull and could cause the new lining to wear prematurely, if

not replaced. If the brake drums are heat spotted, indicating an overheated condition, they should be replaced.

5. Inspect all other brake parts and replace any that are worn or damaged.
6. Inspect the brake drum and, if necessary, refinish. The maximum inside braking surface diameter is shown on each brake drum (Fig. 33). If the maximum inside braking surface diameter shown on the drum is exceeded either by wear or refinishing, the drum must be replaced. Refer to Part 12-02 for refinishing.

BRAKE BOOSTER

Check the booster operation as noted under Power Brake Functional Test. If the brake booster is damaged or inoperative, replace it with a new booster. The brake booster is serviced only as an assembly, including the check valve.

BRAKE TUBING

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.

HYDRAULIC LINES

Double wall 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 connection.

Always bleed the applicable primary or secondary brake system after primary or secondary brake system hose or line replacement. Centralize the pressure differential valve after bleeding the system.

All brake tubing should be double flared properly to provide good leakproof connections. Clean the brake tubing by flushing with clean brake fluid 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

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. On all vehicles except Fairmont/Zephyr, place a new copper gasket over the hose fitting and thread the hose assembly into the front wheel cylinder or caliper. Fairmont/Zephyr front hose does not require a copper gasket and is reusable. Engage the opposite end of the hose to the bracket on the frame. The white stripe on the hose should show no evidence of twisting. Install the horseshoe-type retaining clip, and connect the tube to the hose with the tube fitting nut.

OVERHAUL

Removal of dust and dirt from brake assemblies should be done by using the Rotunda brake vacuum (model 34-0009) or Rotunda brake parts washer (model 650016) or an equivalent. Brake assembly dust and dirt should **not** be removed by either blowing off with an air gun or vacuuming with a standard industrial vacuum cleaner because a health hazard from breathing in asbestos dust may develop. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment.

BRAKE DRUM REFINISHING

Minor scores on a brake drum can be removed with fine emery cloth, provided the emery is thoroughly cleaned off the drum after the operation.

A badly scored, rough, or out-of-round drum should be ground or turned on a drum lathe. (Refer to the lathe manufacturers instructions.) Do not remove any more material from the drum than is necessary to provide a smooth surface for the brake shoe contact. Brake drum maximum braking surface diameter is shown on each brake drum (Fig. 13). Brake drums which exceed the maximum braking surface diameter shown on the brake drum, either through wear or refinishing, must be replaced. The maximum braking surface diameter specification, which is shown on each brake drum (Fig. 13), allows for a 1.52mm (0.060 inch) machining cut over the original nominal drum diameter plus .762mm (0.030 inch) additional wear before reaching the drum-discard diameter.

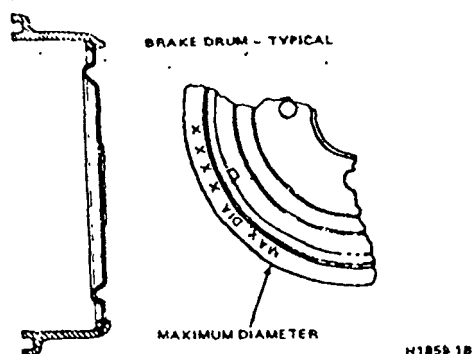


FIG. 13 Rear Brake Drum Maximum Inside Braking Surface Diameter Marking Location—E-100—E-350, Bronco, and F-100—F-350

FRONT DISC BRAKES

1. Remove the shoe and linings as described in Part 12-24 Disc Brakes—Light and Heavy Duty—Sliding Caliper.
2. Measure the thickness of the brake lining. If the lining thickness at any point on the assembly is less than .794mm (1/32 inch) above the backing plate or rivets, or if the lining shows evidence of brake

fluid or oil contamination that is causing a brake pull, replace all four shoe and lining assemblies.

3. To check rotor runout, first eliminate the wheel bearing end play by tightening the adjusting nut. Then check to be sure the rotor can still be rotated.
4. Clamp a dial indicator to the spindle so the stylus contacts the rotor approximately one inch from the outer edge. Rotate the rotor and take an indicator reading. If the reading exceeds .254mm (0.010 inch) total lateral runout within a six inch radius on the indicator, replace or re-surface the disc brake rotor. **The following requirements must be met when re-surfacing disc brake rotors.**

Use a disc brake lathe to re-finish the disc brake rotors. (Follow the manufacturers instructions.)

No more than .508mm (0.020 inch) of material may be machined equally off each surface (A and B, Fig. 14). If rotor thickness falls below the minimum shown on each rotor, it must be replaced.

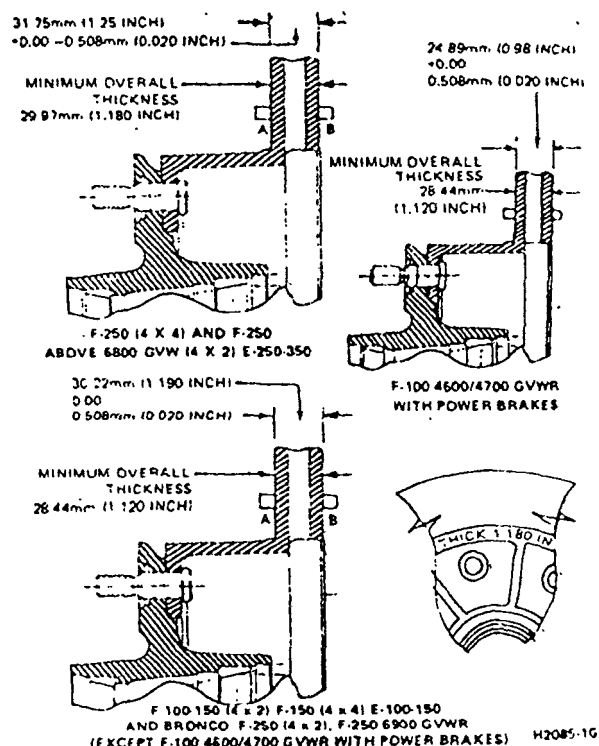


FIG. 14 Disc Brake Rotor Service Limits

The finished braking surfaces of the rotor must be flat and parallel within 0.025mm (0.001-inch); lateral runout must not exceed 0.076mm (0.003 inch) total indicator reading, and the surface finish of the braking surfaces must be 16 to 80 micro inches.

When the runout check is finished, adjust the bearings as described in Part 11-10, Wheel Hubs and Bearings—Front (except Front Wheel Drive) to prevent bearing failure.

5. Check the rotor for scoring. Remove minor scores with a fine emery cloth. If the rotor is excessively scored, re-finish or replace the rotor if necessary.

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

6. Riding of brake pedal (common on left-front applications) must be avoided during vehicle operation.

7. The wheel and tire must be removed separately from the brake rotor, unlike drum brakes where the wheel, tire and drum can be removed as a unit.

8. Do not attempt to clean or restore oil or grease-soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets and the rotor braking surfaces wiped clean.

9. Do not lubricate caliper slide pins.

10. Calipers must be installed with bleed screws in an upward position for proper bleeding of air from brake system.

Drum Brakes

1. Remove wheel, tire and drum assembly from spindle.

2. Use an industrial vacuum cleaner to remove all dust from backing plates and interior of the brake drums.

WARNING: Never inhale dust from brake linings. Asbestos dust when inhaled can be injurious to health. Do not blow out dust with an air line. A vacuum cleaner equipped for this purpose, brush or rag should be carefully used to remove any dust. Any dust should be contained in a sealed bag for disposal.

3. Inspect brake shoes for excessive lining wear or shoe damage. If lining is damaged or worn within 1/32 inch of the rivet heads on riveted linings or within 0.060 inch of the shoe on bonded linings, they must be replaced. Replace any lining that has been contaminated with oil, grease, or brake fluid. Replace lining in axle sets. Prior to replacement of lining, drum diameter should be checked to determine that brake drum braking surface diameter is within specifications. If braking surface diameter exceeds specification, drum must be replaced.

4. Check condition of brake shoes, retracting spring, hold-down springs, and drum for signs of overheating. If shoes have a slight blue coloring, indicating overheating, retracting and hold-down springs should be replaced. Overheated springs lose their pull and could cause new lining to wear prematurely, if not replaced. If brake drums are heat spotted, indicating an overheated condition, they should be replaced.

5. Refer to part 11-15, for hub nut tightening procedure.

Brake Booster

Check booster operation as noted under Power Brake Functional Test. If brake booster is damaged or inoperative, replace it with a new booster. The brake booster is serviced only as an assembly, including the check valve.

Brake Tubing

If a section of 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 body contours, be careful not to kink or crack tube.

Hydraulic Lines

Double wall steel tubing is used throughout the brake system with the exception of the flexible hoses at the front and rear wheels.

Always bleed applicable primary or secondary brake system after primary or secondary brake system hose or line replacement. Centralize pressure differential valve after bleeding system.

All brake tubing should be properly double flared to provide good leakproof connections. Clean brake tubing by flushing with clean brake fluid before installation.

When connecting a tube to a hose, tube connector, or brake cylinder, tighten the tube fitting nut to specified torque with the D81L-600-A inch-pound torque wrench.

REMOVAL AND INSTALLATION

The following apply to vehicles equipped with either air or hydraulic brakes.

WARNING: Never inhale dust from brake linings. Asbestos dust when inhaled can be injurious to health. Do not blow out dust with an air line. A vacuum cleaner equipped for this purpose, brush or rag should be carefully used to remove any dust. Any dust should be contained in a sealed bag for disposal.

CAST SPOKE WHEELS

Removal

1. Raise the vehicle until the tire clears the floor and install safety stands. Remove the tire and rim assembly by removing the clamps and nut.
2. Remove the cast spoke wheel and drum assembly from the front or rear axle.
3. Remove the drum from the cast spoke wheel by removing the nuts, bolts and washers.
4. Check the drum for damage or wear and repair or replace if necessary. If a new drum is installed, remove the protective coating with a degreaser.

NOTE: Replace the drum with the same type and size. Failure to do so will affect vehicle performance. Replace cast drums with cast drums. Replace centrifuge drums only with centrifuge drums.

Installation

1. Assemble the drum to the cast spoke spider. Tighten the nuts to 299-352 N·m (220-260 ft-lbs).

2. Assemble the cast spoke spider and drum assembly to the front or rear axle. Adjust the wheel bearings and the axle shaft installation, if necessary, per the appropriate Section in Group 11.
3. Install the tire and wheel assembly on the cast spoke wheel. Refer to Section 11-01, Wheels, Rims and Tires for the procedure.
4. Tighten the front and rear wheel clamps to 299-352 N·m (220-260 ft-lbs).

DISC WHEELS—OUTBOARD MOUNTED DRUMS

Removal

1. Raise the vehicle until the tire clears the floor and install safety stands. Remove the nuts retaining the tire and wheel assembly to the hub (Fig. 6).
2. Remove the drum from the hub.
3. Check the drum for damage or wear and repair or replace as necessary. If a new drum is installed, be sure to remove the protective coating with degreaser.

NOTE: Replace drums with drums of the same type. Failure to do so will affect vehicle track and performance. Replace cast drums only with cast drums. Replace centrifuge drums only with centrifuge drums.

Check wheel grease seals for leakage. If the hub is removed from the axle, install new wheel grease seals.

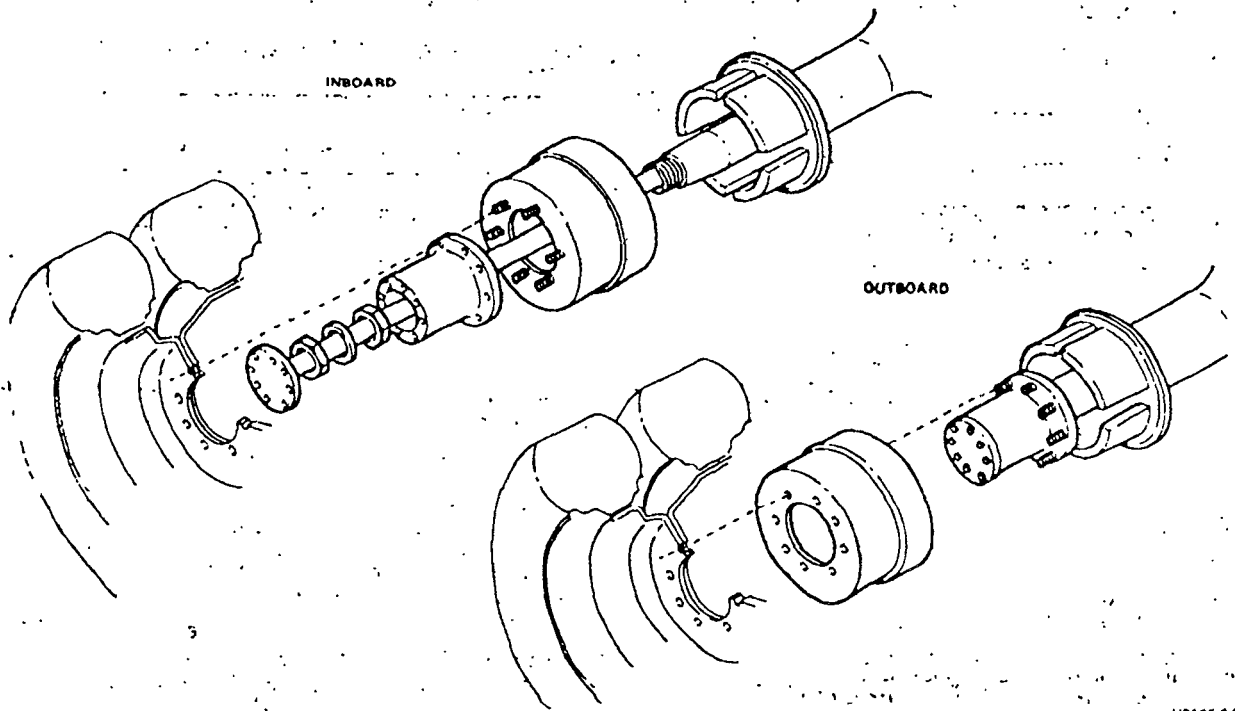


FIG. 6 Brake Drum Mountings

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3. Insert the line through its appropriate ribbed hole in the bar assembly until the end of the line sticks out about as far as the thickness of the adaptor above the bar, or even with the bar, depending on the tool used.
4. Fit the adaptor onto the line and slide the bar into the yoke. Lock the bar in position with the line beneath the yoke screw.
5. Form the single flare by tightening the yoke screw securely.
6. Release the screw and remove the adaptor.
7. Form the double flare by tightening the yoke screw again, with second adaptor fitted, depending on the tool used.

8. Release the screw bar, and flared line. Inspect the flare for cracks or poor flare form, and repeat the process if the flare is not correct.
9. Repeat Steps 3 through 6 at the opposite wheel cylinder.

BRAKE HOSE

Replace a flexible brake hose if it shows signs of softening, cracking or other damage.

When installing a new brake hose, position the hose to avoid contact with other vehicle parts.

OVERHAUL

WARNING: Never inhale dust from brake linings. Asbestos dust when inhaled can be injurious to health. Do not blow out dust with an air line. A vacuum cleaner equipped for this purpose, brush or rag should be carefully used to remove any dust. Any dust should be contained in a sealed bag for disposal.

Removal of dust and dirt from brake assemblies should be done by using the Rotunda brake vacuum (model 34-0009) or Rotunda brake parts washer (model 650076) or an equivalent. Brake assembly dust and dirt should not be removed by either blowing off with an air gun or vacuuming with a standard industrial vacuum cleaner because a health hazard from breathing in asbestos dust may develop. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment. Also, any machining done on brake linings or pads should be done using properly exhaust ventilated equipment.

BRAKE DRUM REFINISHING

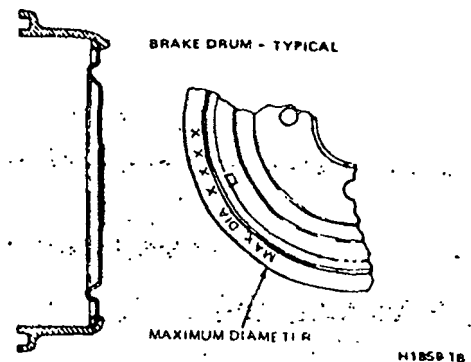
Minor scores on a brake drum can be removed with fine emery cloth, provided the emery is thoroughly cleaned off the drum after the operation.

A badly scored, rough, or out-of-round drum should be ground or turned on a drum lathe. (Refer to the lathe manufacturers instructions.) Do not remove any more material from the drum than is necessary to provide a smooth surface for the brake shoe contact. Brake drum maximum braking surface diameter is shown on each brake drum (Fig. 13). Brake drums which exceed the maximum braking surface diameter shown on the brake drum, either through wear or refinishing, must be replaced. The maximum braking surface diameter specification, which is shown on each brake drum (Fig. 13), allows for a 1.52mm (0.060 inch) machining cut over the original nominal drum diameter plus .762mm (0.030 inch) additional wear before reaching the drum-disc diameter.

FRONT DISC BRAKES

1. Remove the shoe and linings as described in Section 12-24 Disc Brakes—Light and Heavy Duty—Sliding Caliper.

FIG. 13 Rear Brake Drum Maximum Inside Braking Surface Diameter Marking Location—E-100—E-350, Bronco, and F-100—F-350



2. Measure the thickness of the brake lining. If the lining thickness at any point on the assembly is less than .794mm (1/32 inch) above the backing plate or rivets, or if the lining shows evidence of brake fluid or oil contamination that is causing a brake pull, replace all four shoe and lining assemblies.
3. To check rotor runout, first eliminate the wheel bearing end play by tightening the adjusting nut. Then check to be sure the rotor can still be rotated.
4. Clamp a dial indicator to the spindle so the stylus contacts the rotor approximately one inch from the outer edge. Rotate the rotor and take an indicator reading. If the reading exceeds .254mm (0.010 inch) total lateral runout within a six inch radius on the indicator, replace or re-surface the disc brake rotor. The following requirements must be met when re-surfacing disc brake rotors.

Use a disc brake lathe to re-finish the disc brake rotors. (Follow the manufacturers instructions.)

No more than .508mm (0.020 inch) of material may be machined equally off each surface (A and B, Fig. 14). If rotor thickness falls below the minimum shown on each rotor, it must be replaced.

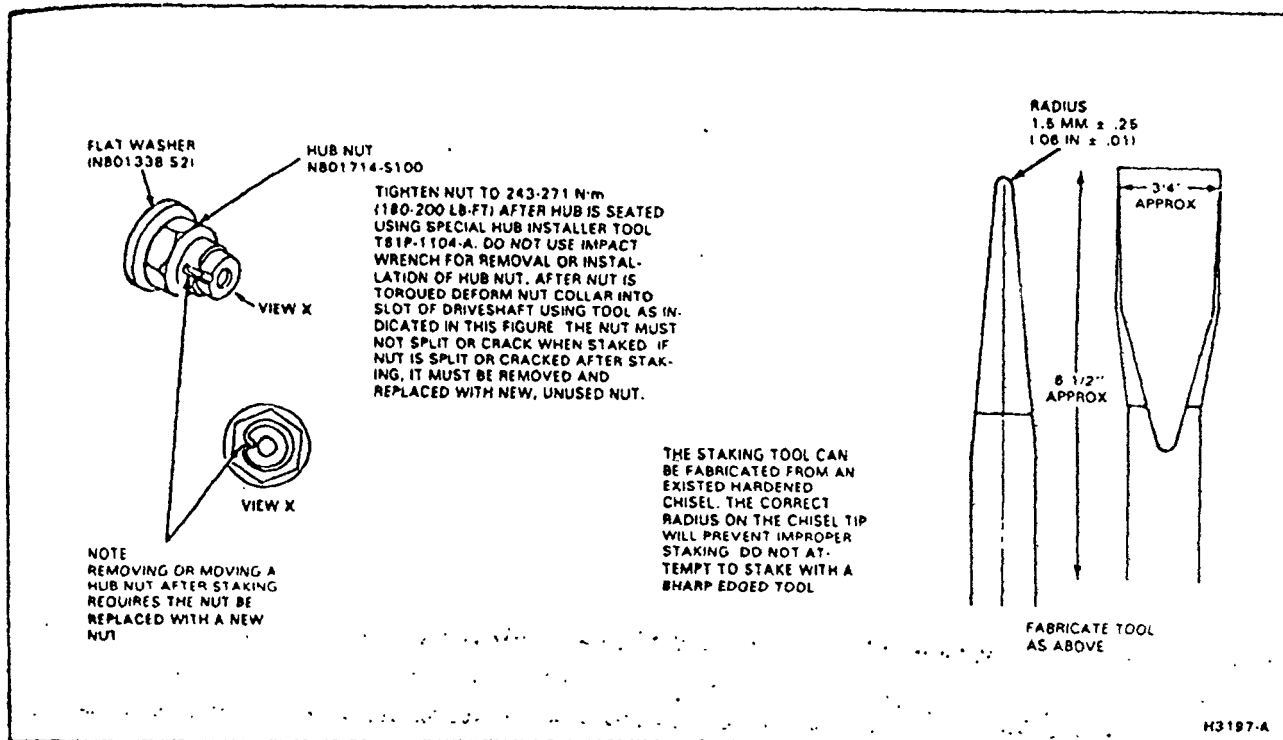


FIG. 11 Hub Nut Installation

Refer to Section 11-12, Front Hubs for nut tightening procedure.

5. Be sure vehicle is centered on hoist before servicing any front end components, to avoid bending or damaging rotor splash shield on full right or left wheel turns.
6. Riding of brake pedal (common on left-front applications) must be avoided.
7. The wheel and tire must be removed separately from the brake rotor, unlike drum brakes where the wheel, tire and drum can be removed as a unit.
8. Do not attempt to clean or restore oil or grease-soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets and the rotor braking surfaces wiped clean.
9. Do not lubricate caliper slide pins.
10. Calipers must be installed with bleed screws in an upward position for proper bleeding of air from brake system.

Drum Brakes

1. Remove wheel and tire assembly and drum assembly from spindle.
2. Remove drum assembly from spindle. Use an industrial vacuum cleaner to remove all dust from backing plates and interior of the brake drums.

WARNING: Dust and dirt conditions present on wheel brake assemblies and rotors and drums, may contain asbestos fibers that can represent a potential health hazard when made airborne by cleaning with compressed air.

All wheel brake assemblies should therefore be cleaned only with a vacuum cleaner suitable for use with asbestos fibers. This type of vacuum cleaner is available through the Rotunda Dealer Equipment Catalog. Dust and dirt from the vacuum cleaner should be disposed of in a manner that prevents dust exposure.

Any service done on brake linings, pads, rotors and drums, should be done using properly exhaust ventilated equipment.